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ASSOCIATION OF FOOD TECHNOLOGISTS

(INDIA)

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE

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3. To promote the profession of Food Technology.

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EDITOR'S NOTE

This issue marks the completion of five volumes since the inception of this Journal in 1964. In this short span of time, it has grown steadily gaining strength. Every effort is being made to speed up the publication of the issues and happily enough, the response of the referees and the editorial associates has been spontaneous. Yet, it has to be remembered that the standard of any Journal largely depends on the strong back-bone of quality papers emanating from carefully planned and meticulously executed programmes of research and development; it is hoped that in times to come, the number of quality papers will increase further and give a boost to the spreading of food science and technology in this region of the world.

The subject of reviews needs some mention. While oil seed processing for edible purposes has been covered in some measure, the subject of grain legumes has hardly been initiated; more information is desirable on this subject because integrated efforts are being made in this country for effecting overall improvements in grain legume production.

* * * *

The year 1968 saw the beginnings of some miraculous achievements in the fields of food and agriculture in India. The high yielding varieties of food grains have ushered in fresh hope that famine need not haunt this country for all time to come. A great many efforts are also being made in other fields of agriculture and animal husbandry, and the prospects have become brighter for reaching respectable targets of crop production. Improved crop production necessitates greater and better facilities for preventing the losses during handling, storage, transportation and processing. Efforts of the research worker, government and industry are being co-ordinated and massive training programmes are being organised for making a success of this great endeavour. The picture on food front is not as gloomy as that forecast by some prophets in preceding years. Yet, the problem of hunger and insufficiency, whether in villages or the slums of industrial cities, is always a challenge to the scientist and the government.

* * * *

With rapidly increasing mass of scientific information, the problem of keeping abreast of the latest advances has become very difficult in recent years. It is particularly true in the new area of food science and technology which embrace a variety of disciplines, applied as well as basic and borderline subjects. A welcome development is the joint effort of the Commonwealth Agricultural Bureaux (C.A.B.), Institut fur Dokumentationswesen and Institute of Food Technologists, in publishing a Journal containing food science and technology abstracts. It is of interest to note that Central Food Technological Research Institute, Mysore is making a similar effort and compiling abstracts from about 120 scientific periodicals. A very important consideration is to see that the abstracts reach the research worker with very little time lag. To achieve this, the abstracts are being issued in mimeographed form since 1966. It is noteworthy that both C.F.T.R.I. and C.A.B. are abstracting under almost identical subject heads. The Journal of Food Science and Technology is publishing the abstracts regularly. It is indeed a great privilege which the C.F.T.R.I. has offered us and for this, we are deeply grateful.

Instructions to Contributors

1. Manuscripts of papers should be typewritten in double space on one side of the paper only. They should be submitted in triplicate. The manuscripts should be complete and in final form, since no alterations or additions are allowed at the proof stage. The paper submitted should not have been published or communicated elsewhere.

2. Short communications in the nature of letters to the editor should clearly indicate the scope of the investigation and the salient features of the results.

3. Names of chemical compounds and not their formulae should be used in the text. Superscripts and subscripts should be legibly and carefully placed. Foot notes should be avoided as far as possible.

4. *Abstract:* The abstract should indicate the scope of the work and the principal findings of the paper. It should not normally exceed 200 words. It should be in such a form that abstracting periodicals can readily use it.

5. *Tables:* Graphs as well as tables, both representing the same set of data should be avoided. Tables and figures should be numbered consecutively in Arabic numerals and should have brief titles. Nil results should be indicated and distinguished clearly from absence of data.

6. *Illustrations:* Line drawings should be made with Indian ink on white drawing paper preferably art paper. The lettering should be in pencil. For satisfactory reproduction, graphs and line drawings should be at least twice the printed size. Photographs must be on glossy paper and contrasty; two copies should be sent.

7. Abbreviations of the titles of all scientific periodicals should strictly conform to those cited in the World List of Scientific Periodicals, Butter Worths Scientific Publication, London, 1952.

8. *References:* Names of all the authors should be cited completely in each reference. Abbreviations such as ***et al.***, should be avoided.

In the text, the references should be indicated by numbers placed above the line (superior). They should be numbered and included at the end of the article in serial order.

Citation of references in the list should be in the following manner.

(*a*) *Research Paper:* Menon, G. and Das, R. P., *J. sci. industr. Res.*, 1958, **18**, 561.

(*b*) *Book:* Venkataraman, K., *The Chemistry of Synthetic Dyes*, Academic Press, Inc., New York, 1952, Vol. II, 966.

(*c*) *References to article in a book:* Joshi, S. V. in *The Chemistry of Synthetic Dyes*, by Venkataraman, K., Academic Press, Inc., New York, 1952, Vol. II, 966.

(*d*) *Proceedings, Conferences and Symposia:* As in (*c*).

(*e*) *Thesis:* Sathyanarayan, Y., *Phytosociological Studies on the Calcicolous Plants of Bombay, 1953.* Ph.D. thesis, Bombay University.

(*f*) *Unpublished work:* Rao, G., unpublished, Central Food Technological Research Institute, Mysore, India.

REVIEW

The Potential for Fish Protein Concentrate in Developing Countries*

SARGENT RUSSELL†

Fish protein concentrate (an odorless, tasteless, finely ground product made by removing the water and fat from fish) has been suggested as a source of protein supplement for meeting world nutritional needs. What are the production possibilities for this product? Will there be problems of consumer acceptance? Is this product, in fact, a *real* alternative source of protein? This paper examines the existing information bearing on these questions and suggests what the impact of fish protein concentrate might be on economic development.

The considerations in this paper have been classified into five parts: two technical—finding an adequate supply of fish and a suitable method of processing; one social—developing acceptance of a suitable product; one economic—financing and managing production; and one political—clarifying policy for economic development. This classification might cause an economist to say that all of the problems are economic. Costs and returns are involved in all cases. A political scientist might argue that the manipulations of various power groups will determine the growth of fish protein concentrate production. While both might be right, it needs to be emphasized that the prospects for the development of a fish protein concentrate industry depend on the concerted effort of many groups interested in promoting human welfare.

Supply of Fish

Snyder writing on Fish Protein Concentrate (FPC) in *Food Technology*, introduces his remarks by saying: 'Marine biologists tell us that only 10 per cent of the annual marine fish potential is presently harvested. We are told by many fishermen that nearly 50 per cent of their catch is discarded at sea. We are also told that there are enough fish in the sea to supply the total animal protein needs of between 5 and 30 billion people'.[1] W. R. Martin, speaking at a conference in Ottawa, sought to predict rather than to judge the potential of the sea when he said:

'The world catch of aquatic products has doubled during the past decade to a current annual yield of more than 50 million metric tons [about 12 kg. per person]. Even the most conservative aquatic biologists predict that landings can double again to one hundred million metric tons, and that this production can be achieved by the end of this century'.[2] The validity of either of these estimates of the potential of the seas will be known only with time and realized only through considerable work.

The first job, finding a sustainable source of supply of fish, is a problem of fishery biology. Martin, speaking of North American waters, has pointed to many species of fish which are currently not utilized or are under-utilized. He indicated that even some non-vertebrate species like squid and krill could be used to make fish protein concentrate. There may be a problem of toxicity in moving to fish which, at present, are not used for human consumption. Nigrelli, reported at the Ottawa conference that there are over 1,000 species of invertebrates and more than 200 species of vertebrates that are poisonous or venomous.[3]

The second job is to organize a low cost fishing fleet. Ezra Levin, President of Vio Bin Corporation stated that the price of raw industrial fish is six to seven dollars a ton in Peru, twelve to fifteen dollars in South Africa, and twenty dollars in the United States. He added that 'Harvesting is a matter of using trawlers and proper equipment for bringing in large quantities of fish' (personal communication).

A group from Resources Engineering of Canada Ltd., estimated fish harvesting costs at $74 per ton.[4] An explanation for this high cost has been offered by William Chapman of Van Camp Sea Foods, who said, 'Most fishermen in North America are price conscious .... [They are] geared to producing high unit price fish and to disregarding production of high volume, low unit price products'. He suggested, in order to overcome this 'fisherman's philosophy', 'a fully integrated sea and land operation may be called for.'[5]

* This article is being published in the *Journal of Developing Areas III.* January 1969.

† Agricultural Economist, University of Massachusetts, Fulbright Lecturer, Faculty of Agriculture, Ege University, Izmir, Turkey, 1967-68.

If an integrated system were established, the building and equipping of the fishing fleet would be the major investment, as shown later.

The utilization of waste material produced in current fish processing operations, particularly the waste from fish fillets, may provide an alternative source of raw material. A. Cunningham, President of the Atlantic Fisheries By-Products Association, has commented:

'The setting up of a few centralized FPC plants would appear to be the only way to operate a financially feasible operation.... [However due] to the widespread location and small production of many of the existing plants, it would probably not be feasible to collect certain material, nor would it be economical to transport to the centralized plants'.[6]

Another by-product of present fishing operations is trash fish which are discarded at sea. These are fish which have little or no value in current fresh fish markets. Estimates of the quantity of trash fish available are based on fishermen's reports which state that up to fifty per cent of the catch are sometimes discarded. Martin states that the quantity available from offshore otter trawlers working out of North Atlantic ports is 100,000 tons a year.[2] However, estimates on the regularity and concentration of trash fish supplies have not been made.

A final source of fish for production of fish protein concentrate for human consumption is the supply now going to fish meal plants producing animal feed. The main difficulty here is conversion to handling and processing techniques necessary for producing a hygienic human food.

Pariser, summarized, at Ottawa, his views on the selection of raw materials: (1) More than twenty thousand species of fish inhabit the oceans; until much more is known about the properties of most of them, only those should, initially, be chosen for the manufacture of FPC that are well-known as suitable for human consumption. Even then, caution must be exercised: a number of fish (over 200 species) many living in tropical regions, are, or can suddenly become, toxic. The toxins, most of which remain as yet unidentified, can be immensely dangerous. It is advisable to select a schooling type of fish such as the hakes or herrings as raw material for the production of FPC: such schools of fish are usually composed of many millions of individuals of the same species, with almost no foreign interlopers among them, thus assuring a homogeneous raw material. Another reason why single species of fish . . . should be selected is . . . [to avoid] variations [that] are likely to affect the processing conditions that must be chosen to insure a satisfactory FPC product.

(2) To insure optimum quality of the finished product, the raw material must be as fresh as possible and indeed be of food grade quality.

(3) Although the use of fresh, iced or frozen fish will give products with the best nutritional qualities, some FPC manufacturing processes use fish meal as the raw material. . . .[7]

The fish to be processed must be kept cool from the time they are removed from the water until they reach a processing plant to reduce spoilage, clean to prevent contamination, and free from injury to reduce the opportunity for spoilage organisms getting into the flesh.

Processing Methods

The methods used for making FPC fall into three groups: physical, biological and chemical. In all cases the objective is to transform fish, a highly perishable product, into a less perishable product. The processing may begin with whole fish as caught or with fish by-products already processed.

Physical processing methods include mechanical pressing for removal of the water and oil from ground-up fish, electrical charging of a fish slurry to break up the fish cells so that solids and liquids can be separated by centrifuging, and dehydration. Mechanical pressing has received little attenion because of the difficulty of maintaining sanitary conditions. Although experimental electrical methods exist, this method is not well understood.

Modern dehydration methods use a mixture of finely ground fish suspended in oil and vacuum evaporation (drying). Then either the oils are removed from the dried product by using a solvent or the undesirable rancidity caused by the oils is overcome by adding an antioxidant.

Biological methods use either fermentation, as with fish sauces and pastes, or specific biological agents. Fish sauces differ from fish pastes in which a cereal is mixed with the fish and the final product has a different consistency to that of fish sauce. Both products are made by fermentation process with salt added. The final product is relatively expensive, not particularly high in protein content, and too high in salt to be suitable for children and expectant mothers.

There are several specific enzymes and microorganisms which have been investigated as agents for breaking down fish proteins into forms that would be valuable for human consumption. Professor Victor Bertullo, of the University of Uruguay in Montevideo, has found a marine yeast which, in the presence of a carbohydrate, breaks down the finely ground fish into proteins and protein substance. Although some bones

and scales are not digested, only centrifuging is necessary to remove this sludge and to separate the fish oils. The resultant liquid, when dried, produces a crystalline powder that is instantly water-soluble and valuable as a food supplement. Plans are being drawn for a plant which uses this method in producing food protein for animals.

Chemical methods can be classified according to the solvent which is used to remove the water and fat. After studying all methods of producing FPC the U.S. Bureau of Commercial Fisheries, selected isopropyl alcohol as the most promising solvent for a two-or three-stage extraction method. The comminuted fish* are mixed with isoprophyl alcohol (twice for a two-stage and three times for a three-stage process), agitated while held at specified temperatures, and then separated into liquid and solids by centrifuging. The liquids which are not removed by centrifuging are removed in a warm air drying chamber. The remaining solids are ground into a fine powder constituting protein concentrate.

Although a product called *garum* (Latin) or *liquamen* (Greek) was available in the days of the Romans, although fish sauces and pastes were developed in the Far East at a very early period, and although sun-drying, salting, and smoking, were originated hundreds of years ago, it is the more recent developments which are behind the present increased effort to utilize fish protein.

In 1937 Professor G. M. Dreosti, Director of Fishing Industry Research Institute, University of Cape Town, South Africa, developed a solvent extraction method. More than 1000 tons of neutral fish flour was used for making a brown bread. In a more recent process, all of the fish oils are not removed but a natural antioxidant oil is added to prevent rancidity. The flour thus produced has a fish flavour as distinct from a fish meal flavour.

During World War II in Germany, a synthetic eggwhite was made from fish.

In 1950 Vio Bin Corporation, in the United States, developed a solvent process and is currently producing a product which is used for feeding animals.

Currently, production of fish protein concentrate is under way in two plants—one in Chile and the other in Morocco—sponsored by the Food and Agriculture Organization of the United Nations. A pharmaceutical plant in Sweden and a plant in Peru produce fish protein concentrate from fish meal. Little is known about fish protein concentrate production in the Soviet Union but in the U.S. a pilot plant, sponsored by the government, will probably be in operation in the Pacific Northwest by 1969.[8]

Marketing

The marketing of fish protein concentrate is a social problem because marketing depends in large measure upon consumer eating habits, customs, and preferences. Professor Dreosti, summarized the present situation as follows:

There are no difficulties here in regard to dependable supplies of fish, nor in regard to technological processing aspects. The only problem we have is to find a suitable market. . . . The fish flour was put into brown bread, but unfortunately the bread was not eaten by those who needed it most. They only ate white bread at a slightly higher price (personal communication).

Experts testifying before the U.S. Senate Subcommittee on Merchant Marine and Fisheries said, 'People, as we know, do not buy and eat foods just because these foods are good for them. Often behind them are thousands of years of culture and traditions governing their dietary habits, in many cases contributing to the problems of malnutrition'.[9]

In contrast, changing food habits in the United States have been accompanied by the development of many formulated foods. Apparently in the U.S., as long as a product is desirable in terms of convenience, appearance, texture, taste and fragrance, it is saleable. Improved nutritional balance and lower costs may occur as a beneficial by-product.

In order to be used as an ingredient or supplement in a formulated food, a new product must mix well without detracting from appearance, texture, taste, and fragrance. However, FPC produced by the isopropyl alcohol solvent method has a tendency toward graininess and does not absorb water easily. When added to bread, it decreases, in some cases, the loaf size (not weight), darkens the colour, and may produce a slight odor. These characteristics of FPC affect the opportunities for supplementation and the ways in which it can be introduced as a new item in diets.

Governmental action also can influence the potential for fish protein concentrate. In the United States, the Food and Drug Administration has ruled that FPC can be sold only in one pound (453 g.) consumer packages[11]. This ruling effectively retards its marketing in the United States. Although there is some question as to what constitutes a proper nutritional level, it is

* Since some fish are called 'ground fish' because they are caught in the sea, the word 'comminuted' is used in place of 'ground' to indicate that the fish have been subjected to grinding.

possible that a government might establish protein standards for flour, bread or other cereal products which would make supplementation necessary*. Food standards are already established for other foods, for example, the vitamin A in margarine.

Competition from other protein sources is another element in the acceptance of FPC. In the United States dried skim milk is an alternative source of high-quality, low-cost protein and the dairy industry has been charged with hampering the development of FPC. Another alternative was introduced in 1967 when a team at the American University of Beirut announced the development of a product called *Laubina*, which is made from wheat, chick peas, and dried skim milk[12].

Thus, the successful introduction of FPC depends on the degree of success realized in solving the problems related to (*i*) food habits, customs and preferences, (*ii*) suitable preparation for consumption, (*iii*) government regulations, and (*iv*) competition from other protein sources.

Financing and Managing Production

In the previous discussion of sources of raw material, it was indicated that the price of industrial fish was \$6-\$7 a ton in Peru, \$12-\$15 in South Africa and \$20 in the United States†. These figures are considerably lower than the estimates of Resources Engineering of Canada. Integration of the fishing fleet with the processing plant may lower costs and is discussed later.

Information on processing costs is limited. The discussion here is restricted to the isopropyl alcohol method because of availability. Later work may show that other methods—Professor Bertullo's biological method, for example—have lower costs.

Costs estimated by Stone and Webster, Canada Ltd. of Toronto, of the alcohol solvent method have demonstrated large economies of size. The costs per pound of finished product were 31-5 cents in a 25-ton-of-fish-per-day plant, 22.9 cents in a 50-ton plant, and 20.5 cents in a 75-ton plant[13]. These estimates assumed an input price of one cent a pound for fish. However, a study by the Bureau of Commercial Fisheries in the U.S., using one cent per pound for fish, estimated the production cost in a 50-ton-per-day plant at 13.9 cents per pound[14]. This is nine cents lower than the Canadian estimate.

Using an input price of three cents per pound for fish, Resources Engineering of Canada, estimated 42 cents per pound as the cost of finished product[3]. Even with a correction of about 13 cents‡ for the added cost of fish, this estimate is 29 cents compared to 22.9 cents and 13.9 cents. Processing differences might explain part of the variation among the Bureau of Commercial Fisheries' estimate of 13.9 cents and the two estimates made in Canada—22.9 cents and 29 cents.§

Estimated capital requirements also differed among these three groups for a 50-ton-per-day plant. The Bureau of Commercial Fisheries estimated total capital requirements of \$879,400, Stone and Webster Canada, Ltd., \$1,459,700 and Resources Engineering of Canada, \$2,000,000. Only Resources Engineering of Canada made an estimate for an integrated operation including the fishing fleet, wharf, and unloading facilities. It was \$9,800,000 with the largest single item being \$6,000,000 for 6 trawlers capable of supplying 50 tons of fish per day for 360 days per year.

There would be considerable value in a detailed analysis which explained the reasons for variation in these estimates. However, there are factors other than plant which will cause variation in cost. To operate any plant requires a good supply of fresh water and of electricity. Transportation facilities for moving workers, supplies and the finished product are essential. The plant must be located near fishing grounds and be designed so that fishing ships can unload. All of these considerations will influence capital costs.

Whether or not an integrated plant should be established by public or private enterprise depends upon the resources available in a country. In many developing countries it would probably be necessary for the government to supply the capital and perhaps the management. Even in the United States it is the government which is investing the initial capital and supplying the management for development.\$

* Replacing 10 per cent of the flour with fish protein concentrate increases the protein from 15 per cent to 23 per cent and the ash from 1.3 per cent to 2.8 per cent[10]. In addition to increasing the amount of protein, fish protein concentrate also improves the biological value of wheat protein. Similar results are obtained for macaronies and other cereal products.

† Cost of raw material supply can be implied from present prices of industrial fish but supplies for making fish protein concentrate will require more care than is now given to industrial fish. Chapman[5] estimates that the extra care will double the present costs for industrial fish.

‡ One cent per pound for fish adds about 6.5 cents per pound for finished product because it takes about 6.5 pounds of fish to make one pound of finished product.

§ Production cost in Chile was 13.4 cents per pound in 1961. The method of production is to remove the oils from dried fish by means of solvents[15].

\$ A comparison of economic efficiency in public and private enterprises may be filled more with emotion than with reason. Land and capital have no appreciation of whether they are publicly or privately owned. Their potential functioning is not

In order to examine relative consumer costs for using fish protein, 25 cents a pound was assumed and compared with protein prices from different sources in the following table from *Marine Science Affairs*:[17]

Type of product	Price per pound (cents)	Protein %	Price of protein per pound (cents)
F.P.C.	25	80	31
Dry non-fat milk	15	35	45
Dried fish (Africa)	14	37	38
Chicken (U.S.A.)	25	15	165

Comparisons of this type can be misleading because they attribute all of the price to protein. When most of the other portion of a product is water—the case for chicken—the relative prices of protein are quite valid, but in comparing FPC and dried milk some consideration should be given to the food value other than protein. In any case, FPC is a low-cost protein of high quality and can be mixed (as can dried milk) with other products.

Of more importance, however, is the fact that a comparison of price or cost among protein sources does not reveal the cost to the consumer of FPC supplementation. When flour or other cereal products are enriched by FPC, the price of the blended product becomes higher than the original product without the supplement. J. Holme, from the Ogilvie Flour Mills Co. Ltd., in Montreal, Canada, said, 'If FPC cost 25 cents per pound and was used at a two per cent level, the cost of a flour and FPC blend would be from 12-20 per cent higher than the flour alone'[18]. If flour were supplemented at the 10 per cent level—a level often used for illustration of the benefits to be derived by adding fish protein concentrate—the increase in price would be from 60 to 110 per cent. These figures exaggerate the increase in price that would be necessary for bread, macaroni, or other consumer products but, even here, with supplementation at 10 per cent, price increases of 30 to 40 per cent would prevail.

In considering this aspect, Hamlisch, concludes that:

'Consumers with very low income, even if they appreciate the nutritional advantages of FPC supplemented staple foods, can pay the increased price with great difficulty, if at all. Those who cannot understand the value of the supplementation, or who cannot afford to buy the food, will not benefit from it. Production of staple foods fortified with FPC cannot be conceived, therefore, under conditions prevailing in most developing countries, without public assistance'[9].

Thus to produce FPC at a low cost, by present methods, will require plants processing 50 or more tons per day. The required investment, particularly for an integrated operation, is of a size which can probably only be handled by government in many developing countries. Even with a low cost of product, supplementation of existing food products would result in increased food prices beyond the reach of low-income groups. Government subsidy might be necessary if widespread consumer acceptance were to be achieved.*

Economic Development Policy

There is a tendency to identify the term *economic development* only with low-income countries. If this were correct, it would mean that the high income countries had stopped developing. It is an expressed goal of both low and high income countries to narrow the differences in *per capita* income among countries. To do this, however, means that low-income countries must develop more rapidly, percentagewise, than high income countries. The production of FPC might best be examined with this goal in mind.

Gunnar Myrdal, Director of the Institute for International Studies in Stockholm, in appraising the present success of speeding up economic development in low-income countries, said: For a long time, statesmen and scholars have expressed the hope and expectation that the high and rapidly advancing level of scientific and technical knowledge in the developed countries would be adapted to increase production in the underdeveloped countries. . . . Few seem to be aware that

affected by ownership. The difference in efficiency rest in the human factor. Human efficiency, however, may be more affected by power, responsibility, and distribution of income than by the type of ownership. Possibly if more attention were given to a study of the delegation of power and responsibility along with the continuing bargaining for distribution of income, we could overcome our emotional ties to public or private ownership. A new concept of personnel management, for example, has been developed, for application both in public and private enterprise.[16]

* Several who read and criticized this report in its initial preparation pointed out that the information available for making an economic judgement is inadequate. Costs of production pertain only to the isopropyl alcohol method and these costs vary widely. There are no comparisons of the cost of providing fish protein concentrate with the cost of developing fresh fish supplies. Costs have been drawn up for the U.S.A. where capital is lower priced than labour compared to capital and labour prices in lower income countries. It was implied that development of fish protein concentrate may be a means of bolstering income for the fishing industry which is currently in financial difficulty in some parts of the world. This generally pessimistic appraisal can be tempered, however, by the appraisal of some in private industry who are confident that fish protein concentrate has a promising future.

scientific and technological knowledge, as it has been directed, has thus far worked to the disadvantage of thy underdeveloped countries[19]. His explanation of whe the underdeveloped countries have been disadvantaged is that science and technology in low-income countries have reduced the death rate thus aggravating population pressures. At the same time, high-income countries have used science and technology to improve their self sufficiency and this has led to deterioration of the low-income countries' international trading positions. He strongly suggests research to develop agriculture and a concentration on developing those industries which serve agriculture. He concludes by saying, 'most of [the] increase in agricultural production must take place in the underdeveloped countries'.[19] Although Myrdal expressed himself in regard to agriculture, the same attitude could apply to the production of FPC.

Hamlisch reiterates the failure of science and technology to aid low-income countries. He says, 'Fisheries trends show that the role of developing countries in world fish production (if the special case of the Peruvian anchoveta fishery is disregarded) as well as in the world markets for fishery products is declining'[9]. His explanation is that 'most developing countries lack the financial, management, and skill resources to catch and process fish on a large industrial scale'.

There is no question that most low-income countries are not developing a food supply faster than developed countries. The differences among countries are increasing[20].

If the production of fish protein concentrate is to contribute to a more rapid rate of economic development in low-income countries, the industry needs to be established in these countries. In the form of food aid, FPC would only contribute to the population pressure mentioned by Myrdal. Even if it could be sold in these countries—which is highly unlikely because it is a high-price food product—the sales could do little to increase the wealth of the country. This kind of trade represents primarily substitution of one produce for another.

These things may have been the reasons why, when writing about FPC, the U.S. National Council on Marine Resources and Engineering Development stated that:

We do not define this food-from-the-sea programme as a means for shipping more fish protein to protein-deficient countries. Rather, we define it as a programme which will help those countries, through the importation of technological capability, to produce the fish protein themselves.[9]

If this is to be the economic development policy in regard to FPC production, more difficulties will be encountered than if production were to be undertaken in a well developed country. Hamlisch has mentioned the difficulties of obtaining financing, management, and skill resources. The problems of marketing have also been mentioned.

Even these difficulties may not touch on the most important problems. Galbraith, economist and former U.S. Ambassador to India, has said,

'On even the most preliminary view of the problem (economic development), effective government, education, and social justice emerge as critically important. In many countries, in diagnosing the barriers to advance, it is the lack of these that is of critical importance. And it follows that until these barriers are removed, little will come from capital investment and technical assistance.'[21]

It seems apparent that if the fish protein concentrate programme is to be effective in reducing protein deficiency, it must be introduced in a country which is willing to subsidize the lowest-income members of its society.

Summary

In the waters of the world there is a sustainable supply of fish forms of life which could be used to supply many times more protein than is now utilized. The location of these supplies, in many cases, will have to be discovered and the equipment for harvesting must be built and organized. Care will have to be used in avoiding toxic forms. Although 'trash' fish and waste products from fish processing offer an alternative source of supply, this source is not sufficiently localized to offer much opportunity of providing a continuous reliable supply.

There are many ways of converting raw fish material into a stable, non-perishable high protein concentrate. Dehydration, fermentation, and solvent extraction represent the physical, biological, and chemical processes being investigated. Currently, solvent extraction is receiving the most attention. The end product of this method is somewhat granular in consistency, difficult to mix with other ingredients and, when added to flour affects the physical characteristics of bread, macaroni and other products.

The marketing of FPC has not been successful in South Africa and other places. Lack of success may be due to the quality or form of the product being offered but food habits and price may be of more importance. Since FPC is expected to be used as a supplement to other foods, success in marketing will depend on the acceptance of those foods to which it is added. Formulated foods have proven successful so long as palatability is maintained and price is

acceptable. The production and sale of FPC is at present a relatively risky undertaking. The capital required for low-cost production in an integrated raw material procurement, processing, and marketing operation is about nine to ten million dollars. To act as a stimulant to economic development in low-income countries, it will have to be located in those countries. Otherwise it becomes only a humanitarian food-aid programme which may aggravate population pressures. The programme also would require large scale government subsidization and its successful implementation would depend on the degree of efficiency in government, of interest and effectiveness of education, and of concern for the nutritional well-being of the people.

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Shelf-life and Sensory Evaluation of Fish Sausage Manufactured on a Pilot Plant Scale

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Fish sausage manufactured on a pilot plant scale with sorbic acid and sodium benzoate as preservatives was microbiologically safe, being free from coliforms, yeasts and moulds, coagulase positive staphylococci and pathogenic anaerobes including Clostridium types. The product had a shelf-life of three weeks at 25±2°C. Total lysine, available lysine, methionine, cystine and tryptophane in fish sausage were 10.3, 10.0, 2.2, 0.9 and 1.0 per cent, respectively. Fish sausage had good acceptability.

Fish sausage being a processed food, the time and temperature employed during processing are insufficient to kill all microorganisms. Thermotolerant and spore-forming bacteria survive the processing and bring about spoilage. Consequently, chemical preservatives are used in fish sausage to give a reasonable shelf-life and prevent rapid putrefaction.

Preparation, shelf life and spoilage of fish sausage have been studied[1-3]. Rapid spoilage of fish sausage stored above 30°C has been reported[4]. Spoilage include spots, softening and flabbiness, caused mainly by aerobic spore formers. The spoilage organisms are not only thermotolerant but also resistant to the preservatives employed[2-3]. Chemical preservatives like nitrofurazone and its derivatives[2,4] and antibiotics like tylosin and nisin[5] are permitted for preservation of fish sausage in other countries. The Indian Food Laws do not permit the use of these preservatives in processed foods. Krishna Swamy *et al.*,[6,7] preserved fish sausage with sorbic acid, sodium benzoate and orange oil. These preservatives compared with nitrofurazone in preservation of fish sausage at 252±°C, for three weeks in the above laboratory studies.

The present investigation was undertaken to study the shelf life and sensory evaluation of fish sausage produced on a pilot plant scale and preserved with sorbic acid and sodium benzoate. Amino acid composition of the final product is also reported.

Materials and Methods

Preparation of fish sausage: Fish sausage required for the study was prepared in the pilot plant at the Marine Products Processing Training Centre, Mangalore, India. Two batches of fish sausage of about 75 kg. each, were prepared using sorbic acid (product I) and sodium benzoate (product II) as preservatives.

Freshly caught croaker and shark available in abundance in Mangalore were dressed to remove entrails, frozen and stored till used. Fish was cleaned and the edible portion was separated from skin and bones in a mechanical meat-picker. Known quantity of croaker and shark meats mixed with hydrogenated groundnut oil and onion, were first passed through a coarse mincer and then through a fine mincer. This was then mixed with other ingredients as per recipe in Table 1, for 15 minutes in a silent cutter.

The prepared material was stuffed in 'saran' casings (30 mm.×80 mm.) with 100 g. of sausage in a mechanical double-cylinder stuffer. The filled casings were sealed with aluminum cord in a mechanical wringer. These were processed in a semi-automatic cooker and cooler. This equipment consisted of a chain attached with boxes made of perforated plates in which sausages were packed. The chain passed through two tanks, one containing hot water at a temperature of 88-90°C and the other containing cold water at 18-20°C. The speed of the chain was adjusted to give cooking and cooling times of 50 and 25 min., respectively. After cooling, the contents of the boxes were transferred to another conveyor which dipped the material in boiling water and later in cold water at room temperature for 20 sec. Sausages were cooled to room temperature. These were packed in cardboard cartons, placed in an insulated box and transported to Mysore within 5 hr. Sausages were stored at 25±2°C immediately after reaching the laboratory in Mysore.

Microbiological examination: pH was determined directly with a Beckman pH meter; microbial load,

TABLE 1. RECIPE OF FISH SAUSAGE MANUFACTURE

Ingredients	Product I		Product II	
	Quantity kg/bowl*	Percentage on total weight	Quantity kg/bowl*	Percentage on total weight
Fish				
Croaker (*Nibea argentata*)	21.75	58.38	22.50	63.86
Shark (*Galoerhinus manazo*)	3.25	8.72	2.50	7.10
Hydrogenated groundnut oil	3.00	8.06	2.00	5.68
Corn starch	2.50	6.72	2.00	5.68
Cane sugar	0.50	1.34	0.25	0.71
Table salt	0.75	2.00	0.50	1.42
Spice mixture†	0.13	0.36	...	...
White pepper	...	...	0.09	0.27
Garlic (*Allium sativa*)	...	...	0.01	0.03
Chilly powder	...	...	0.02	0.04
Fresh onion (*Allium sepa*)	0.37	1.01	0.37	1.06
Preservative				
Sorbic acid	0.05	0.10	...	...
Sodium benzoate	...	...	0.04	0.11
Ascorbic acid	0.01	0.02	0.01	0.03
Monosodium glutamate	0.06	0.16	0.06	0.18
Calgon (Sodium hexametaphosphate)	0.06	0.16	0.06	0.18
Color (Mixture of sausage red and sausage purple)	0.05	0.14	0.05	0.14
Crushed ice	4.77	12.80	4.77	13.51
Total	37.25	100.00	35.23	100.00

* Two bowls operating at a time in each batch. Number of sausages obtained (including defectives) of 100 g. each per batch of about 75 kg. material=500.

† Spice mixture consisted of pepper, cloves, garlic, cinnamon, mustard, nutmeg, cardamom, red chillies and bay leaf.

coliforms, yeast and moulds, coagulase-positive staphylococci and pathogenic anaerobes including clostridium types, by APHA methods[8]. Total volatile base (TVB) was estimated by Conway micro diffusion method.

Amino acid composition: Lysine, methionine, cystine and tryptophane were determined microbiologically[9]. Available lysine was estimated by the method of Carpenter[10].

Shelf-life: This was determined at 25±2°C over a period of 3 weeks by changes in pH, microbiological examination and changes in TVB. For comparison, storage of sausage was done at 37±0.5°C.

Sensory evaluation: Sensory evaluation was conducted to find out the acceptability of fish sausage at different intervals of storage. Fish sausage being a ready to serve/cook product can be consumed as such or incorporated into various preparations. The product being new to Indian dietary, it was felt that people would prefer cooked (fried/boiled) sausage. Fish sausage (I & II) was sliced uniformly (3 mm. thick) and deep-fried in hydrogenated groundnut oil for about 3 min., and the sausage with pleasant reddish brown colour was served hot. The preference between the two products and in the preferred product, the extent to which quality factors, viz., colour, flavour, texture and spicing were liked, ascertained. Objective evaluations were performed by panels of forty-nine persons in the first trial, thirtyseven in the second trial and eighteen in the third trial. The panelists were not aware that stored products were being evaluated in second and third trials. Though the panelists were not familiar with fish sausage, they were regular fish eaters, familiar with taste panel techniques.

Acceptability tests:[11] Panel members indicated their response by scoring the samples on a five point hedonic scale ranging from 'like very much to dislike very much'.

Preference tests: The products were served in random order and the preference response between the two products was collected through direct question in all the three trials.

Quality factors in the preferred products: Likes and dislikes of individual quality factors in the preferred products was judged through Yes/No type answers with a view to understand the reasons for preference and the nature of improvement necessary in the products.

Consumer acceptability trials with various income groups: Fish sausage (products I and II) was supplied to various families who were habitual fish eaters and belonged to different income groups and their acceptability ascertained. The families evaluated the products after preparing them in different forms according to their choice. Majority fried the sausage in oil with additional spicing. The number of families tried were small but each family had on an average 4 people and the opinion given is that of the family.

Results and Discussion

Amino acid composition: Lysine, available lysine, methionine, cystine and tryptophane were 10.3, 10.1, 2.2, 0.9 and 1.0 per cent, respectively (Table 2).

TABLE 2. ESSENTIAL AMINO ACID COMPOSITION OF FISH SAUSAGE

	Per cent g/16g N	
	Product I	Product II
Total lysine	10.3	10.4
Available lysine	9.9	10.2
Methionine	2.4	2.0
Cystine	0.9	0.9
Tryptophane	1.0	1.0

Available lysine was 97.1 per cent of total lysine, thereby revealing no appreciable destruction of lysine during processing on a pilot plant scale.

Shelf-life: The changes in pH, microbial load and TVB are given in Table 3. From the results it is seen that there was slightest decrease in pH in both products I and II. Microbial count increased normally during storage, the increase in product II being more than that of product I. Tanikawa[12] reported that fish sausage with microbial load of 45×10^7 for aerobic bacteria and 67×10^3 for anaerobic bacteria were quite edible and could be safely sold. It will be seen that the microbial load of fish sausage in the present study was less than that reported for edible ones. Coliforms, yeasts and moulds, pathogenic staphylococci and clostridium types were absent.

TVB increased in the products during storage, the increase being a little higher in product II.

Sensory evaluation of stored fish sausage has shown that even at maximum TVB, the products remained edible.

During the period of storage, fish sausage had good appearance, uniform colour and elastic texture. Spoilages like spots, softening and flabbiness did not develop in fish sausage. The products stored at $37^\circ\pm0.5^\circ$C, spoiled in about 10 days, which was characterised by increase in pH, sweating, loss of elasticity, flabbiness with gas production and sour odour. Both preservatives gave products acceptable over the entire storage period at $25\pm2^\circ$C. Though sorbic acid and sodium benzoate are considered more effective in the acid range, the preservative action of the two additives for fish sausage in the pH region of 6.0 may be due to the combined action of the preservative, salt and spices.

TABLE 3. SHELF-LIFE OF FISH SAUSAGE STORED AT ROOM TEMPERATURE ($25\pm2^\circ$C)

Days of Storage	pH		Microbial load		Total volatile bases (mg N/100g)	
	I	II	I	II	I	II
0	5.9	6.2	11×10^2	45×10^2	...	...
6	5.8	6.0	7×10^3	36×10^4	20.0	38.0
14	5.8	5.9	24×10^4	21×10^5	30.0	48.0
21	5.7	5.9	3×10^5	5×10^6	38.5	78.0

TABLE 4. MEAN ACCEPTABILITY SCORE FOR FISH SAUSAGE

Product	Acceptability scores for		
	First evaluation (6 days)	Second evaluation (14 days)	Third evaluation (21 days)
I	4.2	4.3	4.4
II	3.7	4.3	4.2

5.0 Like very much; 4.0-4.9 like moderately; 3.0-3.9 Neither like nor dislike; 2.0-2.9 dislike moderately; 1.0-1.9 dislike very much.

TABLE 5. PREFERENCE RESPONSE IN ALL THE THREE EVALUATIONS

Preferences to	Number of cases
Product I	63*
Product II	31
Neither products	10

* Significant at 1% level[12]

TABLE 6. ANALYSIS OF DATA REGARDING QUALITY FACTORS

Quality factors	Response	Product I*		Product II†	
		Number of cases	Percentage	Number of cases	Percentage
Colour	liked	60	95	27	87
Flavour	,,	61	97	29	94
Texture	,,	62	98	26	84
	Preferred more	26	41	17	55
Spicing (Taste)	Preferred reduction	14	22	11	35
	Felt enough	23	37	3	10

* Total Number of cases who preferred=63;

† Total number of cases who preferred=31; Percentages are worked out on this basis.

TABLE 7. CONSUMER-ACCEPTABILITY TRIALS WITH VARIOUS INCOME GROUPS

Particulars	Product I*		Product II*	
	Number of cases	Percentage	Number of cases	Percentage
Liking (General acceptance)	21	95	17	89
General appearance				
Packaging appearance	20	91	17	89
Right size	19	86	17	89
Colour appealing	18	82	15	79
Colour appealing after cooking	19	86	15	79
Like smell	16	73	15	79

* Number of families who evaluated product I and product II were 22 and 19 respectively.

Acceptability: From Table 4, it is seen that product I showed good acceptability in all the trials and product II fair to good acceptability. There was an indication that the products improved in quality on storage. Analysis of the data of panelists confirmed this feature.

Preference: From the preference analysis given for the two products (Table 5), it is seen that product I was preferred to product II, being significant at 1 per cent level. The preference appears to be due to taste, flavour and texture.

Quality factors: The analysis of data in Table 6 showed that colour, flavour and texture of product I appealed to over 95 per cent of the panelists. With

regard to spicing, the opinion varied too widely to draw any definite conclusion. The results in Table 7 is indicative of good consumer acceptability of fish sausage (products I and II) with different income groups. A majority opined that colour and packaging were appealing.

The formulations of fish sausage were varied in the levels of hydrogenated groundnut oil, starch and seasoning to get an indication of the effect of such variations on consumer reaction. Fish sausage with higher amounts of hydrogenated groundnut oil, starch and spices seem to be preferred to one with lower amounts of the above ingredients.

The cost of fish sausage calculated on the basis of the pilot plant trials projected to a production of 5,000 sausages in single shift and an annual 250 working days production of 12,50,000 sausages works out to Rs 7 per kg.

Acknowledgement

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Effects of Temperature and Sample Location on the Penetration of Minimal Curing Chemicals in Ham

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Investigation on the methods of curing ham, so that it could be preserved at higher temperatures without changing its colour and flavour have been reported. The treatments tried are dry cure, 4 per cent pickle plus cover cure, 4 per cent pickle plus brine cover and 8 per cent pickle plus cover pickle. The results indicate that the dry cure method is the most desirable of these techniques.

In India, salt curing of meat and fish has been a method of preservation practised for generations. But, it is not satisfactory because of elevated temperatures. Refrigeration facilities are not available everywhere in our country. Therefore, it was felt necessary to study whether it is possible to cure ham at elevated temperature without changing its colour and flavour characteristics. An attempt has been made in this experiment to investigate the effect of temperature and sample location on the penetration of curing chemicals in ham under different environmental conditions. Minimal curing chemicals (salt, sugar, and sodium nitrate) were used for this purpose.

Materials and Methods

A total of 72 hams were cured (average weight 9 kg.) in the study. The treatment[1] (8:3:3) are shown in Table 1. After treatment, two-thirds of the hams were cured at 3.3-4.4°C and rest at 14.5°C for 35 days with relative humidity from 65 to 85 per cent. After curing the hams were aged for 5 weeks. The first phase of aging rested for five weeks and during this phase, all the hams cured at 14.4°C plus one sample cured at 3.3-4.4°C were aged in a 14.4°C environment; while the rest of the hams cured at 3.4°C were aged at 22.2°C environment. The final phase of aging lasted for 5 weeks during which time all hams were aged by keeping them for 16 hr per day at 25.6°C and other at 36.7°C in a temperature-controlled smoke chamber without smoke.

TABLE 1. TREATMENT OF HAMS

Treatment	Description
A. Dry cure (18 hams)	Dry cover mixture (8:3:3) applied as cover cure at 42.5 g. per 454 g. of the green weight of the ham.
B. 4% pickle+cover cure (18 hams)	Hams injected with 85° salinometer reading chilled pickle at 4% of the green weight of the ham and covered as A.
C. 4% pickle+brine cover (18 hams)	Hams injected with pickle as B and covered in the same pickle.
D. 8% pickle+cover pickle (18 hams)	Hams injected with 8% pickle as B and cover cured as B

One-third of the hams were kept as controls, one-third were used for chemical analysis and the remaining one-third were used for bacteriological analysis. Samples were taken from the ham by a 1.84 cm diameter stainless steel corer for chemical analysis and were divided into three sections, the medial, central and lateral samples. Moisture (vacuum oven), salt[2], nitrate[3] and nitrite determinations were made on these portions on the initial, 3, 14, 35, 70 and 105 days. The hams which were sound at the end of the study were evaluated by a sensory panel for organoleptic characteristics.

Results and Discussion

It was not possible adequately to evaluate the effects of curing temperature, on the degree of dehydration, rate of salt and nitrate penetration with subsequent transformation to nitrite as all the hams at 14.4°C curing environment spoiled prior to 35th day or the end of the curing period (Table 2). No consistent differences were found in their characteristics at the end of the 14th day. A close similarity was observed between the medial and central sample portions with respect to their moisture content and a corresponding similarity of salt and nitrite penetration into these tissues (Fig. 1 and 2). The lateral sample contained more fat and hence less moisture with subsequent different penetration and dehydration characteristics than that of the medial and central portions. The salt penetration in the lateral portion was slower and the final concentration reached was lower than other portions (Table 2).

The nitrate concentration reached its highest in the medial and lateral sections by the 3rd day and after-

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TABLE 2. MEAN SALT CONTENT OF HAMS BETWEEN CURING METHODS, TEMPERATURE TREATMENT AND SAMPLE LOCATION

Curing treatments	Per cent salt content in 0-Day	3-Day	14-Day	35-Day	*105-Day
3.3°C Medial sample					
Dry cure	0.23	1.67	4.24	2.24	4.37
4% pickle+cover cure	0.23	2.36	2.52	2.53	3.60
4% ,, +brine ,,	0.23	2.48	3.56	5.67	4.85
8% ,, +cover ,,	0.21	2.04	2.84	2.66	3.94
Mean	0.22	2.13	3.29	3.28	4.19
3.3°C Centre sample					
Dry cure	0.18	1.04	3.15	2.48	3.47
4% pickle+cover cure	0.21	2.50	2.10	2.28	3.29
4% ,, +brine ,,	0.21	2.01	2.91	4.9	4.97
8% ,, +cover ,,	0.21	1.90	1.87	2.52	3.49
Mean	0.20	1.86	2.50	3.11	3.80
3.3°C Lateral sample					
Dry cure	0.17	0.74	1.62	1.88	2.60
4% pickle+cover cure	0.17	1.23	1.38	1.24	1.68
4% ,, +brine ,,	0.19	1.61	1.70	3.46	2.79
8% ,, +cover ,,	0.17	1.63	1.23	1.80	2.60
Mean	0.18	1.30	1.48	2.09	2.41
14.4°C Medial sample					
Dry cure	0.21	1.85	4.25	...	...
4% pickle+cover cure	0.24	2.05	2.09	...	...
4% ,, +brine ,,	0.24	1.73	4.58	...	...
8% ,, +cover ,,	0.22	1.55	3.07	...	...
Mean	0.22	1.79	3.50	...	...
14.4°C Centre sample					
Dry cure	0.19	0.34	2.06	...	...
4% pickle+cover cure	0.24	0.85	2.09	...	...
4% ,, +brine ,,	0.23	1.93	3.54	...	...
4% ,, +cover ,,	0.17	1.67	1.86	...	...
Mean	0.20	1.18	2.38	...	...
14.4°C Lateral sample					
Dry cure	0.65	2.65	1.60	...	...
4% pickle+cover cure	0.16	0.53	1.48	...	...
4% ,, +brine ,,	0.16	1.33	2.64	...	...
8% ,, +cover ,,	0.17	1.67	1.86	...	...
Mean	0.28	1.54	1.86	...	...

* Control and bacteriological hams only

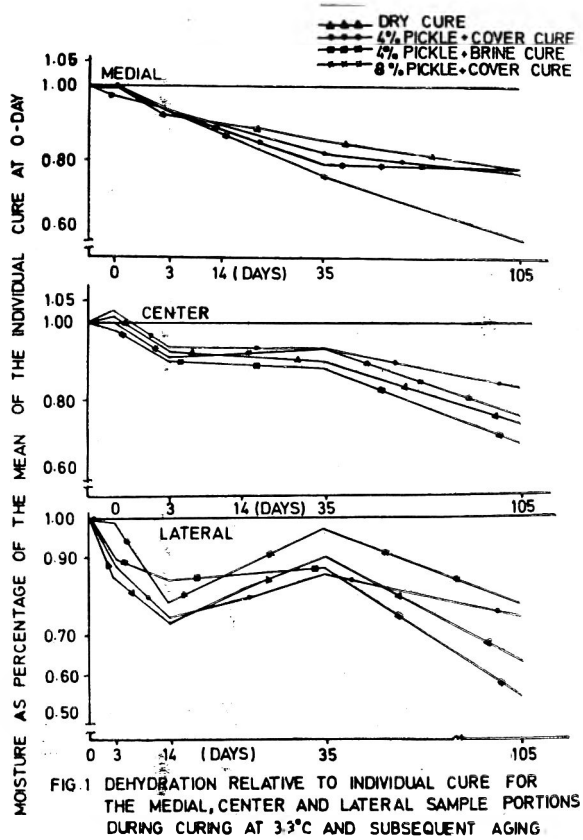

FIG. 1 DEHYDRATION RELATIVE TO INDIVIDUAL CURE FOR THE MEDIAL, CENTER AND LATERAL SAMPLE PORTIONS DURING CURING AT 3.3°C AND SUBSEQUENT AGING

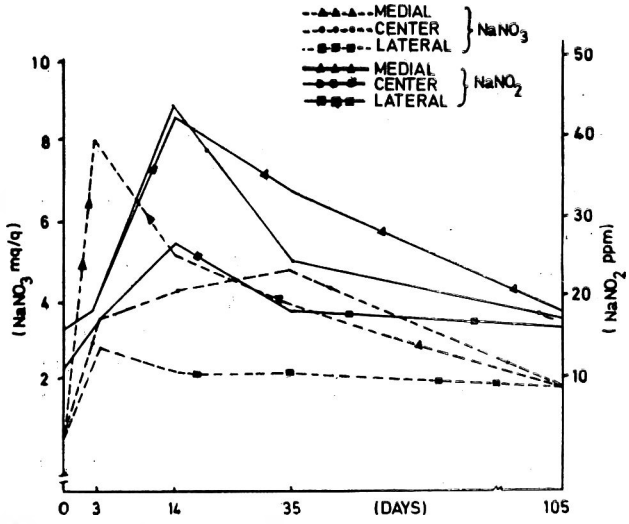

FIGURE 2 NITRATE AND NITRITE CONTENT OF THE MEDIAL, CENTER AND LATERAL SAMPLE PORTIONS OF HAMS CURED AT 3.3°C

wards decreased slowly. In the central portion, the maximum nitrate concentration was not reached until 35th day. The nitrite concentration reached its maximum on the 14th day and declined from that point until the concentration at the end of the aging was as low as the initial concentration (Fig. 2).

The minimal cures used for this was not adequate for ideal ham, as can be seen from the higher degree of spoilage encountered in these samples and final low salt content of the cured and aged ham. The 4 per cent plus brine cure resulted in greatest degree of dehydration and the highest salt content at the completion of the ageing period. The dry cure was second in degree of dehydration and salt content followed by 8 per cent cover and lastly by 4 per cent plus cover cure. No large differences were found between the mean salt content of the medial and centre portions of the hams cured at 3.8-4.4°C at the end of the 35th day cure; thus, no dramatic salt equilization of cure occurred during the ageing process (Table 2). These concentrations of salt approach nearly to those reported by Fields *et al.*,[4] for 'tendered' (0.034 per cent) and for ready-to-eat hams (3.62 per cent).

The injection of pickles into the hams increased the nitrate concentration at the third day (Fig. 2) over the

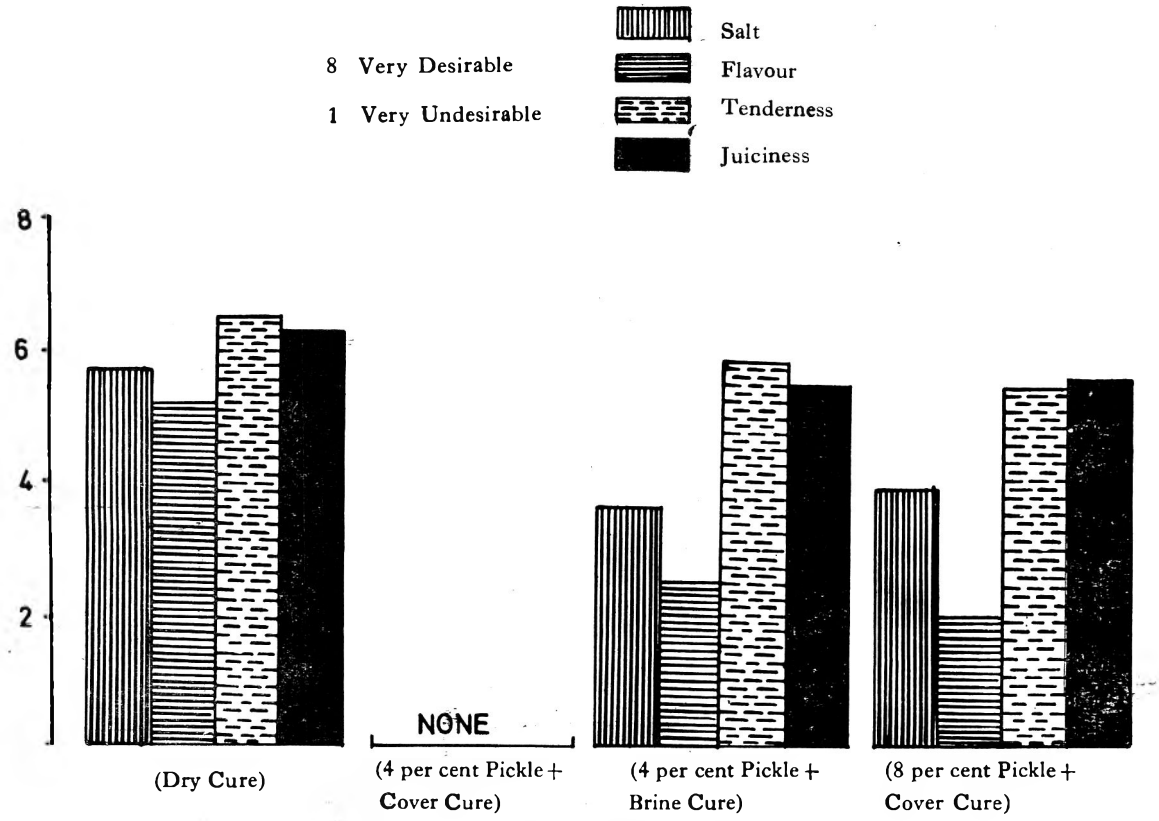

Fig. 3. Effects of Cures on Sensory Characteristics of Hams Cured at 3.3°C

dry cure method. The 4 per cent brine cure had a higher nitrate concentration again with no difference with termination of the ageing period.

In the control hams, none of the curing methods with minimal cures used were adequate to give a preserved product.

On sensory evaluation, the drycure hams were superior (Fig. 3) to the 4 per cent plus brine and 8 per cent plus cover cured hams with respect to saltiness, flavour, tenderness and juiciness. The 4 per cent plus brine and 8 per cent plus cover cured hams were rated undesirable with regard to flavour.

The dry cured method appears to be the most desirable of these curing techniques tests and concurs with the observation made by Fields *et al.*,[5] other cures used in this study were not found adequate to produce a preserved country style ham under conditions of elevated temperature and humidity.

Acknowledgment

Author is grateful to Dr H. D. Naumann, Professor, Meat Technology, under whose guidance the work under taken.

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Relationship of the Coarseness of Rice (*Oryza sativa*) Varieties to the Thickness of Bran and Aleurone Layers

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The product of breadth and thickness (BT) which is proportional to the cross sectional area of the rice is found to be a suitable index of coarseness or fineness of rice varieties. The thickness of bran and aleurone layers was found to be significantly correlated with BT or B. Bran and aleurone thickness was greater in the dorsal side than on the lateral side. This was true of transverse section at the germ, central and distal parts of the grain.

It is generally known that the coarse and coloured varieties of rice have a thicker bran coating[1] and have to be highly polished to be acceptable for culinary use. A relation of coarseness to protein content has also been recorded[2]. The object of this study is to test this by quantitative studies on pure bred strains of paddy. An attempt has been made to develop an index for coarseness so that it could be correlated with the bran and aleurone thickness.

Materials and Methods

Forty pure bred strains of paddy representing *Indica*, *Japonica* and their hybrid selections were obtained from several paddy breeding stations and brown rice samples prepared by hand dissection by an end point damage of the paddy at the end distal to the germ. Length and breadth of twentyfive randomly selected grains were measured by casting the shadow of the grains on the photographic enlarger screen and measuring the dimensions. Thickness of grain was arrived at by measuring the lateral diameter in median transverse sections. Thickness of bran (pericarp+ testa) as well as of aleurone layers were measured in transverse sections of the brown rice prepared according to details discribed earlier[3]. Sudan IV was used for staining the bran layers. Bran and aleurone thickness was measured in transverse sections at the germ, middle point and distal ends of the grain, to study their possible variations along the length of the grain.

Results and Discussion

Commercial classification for fineness of grains takes into account both the length as well as the breadth of grain. During examination of about fifty varieties of rice, it was found that fineness depended more on cross sectional area than on length, although for grains having the same length, the ratio of cross sectional area to the length could be an index of its fineness or slimness. Since consumer preference both from the point of view of appearance as well as the cooking and eating quality, is for a fine grain irrespective of its length, the fineness or coarseness of grains is represented here by the product of breadth and thickness (BT) representing the cross sectional area. This product is a better index than breadth alone, since thickness also contributes to the cross section. A rough classification of the varieties examined indicates that a grain could be considered as fine upto a BT value in square millimeters of 4.5, as medium for values between 4.5 and 5.5, and as coarse for values above 5.5; varieties with values under 3.5 could be classified as superfine.

The data on maximum, minimum and mean dimensions of rice grains, BT values and the thickness of bran and aleurone for forty different varieties are presented in Table 1. Variation in grain dimensions was greatest in breadth and least in thickness. The results of association analysis indicate that cross sectional area is highly associated with bran and aleurone thickness. The same was true of the relation between the kernel breadth and the thickness of bran and aleurone. Although detailed data are not presented here, there was also a direct relationship of bran thickness to aleurone thickness. In a transverse section of the grain, breadth (representing dorsiventral diameter) was correlated with dorsal bran and aleurone thickness and less so with lateral bran thickness. Thickness

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TABLE 1. MEAN VALUES OF KERNEL DIMENSIONS AND BRAN AND ALEURONE THICKNESS FOR FORTY PURE BRED RICE VARIETIES

Parameters	Length (L)	Breadth (B)	Thickness (T)	BT	BT/L	Thickness of Bran		Thickness of Aleurone	
						Dorsal	Lateral	Dorsal	Lateral
	mm.	mm.	mm.			μ	μ	μ	μ
Maximum	7.88	2.82	2.21	6.15	1.19	69.0	37.0	89.0	56.0
Minimum	4.94	1.93	1.62	3.18	0.54	28.0	3.0	30.0	17.0
Mean	6.03	2.43	1.95	4.81	0.80	45.9	19.1	67.3	32.3
S. E.	0.08	0.04	0.02	0.13	0.02	1.9	0.9	2.1	1.8
C. V. (%)	8.10	10.40	16.60	16.60	18.90	25.5	27.2	19.3	34.7

Association analysis :

	Dorsal bran	Lateral bran	Dorsal aleurone	Lateral aleurone
Breadth (B)	0.4805†	0.2979NS	0.4582†	0.5043†
Thickness (T)	...	0.3392*	...	0.3764*
BT	0.4540†	0.3179NS	0.4128*	0.4621†

† Significant at 1% level; * Significant at 5% level; NS Not Significant

of the grain representing lateral diameter of a transverse section was associated with lateral bran and aleurone thickness. The above observations bear out the general belief that the coarse varieties of grains have thicker bran layers and also higher protein content contributed partly at least by thicker aleurone layer. Since oil is mostly confined to the peripheral and germ portion of the grain and specially with aleurone, coarse varieties would also be expected to have higher oil content.

The bran and aleurone thickness along the dorsal part of the grain was always greater than the average bran thickness on the lateral side confirming recent observations in this regard[4]. This is true not only in the middle portion of the grain but also at the germ and distal ends of the grain. This is borne out by data presented in Table 2. The differential thickness of bran between the dorsal and lateral parts as also between the dorsal and ventral portions of the rice grain[1] is of significance in rice milling. It is found that during progressive milling, the lateral parts of the grain get abraded of the bran layers earlier than the dorsal section and it is only at a later stage in polishing (6 to 8 per cent polish) that the layers of the bran in the dorsal side get removed (unpublished work of Mahadevappa and Desikachar).

TABLE 2. THICKNESS OF BRAN AT DIFFERENT POINTS ALONG THE LENGTH OF THE RICE GRAIN

(Data relate to 40 varieties of rice)

Parameters	Germ tip		Middle point		Distal end	
	Dorsal	Lateral	Dorsal	Lateral	Dorsal	Lateral
	μ	μ	μ	μ	μ	μ
Maximum	167.0	63.0	150.0	71.0	146.0	67.0
Minimum	67.0	25.0	75.0	25.0	84.0	29.0
Mean	120.3	47.4	112.8	52.2	108.0	49.3
S. E.	2.85	1.36	2.77	1.61	2.75	1.52
C. V. (%)	15.0	18.2	15.3	19.3	15.5	18.8

General observations on the various grain parameters were also made. There was close correlation between bran and aleurone thickness, a significant positive correlation between length and breadth as also between breadth and thickness, while there was no relation between length and thickness. These observations are however of genetic interest. Detailed observations will be published separately.

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Multiwall Paper Sacs as Possible Barriers Against Entry of Insect Pests of Copra in Storage

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The performance of multiwall paper sacs and sealing strips of Reed Medway Sacs Ltd. as possible barriers against the entry of pests of stored copra has been investigated. The results show that all paper bags employed could keep copra free from infestation up to a period of three months and those treated with pybuthrin up to nine months.

The quantity of copra damaged in India every year, is more than 11,600 tons (estimated at five per cent loss), valued at about 11.6 million rupees[1]. This is brought about by direct loss in weight and by deterioration on account of increase in the free fatty acids due to insect feeding. The prevalence of insects in stored copra was noted to be intimately connected with the mouldy degeneration of copra. As preventive measures, reduction of moisture content of coconut meat below 6 per cent, by rapid uniform drying soon after splitting the nuts and use of insect free bags for transportation, have been recommended. Menon and Pandalai[2] have reviewed the control measures. The risk of absorption and retention of poisonous chemicals by the oil containing meat, channelled the efforts of research workers in the direction of finding suitable containers to store copra, free of pest infestation. Mathen[3] found in a survey that conditions prevailing for storing copra on the west cost of Kerala, were far from satisfactory and emphasised the need for standard designs of warehouses and evolution of suitable containers to hold copra in storage and transit. Marar and Padmanabhan[4] reported that alkathene-lined gunny bags preserved copra in good condition, free from mould and insect attack up to a period of six months. The present authors got interested in the reports from the Purnell Groups Research Division, Cumberland, on the efficiency of multiwall paper sacs and sealing strips, in giving complete protection to flour and animal feeding stuffs, for a total of eleven months against a range of stored pests and carried out experiments to find out the efficiency of these sacs against the pests of stored copra.

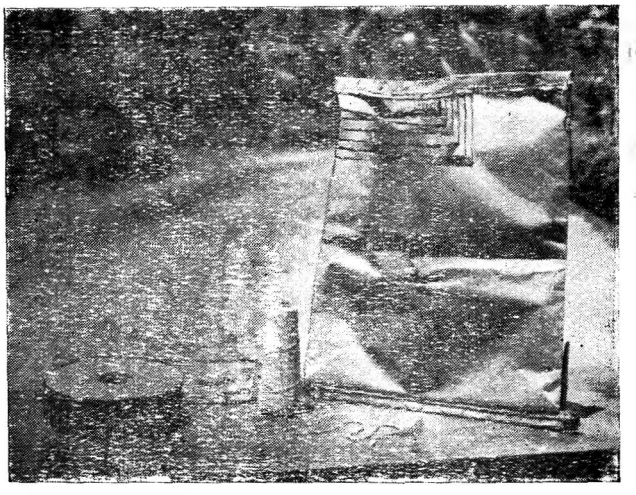

Fig. 1. **'Repellex' tape thread and multiwall paper sac the layers of facing side on the left top corner have been partly removed to show the 6-plies**

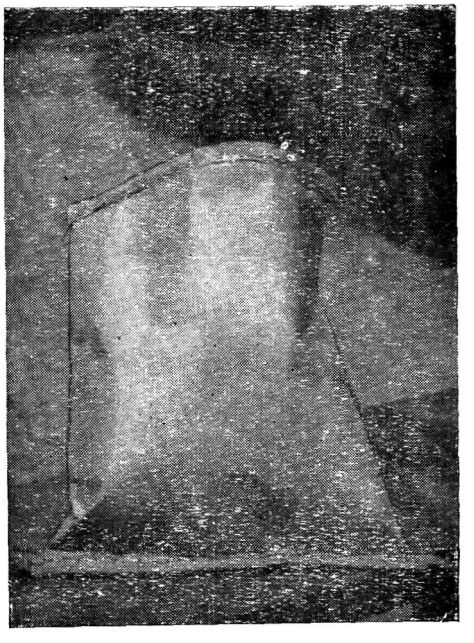

Fig. 2. **Paper sac filled and stitched**

Materials and Methods

The containers used in the trial to store copra were multiwall (6 plies) paper bags of miniature size 20″×15″ each (against the standard size 45″×25″), specially manufactured by Reed Medway Sacks Ltd., Larkfield, kent, (Fig. 1 and 2). Treated ones had their second

kraft from outside made out of Pybuthrin (Pyrethrins piperonyl butoxide)—coated insect repellent paper developed by 'Cumberland Paper Co' of Cleator Mill, Cumberland, in co-operation with 'Cooper Technical Bureau'. The inner ply was besides, wax-laminated in order to resist the high oil content of the product and also to prevent entry of moisture from outside. The bags were obtained sealed at the bottom with ordinary 'Repellex' treated tape and thread, while closure of the mouth ends, was effected after filling copra into them by cobbler's stitches with the tape and thread provided along with the bags. Copra used for the experiment was obtained by sun-drying fresh nuts. Fifteen copra (30 halves) were filled into each bag. Sixty paper bags and eighteen ordinary gunny bags filled with copra were stored in six different godowns in the west coast of Kerala. The details of the treatments are:

T_1—Treated paper bags, treated tape and thread,
T_2—Untreated paper bags, treated tape and thread,
T_3—Treated paper bags, untreated tape and thread,
T_4—Untreated paper bags, untreated tape and thread and
T_5—Ordinary gunny bags, (control).

Godowns 1-3 had three each of all the treatments, godown 1 had T_1 replicated twice, godown 4 & 5 had all except T_2, while godown 6 had only one replication each of T_1 & T_5. Observations were recorded by counting the total number of different species of insects present in each sac. The sacs were drawn from each godown to represent each replication at the end of three months, six months and nine months after deposit. Bags opened for observation were not redeposited. Statistical analysis of data was made by conducting the Student's 't' test.

Results and Discussion

The more important pests observed were *Oryzaephilus surinamensis L.*, *Trogoderma granarium* Everts, *Tribolium castaneum* Hbst., *Necrobia rufipes* Degeer and *Corcyra cephalonica* Staint.

Statistical analysis of data relating to the number of the more abundant pests observed viz., *O. surinamensis* and *T. castaneum* has shown that no bag offered any significant protection against either of these individually, in the third quarter. All paper bags in the first quarter and T_1 in the second quarter, offered substantial protection to copra against the attack of *O. surinamensis* while T_3 could not offer sufficient protection in the second quarter. All bags served as efficient barriers against *T. castaneum* in the second quarter.

Taking into consideration the total number of pests in the various treatments, all paper bags afforded significant protection up to three months as compared to ordinary gunny bags, while treated bags served as efficient barriers up to nine months. Between the paper bags, those with untreated kraft, untreated tape and thread presented the highest numerical strength of pests as compared to those with either treated kraft or tape, or both. These results gain additional significance when it is taken into account that the experiment was started only in 1965, more than three years after the manufacture and despatch of the sacs in early, 1962, due to the delay in transit. The moisture content of the copra, expressed in percentage on dry weight basis, at the commencement of the experiment was 7.6. At the end of the first quarter, copra in T_1, T_2, T_3, T_4 and T_5 had, respectively, 7.8, 7.5, 7.1, 8.0 and 7.9 per cent moisture. After six months, copra in gunny bags contained 7.3 per

TABLE 1. AVERAGE NUMBER OF PESTS IN THE DIFFERENT BAGS

		T_1	T_2	T_3	T_4	T_5
First quarter	*Os*	23.71*	3.67*	29.60*	44.80*	288.83
	Tc	6.00	1.00	0.60*	2.80	8.00
	others	28.72	0.00	44.00	38.20	17.84
	Total	58.43*	4.67*	74.20*	85.80*	314.67
Second quarter	*Os*	79.14*	17.00	12.40	491.20	1453.67
	Tc	11.43*	1.33*	18.60*	13.20*	85.17
	others	0.43	1.67	29.80	157.20	69.66
	Total	91.00*	20.00	60.80	661.60	1608.50
Third quarter	*Os*	239.17	325.33	87.75	528.00	860.80
	Tc	65.17	30.33	38.00	10.00	112.80
	others	25.16	8.34	6.50	39.75	116.40
	Total	329.50*	364.00	132.25*	577.75	1090.00

* Difference over control, significant at 5% level

Os: *Oryzaephilus surinamensis*, Tc: *Tribolium castaneum*, others: include adults of *Trogoderma granarium*, *Necrobia rufipes*, *Corycera cephalonica* and larvae/pupae of the various pests.

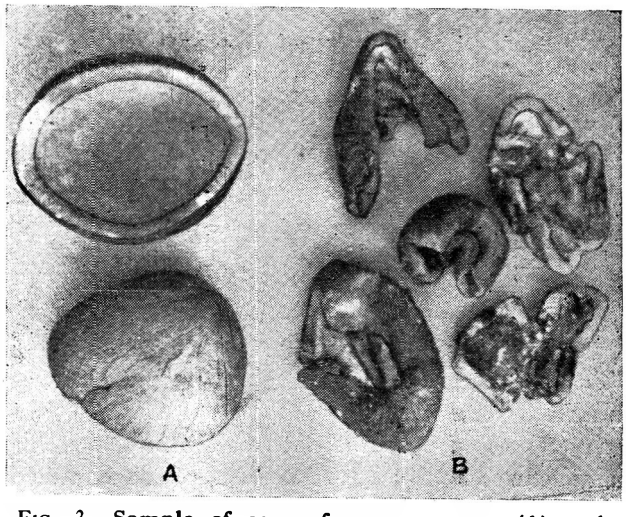

FIG. 3. **Sample of copra from paper sac (A) and gunny bag (B)**

cent moisture. At the close of the experiment, copra in the control yielded 8.1 per cent moisture.

Cumberland Paper Co. found that closure with treated tape and thread was more important than treatment of the bags in making efficient barriers. The better performance of treated bags evident here is, as suggested by them, probably due to the tropical conditions permitting a greater activity of the pests entering into the paper bags. But the material of the paper bag was free from any punctures. Sreenathan *et al.*[5] carried out an assessment of relative resistance of nine types of seams described by British Standard Specification 1133, Section 9 (Textile bags, sacks and wrappings) against insect infiltration to unseasoned Indian Multipurpose Food in hessian-kraft-polyethylene laminate. They observed that penetration of insects depends on the capacity of different pests to bore into the structure of the container, nature of seams and favourable temperature and relative humidity. The average weight of copra in the paper bags at the end of the experiment (after nine months) was 102.2 g. against 56.2 g. in gunny bags, the nett loss in weight due to pest infestation being 45 per cent. Figure 3 shows the difference in condition between copra in paper sac (treatment) and gunny bags (control) at the end of the experiment.

Acknowledgement

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Development of Pre-digested Protein-rich Food based on Indian Oil Seed Cakes and Pulses—Part 1

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A process for the preparation of a predigested protein-rich food by pure culture fermentation of Indian oil seed cakes and pulses has been outlined. This paper deals with the standardisation of conditions for rice-*koji* and the laboratory trials on the preparation of *miso-like* products from soybean and combinations of soybean with oilseed cakes.

The building of nutritive value, texture and flavour in oilseed cakes and concentrates at a low cost is one of the problems facing the food technologists in India. For this, fermentation has been shown to be acceptable and economic. Japan has a long history of using fermented soybean products[1]. These soybean foods range from *miso* and *natto* to such seasonings as *shoyu* and *ajinomoto* (mono-sodium glutamate). These are inexpensive and easily produced. Oilseed cakes and pulses with their high protein and oil contents could be used for such products. It was therefore felt that this technique of microbial processing might be made use of in India to process selected oilseed cakes and pulses. Earlier work on groundnut cake and Indian pulses carried out in Japan had shown clear possibilities[2]. Excellent *miso* has been prepared with soybean grits inoculated with a pure culture of *Saccharomyces rouxii* strain NRRL Y 2547[3]. Since the advantage of pure culture fermentation over traditional type of fermentation was demonstrated, in this investigation only pure culture fermentation techniques were adopted.

A predigested protein rich food based on soybean and rice had been standardised earlier in our laboratory. Attempts were made to produce a similar product containing soybean, selected oilseed cakes and pulses. A standardised procedure for preparing the product on a laboratory scale and the chemical analysis of the product are presented.

Materials and Methods

Soybean, rice and Bengalgram dhal were obtained from commercial sources. The groundnut cake, sesame cake and coconut cake were prepared in the Institute. Standard methods were employed for analysis[4]. Amino nitrogen was estimated by the method of Pope and Stevens[5] and reducing sugars by copper reduction[6].

The organisms used in the experiments were *Streptococcus faecalis S-35*, *Pediococcus soyae* IAM 1673, *Saccharomyces rouxii* Boutroux, *Aspergillus oryzae* M-1, A-1002, and BF. They were obtained from the Food Research Institute, Ministry of Agriculture and Forestry, Japan.

The preparation of *miso*-like product involved two separate and distinct fermentations. The first, aerobic pure culture fermentation of rice with selected strains of *Aspergillus oryzae*, serving as a source of enzymes and nutrients for the second fermentation, namely the fermentation of mixture of mold rice, salt and the oil seed cake.

Preparation of rice-koji: *Rice-koji* is a term used for mold-grown masses of rice. *Koji* produces several kinds of enzymes of which hydrolases are important for digesting the material. Among hydrolases are amylases and proteinases. For making *koji*, *tane-koji* is used. *Tane-koji* is a mold starter culture.

(*i*) *Preparation of tane-koji:* 20 g. of corn and barley were taken separately in 250 ml conical flasks and 20 ml of water was added to each flask. The flasks were sterilized at 15 p.s.i. for 20 min, cooled and inoculated with the spores of *A. oryzae* A-1002 and *A. oryzae* B. They were incubated at 30°C for 5 days, when the material was well covered with yellowish green spores of *A. oryzae*. It was dried at room temperature, powdered and put into polythene bags. This, *tane-koji* was utilised, whenever necessary, in the preparation of *rice-koji*. Both barley and corn

gave good results when used in the preparation of *tane-koji*. Later tree-ash was added at 1 per cent level to avoid clumping of cooked barley or corn.

(*ii*) *Preparation of rice-koji:* 500g. of polished rice was washed and soaked in cold water for 18 hours. Excess of water was drained out. It was then steam cooked for one hour in stainless steel-tray. The cooked rice was spread on perforated stainless steel trays (36 cm × 26 cm × 6 cm) in a layer approximately 2.5 cm thick, cooled and inoculated with *tane-koji* at 0.001 per cent level. The trays were covered with damp clothes and kept in a humidity chamber (75% RH) at 30°C. After 24 hr, the *koji* was stirred and lumps were broken. After 40-42 hr, rice was found to be well covered with white mycelium of the inoculated *A. oryzae* strains. At the end of incubation, the *koji* was removed from the tray, stirred and cooled. This was later used to prepare *Miso*, the fermented food.

It was found that the extent of absorption of water by rice depends upon quality of rice, and the time of soaking. Hence, after soaking for 18 hr, the extra water was drained off and the rice was weighed. Extra water was added so that the ratio of water to rice remained constant at 1.25:1. This was later cooked at 15 p.s.i. for 10 min. The cooked rice with a moisture content of about 50 per cent, gave desirable *rice-koji*. Larger wooden trays of the size 70 cm × 45 cm × 6 cm with wire mesh were used for the preparation of *rice-koji* (about 1,500 g.).

(*iii*) *Main fermentation:* Initially, trials on the preparation of *miso* based on soybeans and rice were conducted to standardise conditions. To 1000g of soybean grits (decuticled), 1.51 of water was added. It was then soaked for 2½ hr at room temperature and cooked for 20 min at 15 p.s.i. The cooked soya grits were cooled and mixed with commonsalt and *rice-koji* in the following proportions:

Cooked soybean	1000 g.
Sodium chloride	96 g.
Rice koji	275 g.

The constituents were minced thoroughly by means of a hand meat-mincer into a pasty material. This was inoculated with cultures of *Streptococcus faecalis*, *Pediococcus soyae* and *Saccharomyces-rouxii* grown in soya soak water with 10 per cent NaCl. The mixed pasty material was tightly packed in fermentation jars and covered on the surface with butter paper and aluminium foil, over which clean, dry stones were placed for partial anaerobic conditions. The jars were incubated at 30°C for 20 days. Chemical analysis of the sample was done on the 10th and 20th day. The results are presented in Table 1 along with the analytical data of an authentic sample of soybean *miso* obtained from Japan.

Processing variation: Several batches of *miso*-like products were prepared later on, with varying composition of raw materials. Soybean was partially or fully replaced by oil seed cakes as shown below in Table 2.

The chemical analysis was done at an interval of 10 days, and the data are presented in Table 2.

Dehydration: After 20 days of fermentation, the material from the fermenting jars was removed and dried in a freeze-drier. The freeze-dried material was analysed as in the case of wet *miso* and the results are recorded in Table 3. Microbiological assay for amino acids (tryptophane, lysine, cystine and methionine) was conducted and the results are presented in Table 4.

TABLE 1. CHEMICAL ANALYSIS OF WET *Miso*

Composition of *Miso*	Fermentation period in days	Moisture %	pH	Total N_2 %	Soluble N_2 %	Amino N_2 %	NaCl %	Reducing sugars %	Acidity as lactic acid %
Soybean	0	50.0	5.7	2.49	0.52	0.36	6.05	6.26	0.72
	10	51.0	4.8	2.35	1.40	1.20	6.20	7.70	2.30
	20	50.0	4.7	2.51	1.34	1.26	6.18	8.50	2.31
Soybean	0	57.6	5.7	2.28	0.45	0.34	5.91	6.05	0.72
	10	57.0	4.8	2.30	1.28	1.26	6.01	7.70	2.16
	20	58.4	4.7	2.24	1.46	1.40	6.01	7.70	2.26
Sample No.1*	...	46.50	4.8	1.96	1.24	0.84	14.25	8.6	1.80
Sample No.2*	...	48.80	5.0	2.05	1.08	0.75	10.33	13.3	1.92

* Authentic sample of *Miso* from Japan

TABLE 2. CHEMICAL ANALYSIS OF WET *Miso*

Composition of *Miso*	Fermentation period in days	Moisture %	pH	Total N_2 %	Soluble N_2 %	Amino N_2 %	NaCl %	Reducing sugars %	Acidity as lactic acid %
Soybean 50% and solvent extracted coconut cake 50%	0	51.2	5.3	1.70	0.57	0.21	6.55	7.98	0.90
	10	53.2	5.2	1.64	1.10	0.49	6.50	8.23	1.44
	20	53.6	5.1	1.64	1.14	0.67	6.51	8.93	1.62
Soybean 50% and E.P. coconut cake 50%	0	57.6	5.2	1.67	0.72	0.28	5.73	7.57	1.26
	10	57.2	5.2	1.69	1.15	0.32	5.85	8.78	1.26
	20	57.6	5.2	1.70	1.20	0.70	5.84	6.91	1.26
Soybean 50% and defatted groundnut cake 50%	0	48.8	5.3	2.67	1.17	0.35	6.31	9.44	1 26
	10	48.4	5.2	2.72	1.92	0.81	6.08	10.18	2.07
	20	50.0	5.2	2.70	2.03	0.91	5.85	10.24	2.07
Soybean 50% and defatted sesame cake 50%	0	52.8	5.3	2.30	0.68	0.26	7.35	5.31	1.08
	10	53.6	4.6	2.23	1.03	0.49	7.27	8.18	1.98
	20	54.4	4.6	2.17	1.09	0.49	7.01	7.79	2.34
Soybean 50% and Bengalgram dhal 50%	0	54.4	5.6	2.05	0.60	0.21	7.36	6.75	0.63
	10	56.0	5.1	2.03	1.16	0.56	7.20	10.18	1.62
	20	57.6	4.9	1.92	1.42	0.70	7.10	10.30	2.16
Soybean 65% and Bengalgram dhal 35%	0	49.0	5.1	2.33	0.96	0.70	7.05	8.25	1.44
	10	53.6	5.0	2.20	1.50	1.33	6.85	7.19	2.05
	20	52.0	4.9	2.30	1.66	1.48	7.01	7.53	2.16
Groundnut flour (defatted) 75% & Bengalgram dhal 25%	0	52.0	5.6	2.34	0.53	0.14	6.90	8.20	0.54
	10	54.4	4.9	2.30	1.47	0.77	6.78	8.31	2.07
	20	54.8	4.8	2.30	1.58	0.84	6.78	9.36	2.16
Soybean 50% and K.M. processed coconut cake 50%	0	50.6	5.1	1.47	0.62	0.25	7.25	6.93	0.90
	10	52.0	5.1	1.40	0.98	0.63	7.13	8.32	1.44
	20	53.6	5.1	1.39	1.02	0.56	7.01	7.59	1.26

TABLE 3. CHEMICAL ANALYSIS OF FREEZE-DRIED *Miso*

Composition of *Miso*	Total ash %	Ether extractives %	Sodium chloride %	Total acidity as lactic acid %	Reducing sugars %	Soluble N_2 %	Protein %	Amino N_2 %
Soybean	16.09	8.09	14.03	6.12	8.06	2.93	34.93	1.61
Soybean	16.74	8.23	13.91	5.94	8.37	2.53	29.31	1.40
65% Soybean and 35% Bengalgram dhal	15.77	8.23	13.33	7.21	17.33	2.98	26.52	2.66
Bengalgram dhal	14.18	...	14.96	4.50	13.97	1.67	20.32	1.51
50% soybean and 50% Bengalgram	17.25	...	17.54	6.30	8.30	2.31	31.49	...
50% soybean and 50% solvent extracted coconut cake	13.53	8.9	13.33	4.68	20.22	2.05	21.37	1.82
50% groundnut flour (defatted) and 50% soybean	11.84	...	11.46	5.76	...	3.50	31.44	...
50% soybean and 50% K. M. processed coconut cake	16.53	15.98	13.91	2.88	15.80	2.09	20.11	1.33
50% soybean and 50% expeller-pressed coconut cake	13.25	9.97	13.21	5.40	18.98	2.14	22.18	1.36
75% groundnut cake (defatted) and 25% Bengalgram dhal	15.98	2.94	12.98	5.22	20.78	3.12	30.89	1.96

Results and Discussion

With a view to improve nutritive value, texture and acceptability of the products, mixtures of soybeans with Bengalgram dhal and other oil seed cakes have been used as substrates for fermentation. The final product obtained had good acceptability and there was a general improvement in digestibility. A marked increase in the soluble nitrogen fractions, as also in the amino nitrogen was observed (Table 3). The reducing sugars also show a similar increase as the

TABLE 4. AMINO ACID COMPOSITION OF *Miso* SAMPLES (PER 16 g. NITROGEN)

Composition	Lysine	Methionine	Cystine	Tryptophane
Soybean	3.00	1.1	0.27	1.10
65% soybean and 35% Bengalgram dhal	3.30	1.08	0.37	0.83
65% soybean and 35% Bengalgram dhal	3.47	...	0.51	0.71
Bengalgram dhal	3.80	1.28	0.60	0.70
50% soybean and 50% Bengalgram dhal	4.00	0.89	0.41	1.30
50% soybean and 50% coconut cake	3.75	1.48	0.53	1.20
50% soybean and 50% coconut cake (K. M. processed)	4.42	1.65	0.60	1.20
50% soybean and 50% expeller pressed coconut cake	3.26	1.66	0.47	1.40
75% defatted groundnut cake and 25% Bengalgram dhal	3.00	1.13	0.30	1.20
50% soybean and 50% sesame cake (defatted)	4.00	1.82	0.85	1.60

fermentation proceeds. All these indicate that during the course of fermentation, the amylolytic and proteolytic enzymes were active on the substrate. As freeze drying was too expensive for large scale operation, more economical methods of dehydration will have to be tried as the wet *miso* has a high moisture content very short shelf life.

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THIRD INTERNATIONAL CONGRESS OF FOOD SCIENCE AND TECHNOLOGY

A Third International Congress on Food Science and Technology will be held in Washington, D.C. during August 9-14, 1970. The Theme of the conference is SOS/70, "the Science of Survival". Stressing the urgency of the continuing need to expand, improve and conserve the world's food supply for the benefit of all mankind, the urgency of the problem of man's food for today, tomorrow and the future.

More than 3,000 food scientists and technologists representing 50 nations will be attending the Congress. They will be joined by leading authorities on the political, socio-economic and cultural aspects of the world food problems. In addition, students from around the world interested in the field of food science and technology are expected to attend.

The Third International Congress will focus on the contribution of food science and technology to the SCIENCE OF SURVIVAL. The Congress is sponsored by the International Committee of Food Science and Technology and the United States Department of Agriculture. The host organization is the Institute of Food Technologists. Active support will come from governmental agencies, corporations involved in the many phases of developing and supplying food, and related associations, as well as the membership of the Institute of Food Technologists.

Major topics which will be discussed by world Authorities will include: Protection of the food supply; Conversion of novel raw materials to food use; Effect of food processing on nutritional values; New and improved processing and preservation methods, Acceptability and marketability of new foods, Sensory attributes of food products, Food safety laws and regulations and Education and documentation.

To facilitate communications among participants, simultaneous interpretation will be provided in English, French, German, Russian and Spanish.

For further information, contact: Dr W. A. Gortner, Secretariat, SOS/70—Third International Congress of Food Science and Technology, U. S. Department of Agriculture, Beltsville, Maryland 20705.

SHORT COMMUNICATION

Some Aspects of the Carcass Yield and Meat Quality of Bannur Lambs

Twelve per cent of the total livestock population in India are slaughtered to produce 513 tonnes of meat which is much below the target of 10 million tonnes required by the population. Out of this, 60 per cent is obtained from sheep and goat. Sheep meat alone contributes 25 per cent of the total meat production in the country[1]. *Per capita* meat production in our country is only 1.2 kg per year whereas in U.S.A. it is 91 kg. Our animal protein consumption is 6.4 g. per day which is only one seventh in comparison with the animal protein intake of the developed countries[2]. Keeping all these factors in view, a study was undertaken to assess the carcass yield and meat quality of Bannur lambs in comparison with the non-Bannur lambs.

In the present study 9 Bannur lambs of 10-14 months age, reared under village conditions were slaughtered under different lots and the live weight, dressing yield, area of the rib eye muscle, degree of marbling, carcass conformation, finish and consumers' acceptance were compared to 9 non-Bannur market lambs of Mysore of the same age group and management record.

It may be observed from the results in Table 1 that the mean live weight of the Bannur lamb is 25 kg. whereas in non-Bannur it is 20.4 kg. The hot carcass weight is significantly higher in Bannur than non-Bannur which are 13.0 kg. and 9 kg. respectively. The average dressing percentage of Indian sheep is only 45 per cent whereas in Bannur it is 53 per cent and for non-Bannur market lamb of Mysore it is 48 per cent. The dressing percentage of Bannur can be compared with that of the lambs of U.S.A. where it varies from 48 to 55 per cent[3]. It has also been noted by Mirajkar[4] that in Bannur lamb when grazing is supplemented with maize and groundnut cake, the dressing percentage becomes 58.1 per cent. Bannur is an early maturing breed reported by Kulkarni *et al*[5]. Area of the rib eye muscle and its marbling is the index of carcass quality. In Bannur the rib eye muscle area is 10.89 sq. cm. and the fat percentage is 6.3 per cent whereas in non-Bannur market lamb it is 7.89 sq. cm. and 3.7 per cent, respectively.

The conformation, finish and quality are superior in Bannur than non-Bannur lamb. The wholesale cut out percentages for leg, loin and shoulder are 34 per cent, 13 per cent, 22 per cent in Bannur and 31 per cent, 11 per cent and 21 per cent, respectively in non-Bannur lambs.

The data on the separable lean, bone and fat ratio (Table 2) of the different cuts indicate that non-Bannur lambs have more bone and less amount of separable fat than the Bannur. Consumers' acceptability trials under hedonic scale analysis (very desirable 8, very undesirable 1) also indicate that Bannur meat is more desirable than the meat of non-Bannur in tenderness, juiciness and flavour.

This study indicates that Bannur lamb is superior to non-Bannur market lambs of Mysore in respect of meat quality and dressing yield.

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TABLE 1. APPROXIMATE AVERAGE CARCASS YIELD OF THE BANNUR LAMBS IN RELATION TO NON-BANNUR LAMBS

Carcass yield	Bannur lambs	Market lambs Mysore	Average Indian lambs
Live weight (kg)	25.00	20.40	20.00
Hot carcass wt (kg)	13.00	9.90	9.00
Dressing %	53	48	45
Area of the rib eye muscle (sq. cm.)	10.89	7.85	...
Carcass conformation	Good	Fair	Poor

TABLE 2. PHYSICAL COMPOSITION OF BANNUR LAMB AND MARKET SHEEP

	Edible lean		Bone		Edible fat	
	kg	%	kg	%	kg	%
Bannur	6.1	46.4	3.0	24.0	2.6	27.7
Market sheep (Mysore)	6.0	50.5	2.3	27.7	1.1	15.9

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Pulse Milling in India I—Processing and Milling of *Tur, Arhar* (*Cajanus cajan* Linn)

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Milling of pulses (edible legumes) for the production of *dhal* is an age old process in India. Of the 12.4 million tons of various pulses produced annually[1], more than 75 per cent is milled to produce *dhal*. *Dhal* milling is an important industry ranking with rice milling and flour milling industries with a large capital investment.

Tur (*Cajanus cajan*) accounts for 12-15 per cent of the total pulse production and is consumed mostly as dehusked split *dhal*. Its milling is comparatively more difficult than the milling of other pulses; a survey of this section of the industry is presented here as typical of other pulses also.

Although milling of *tur* has been practised in India for centuries, it is only a few decades ago that the present day automatic mills came into existence. Various methods, wet or dry, were in vogue for the small-scale dehusking and splitting of *tur*. *Tur* milling in commercial or household practice consists mainly of two steps: (*i*) loosening the outer husk by wet or dry methods and (*ii*) removal of husk and splitting into two cotyledons using suitable machines. In some methods both dehusking and splitting are effected in the same operation while in others dehusked whole grains are 'conditioned' and then split separately.

Home-Scale Methods

In central and northern India where the dry method is prevalent, the pulse is dried in the sun in thin layers for a day or two, sometimes after mixing with oil; it is then sprinkled with small amounts of water, heaped for sometime and milled in mortars or hand-operated wooden or stone *chakkis*. One labourer can produce 30-40 kg. of *dhal* in eight hours[2]. In the wet method practised mostly in southern India, the grain is steeped in water for a few hours, drained of water, coated with red earth and then dried in the sun for 2-4 days. The grain is then milled in mortars or hand-operated *chakkis*. Dehusking and splitting take place simultaneously. The husk is removed by winnowing. One labourer can produce 60-75 kg. of *dhal* in eight hours by this method.

Dhal produced by the dry method is said to cook better, since oiling, drying and milling are done a number of times before the grains are completely dehusked and split[2]. *Dhal* produced by the wet method tastes better but takes longer time to cook[2].

Methods in Vogue in Large Mills

There are over 700 big *dhal* mills in the country scattered mostly in central and northern India. The commercial methods involve the same operations as in household methods and mostly they are mechanized except for the drying step. Various processing techniques and practices followed for milling *tur* in different parts of the country are discussed here.

Wet method: The wet method of processing is practised by comparatively smaller units. In this process *tur* grains are steeped in water for 4-12 hr in cement tanks, after which the water is drained off. Red earth mixed with water to form a paste is then mixed thoroughly with the steeped grains at 2-3 per cent level. The grains are then kept heaped for about 16 hr, usually overnight. Subsequently the grains are spread in drying yards in thin layers for 2-4 days, and heaped in the nights. When the grains are dry enough (as indicated by rubbing in the hand) they are passed through a power-operated emery-coated vertical *chakki*. Dehusking and splitting take place simultaneously. About 95-98 per cent of the grains are dehusked and split. The husk is aspirated off and the *dhal* is separated in a sieve. The residual unhusked whole grains are passed again through the *chakki* for complete dehusking and splitting, and *dhal* separated.

When the moistened grain is dried, the cotyledons cave-in at the surface of fusion, touch each other only at the edges, and shrink more than the husk as a result of which the husk is loosened. Heaping during nights

after sun-drying helps to preserve heat. When this grain is passed through a *chakki*, the shearing action of the rotating plate splits the grains into two halves which slip out of the loosened husk. The milling property of *tur* conditioned thus is excellent and the yield of head-*dhal* is about 75 per cent.

The milling quality as also the cookability of *dhal* conditioned by wet-methods are greatly influenced by the duration of steeping in water. Steeping facilitates dehusking and splitting, but adversely affects the cookability of *dhal*. Longer the period of soaking (4-6 hr) greater is the loosening of husk, and caving-in of the cotyledons on drying and easier the milling (dehusking and splitting). Yield is also increased due to lesser breakage. However, the *dhal* takes longer time to cook. Milling can be rendered more easy by prolonged steeping for 12 hr or more but the *dhal* remains uncooked and tough even on prolonged boiling.

Treatment with redearth is said to impart a good yellow colour to the finished product. Presumably, it preserves the natural colour because during milling there is no appreciable scouring of the cotyledons. More than that the redearth helps to remove small patches of adhering husk by its mild abrasiveness.

The wet method of processing *tur* is laborious and is completely dependent on climatic conditions, especially when the grains are steeped in water for long periods. The time taken is usually 5-7 days, and mills even with the best of facilities can process only 60-70 quintals per batch. This method is particularly suitable for the small grained red varieties of *tur* (grown in the southern regions) whose skin is more firmly attached to the cotyledons.

Dry method: Dry processing of *tur* is in vogue in states where bright and hot weather are available for the greater part of the year. This method enables the sun-drying of larger quantities of grains in a given drying yard than water-soaked grains and turn over can be considerably increased with minimum facilities. However, loosening of the husk is not adequate and milling losses are higher due to higher breakages and powdering. In a typical dry method the pulse is first cleaned of grits, chaff and other impurities in flat oscillating or rotary type sieves, and usually graded according to size in a grading sieve. Each grade is then passed through an emery coated roller for initial 'pitting' or 'scratching' of the husk to facilitate subsequent oil penetration. About 1-2 per cent of the grains are incidentally dehusked. The 'pitted' grains are then thoroughly mixed with 0.5-1.0 per cent oil (linseed oil, cashew oil or any other easily available oil) in an oiling machine which is essentially a worm mixer. The oiled grains are then spread 5-10 cm. thick layers for sun-drying in drying yards, for 2-5 days; the grains are heaped during nights to preserve heat. On the last day of drying, the grains are sprayed with 2-5 per cent water, thoroughly mixed and heaped overnight; they are then passed through a roller for dehusking. About 40-50 per cent of the grains are dehusked in the process and a major portion of the husked grains gets split simultaneously. The husk is aspirated off and the mixture of grains and *dhal* is passed through a *dhal*-separating sieve to remove *dhal*. The residual unhusked and husked whole grains (*kappi* or *gota* as called by the trade) are then dried in the sun for a day, mixed with further amounts of water and again passed through the roller or a *chakki* (under-runner disc sheller), when another 25-30 per cent of the grain is dehusked and split; the husk and *dhal* are separated as before. The remaining whole grains (*kappi* or *gota*) consisting mostly of small and immature grains are again treated as before until complete dehusking is effected (Fig. 1).

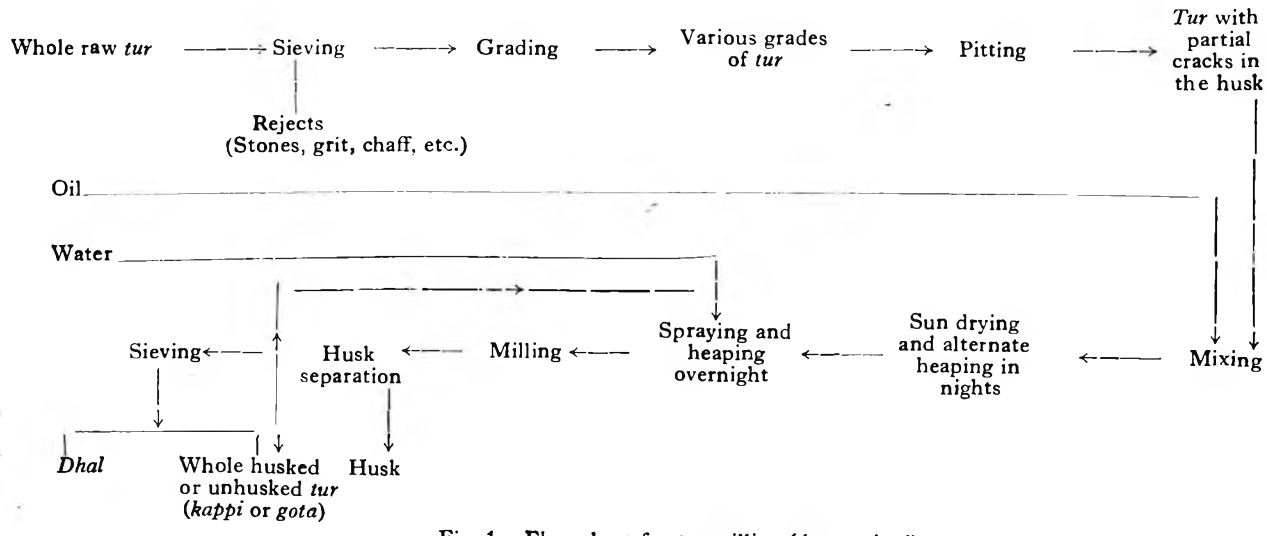

Fig. 1. Flow sheet for *tur* milling (dry method)

Details of milling procedures vary widely from mill to mill and region to region. The use of roller or *chakki* (stone or emery coated, vertical or under-runner-disc-sheller type) for dehusking or splitting grains is usually dependant on the behaviour of the grains in these machines, and the regional practices. Some millers use a roller for both dehusking and splitting while others use a roller and sheller alternatively for the purpose. In some mills the grains are graded before being sent to the machines. The use of a cone polisher to polish the split *dhal* is common in the Deccan region. Such polishing cones usually have smooth rollers. In many centres water is added to grains soon after they are sun-dried; in others water is added to dehusked whole pulse before it is split; thus dehusking and splitting are effected in two separate stages. When bigger grained varieties of *tur* are milled, dehusking and splitting take place simultaneously. However, when only a roller is used the grains have to be passed repeatedly through the machine (3-5 times) for complete dehusking and splitting.

Material Balance Data

The grains available in the market usually contain 2-5 per cent impurities, some added moisture and infested grains. The yield of head *dhal* usually varies from 65-75 per cent, depending upon the quality and variety of raw material. The bigger bold-grained varieties of *tur* grown in Central India give a higher yield (72-75 per cent) and better quality *dhal* than the smaller grains grown in Uttar Pradesh and other places (65-68 per cent). The by-products consist of: brokens 3-8; powder fraction, 15; and husk about 10 per cent. Where a roller is used, larger amounts of husk are powdered, and surface scouring of the endosperm is considerable. Germ from the split grain is generally lost in the powder or in the broken fractions. Usually 5-10 per cent extra moisture is present in the final *dhal* and the yield figures reported by the millers is, therefore, to be corrected for this.

Although the husk forms only 11-14 per cent of the grain, the yield of head *dhal* is about 15-20 per cent less than the theoretical, because it is dependent mostly on the ease of dehusking and splitting, and the number of times the grains have to be passed through the machines.

Regional, Seasonal and Varietal Differences in the Milling Characteristics of Tur

As already indicated, the milling characteristics of *tur* are greatly influenced by varietal, seasonal and cultural factors. The bigger bold grained varieties grown in central India are generally easier to mill, the husk being less rigidly attached to the cotyledons. Mild sun-drying is sufficient to loosen the husk, and there is greater percentage of dehusking in the first pass through roller. Splitting takes place simultaneously, thereby decreasing the cost of processing, and increasing the yield of head *dhal*. However, milling of grains harvested in winter (*Rabi* crop) season is more difficult.

In smaller sized varieties grown generally in North India, the seed coats are firmly attached to the cotyledons. They require more of oil and longer sun-drying, and should be passed through the roller a number of times for complete dehusking and splitting. The cost of processing is higher and the yield of *dhal* is reduced due to powdering and breakage.

Same or similar varieties of *tur* grown in different parts of North India show varying milling characteristics, and those grown in the hotter regions being easier to process. Fresh *tur* (soon after harvesting) is more difficult to mill than material stored for 3-4 months; the red variety of *tur* grown in the northern parts of Mysore state is very difficult to mill even by conventional dry methods. Special methods of processing are sometimes used for these difficult-to-mill varieties. The grains are treated with a small amount of alkali (sodium hydroxide or sodium carbonate) and spread in the sun for 2-4 days and shelled. Alkali treatment is said to improve the shelling quality of the grains.

Consumers in Madras and Bihar states, appreciate a deep yellow colour in *dhal*. For this, *dhal* is mixed with yellow colour additives (even non-permitted dyes) in water solution, dried and sold. This method of colouring is also used by millers to mask small patches of husk remaining on the *dhal*, due to incomplete milling. In western and North-western India, consumers prefer an oily looking *dhal*, for which an extra oil coating is given to the finished *dhal*. This imparts an oily shine to the product.

Quality of Market Dhal

Bigger, bold *dhal* with bright yellow colour is considered to be best in quality. This is generally obtained from the white or light coloured bold grained *tur* grown in Central India, and is more expensive. *Dhal* obtained from smaller grains are usually priced less. They also lack the bouquet or aroma characteristic of the better grades.

Tur dhal is generally separated into three grades in the mills. *Dhal* obtained in the first rolling (40-50 per cent) is considered the best and first grade. The unsplit pulse after the first pass is again sun-dried and passed through the roller to obtain another 35-40 per cent of second grade *dhal*. These *dhals* are generally smaller in size and subjected to greater

scouring. The third grade which consists mostly of *dhal* from immature and deformed grains and bigger brokens, forms about 10-15 per cent. The third grade *dhal* is usually mixed with the second grade and sold. The medium sized brokens are usually sold for local consumption.

Disposal of By-products

The by-products of *dhal* milling, husk, powder and small brokens, are usually sold as cattle feed. The husk aspirated after shelling forms about 10 per cent of the raw material and is sold as cattle feed at a lower price. The *dhal* powder and small brokens which are richer in nutrients, are sold at a higher price, also for cattle feed. A number of cattle-feed mixes based on these by-products are in the market.

Efficiency of Processing Methods and Machines

As already indicated, processing of *tur* to prepare *dhal* is an age-old industry throughout India. The wet-processing method, although quite efficient for the purpose, is laborious, difficult and cannot be adopted on a large scale. Sun-drying (after treating with oil) has been the method of choice for loosening the husk on a large scale; the duration of sun-drying is however, determined by the variety of grain, season of crop and climatic conditions. Repeated treatments are necessary to loosen the husk in certain varieties. In the process of spreading the grain in drying-yards for varying periods the loss of moisture is not appreciable, particularly when a coating of oil has been given. A certain amount of differential shrinkage of the husk and endosperm takes place during drying, but the extent to which these changes take place is probably influenced by the amount and nature of the gums and mucilages present in the grains and their ability to hold moisture. By far, the method adopted by the miller for loosening the husk, is not an absolutely satisfactory one, as it is dependent on climatic conditions and other environmental factors and milling starts with inadequately 'conditioned' grains.

The machines used in the dehusking, splitting and polishing of the grain and *dhal* are mechanised versions of age-old, hand-operated contrivances (mortar and pestle and wooden or stone *chakkis*). These machines are far from perfect and are not very efficient. The roller mill is essentially an emery coated tapering roller and is used for the removal of the husk by abression. The removal of the husk usually completed in several passes involves the risk of scouring greater portions of endosperm in each pass; about 15-25 per cent of powder formed in the roller is due to scouring of dehusked whole grains. The edges of two cotyledons (from the split *dhal*) are also rounded off which adds to the loss. The use of a tapering roller exerts unequal pressure on individual grains and leads to incomplete dehusking and scouring of husked grains. The millers usually use a very coarse emery (6-8 mesh) so that the husk is removed by shear.

The *chakki* (vertical or horizontal) used for dehusking or splitting causes breakages (15-20 per cent). Absence of grading of grains aggravates this risk, and causes non-uniform splitting. This machine is more suitable for wet-processed grains, as otherwise, the breakage is abnormally high particularly in the case of small grained varieties. Millers in the northern regions generally avoid the use of a *chakki*.

Moisture has an opposite effect with regard to ease of dehusking and splitting. The grains are dried for dehusking while for splitting they are treated with moisture. Except in the case of bigger grains, dehusking and splitting are carried out satisfactorily in two steps.

Splitting of husked whole grain to *dhal* helps in its separation from unhusked grains, but results in the loss of the germ which forms 2-5 per cent of the grains, as also losses as brokens.

Since the sun-drying is entirely dependent on climatic conditions, *tur* is milled only during the hot and favourable seasons of the year; the other pulses being processed at other times.

Main Difficulties and Deficiencies of Tur Milling Industry

Sun-drying is an important step to loosen the husk in *tur* milling. During summer months, this step is effectively carried out and most of the mills can work to higher capacities, the only limiting factor being the size of the drying yards. But during rainy seasons and winter months, *tur* cannot be processed efficiently. Sometimes when the grain is spread in the yards for drying, rains start and the millers are put to great difficulties. Dependence on weather conditions seriously limits the milling schedules.

Since the husk adheres to the cotyledons firmly, it is not easily removed in the machines unless suitably loosened by repeated treatments. Suitable methods of 'conditioning' the grain to loosen the husk effectively for milling should be developed.

The machinery used for dehusking and splitting is inadequate since it gives rise to large amounts of breakage and powdering. Rollers and shellers are generally of inferior quality, the rollers sometimes are not concentric and properly balanced. Sometimes the emery used is not of the required grade. If the shelling surfaces of sheller are not parallel, it causes breakage. Passing the grain through different machines causes more wastage.

Millers generally prefer bigger grains because of their favourable milling quality and better yield. Agricultural production of bigger grained varieties of *tur* with good milling characteristics should be encouraged.

The amount of oil and water added to the grains for 'conditioning' is arbitrary. Often, excess of water leads to spurious figures of yield and poor keeping qualities of products.

The problem of dust and consequent health hazards to the workers deserves immediate attention. Many of the big *dhal* mills are housed in improvised sheds or buildings with little ventilation. The workers do not have any protection from the thick cloud of dust. Absence of dust-proof machinery, closed conveying methods and aspiration vents aggravates this. Adequately ventilated buildings, with exhaust fans and modern methods of handling the material will go a long way to solve these problems.

Infestation control techniques are generally neglected in packing and storing the raw materials and finished products. Since the milled products leave the factory within a few days, this aspect is not generally considered important by the millers. The control of infestation in the raw material is, however, of paramount importance as the infested grains are either powdered or completely broken during milling. This is true not only for *tur*, but for other pulses also.

Capital Investment, Capacity and Per Cent Equipment Utilization

Bigger *dhal* mills with a net turn-over of 200-500 quintals per day generally have labour saving devices, large drying yards and godown facilities and adequate number of rollers, shellers or cone polishers. Their total capital outlay on machinery, building, drying yards, godowns, etc., varies from Rs 1.5-3 lakhs. The medium sized *dhal* mills with capacities of 50-200 quintals per day form the largest proportion of industry. They usually do not have big drying yards and godowns. These mills are generally semi-automatic with one or two smaller rollers and shellers. Their total investment varies from Rs 75,000-Rs 100,000. Small mills processing 10-50 quintals of pulse per day with a single sheller are found mostly in South India where wet-processing of *tur* is practised. Investment on such mills varies from Rs 3,000-10,000.

Due to limitations of drying yard capacity, climatic conditions, availability of raw materials and sometimes demand of finished product, many mills work only to 25-50 per cent capacity although they work to fairly high capacity (about 75 per cent) in summer. Usually the milling is done in the night shifts since sun-drying etc., are done during day time. During other seasons, pulses other than *tur* which require a minimum of 'conditioning' treatments are milled. Equipment utilization of smaller mills are generally high since they cater to the needs of local small-scale industries.

Cost of processing: The cost of processing the grain largely depends on its milling quality, climatic conditions, and labour charges. For raw materials of good milling quality, the processing cost varies from Rs 4 to 7 per quintal while for smaller grains with poor milling quality it varies from Rs 6 to 10 per quintal.

Conclusion

Dhal milling industry is a vital industry of the country ranking in importance with rice milling or flour milling industries. It has a large capital investment. The methods and machinery adopted for the processing and milling are however, laborious and highly wasteful. More than three fourths (about 10 million tons) of the total pulses produced in the country are processed to make *dhal*. Every effort must therefore be made to minimise the wastage by improved processing techniques and machinery.

Problems of dust prevention, infestation control, and effective quality control of raw materials and finished products need careful scrutiny. Development and production of improved varieties of pulses with better milling quality and yield need to be undertaken on a country-wide basis.

An Improved Method for Processing Tur

The Central Food Technological Research Institute, Mysore is carrying out investigations for improving the techniques of *dhal* milling. The methods adopted for the loosening of husk and the machinery used for the dehusking and splitting are being improved. An effective conditioning technique for the loosening of the husk has been developed which is independent of climatic conditions. This technique also overcomes the influence of variety and season on milling quality. An improved pearler has also been developed for dehusking the conditioned *tur*, which reduces the breakage and powdering to a minimum. By this improved processing method, an increase in yield of 10-12 per cent of pearled tur and *dhal*, has been effected.

Acknowledgments

We wish to thank Dr H. S. R. Desikachar for the help and valuable suggestions given during the preparation of the manuscript.

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Radio Isotopes and Their Applications

Speaker: Dr V. K. Iya

Head of the Isotope Division, Bhabha Atomic Research Centre, Trombay, Bombay

Dr V. K. Iya, highlighted some of the problems of production and separation of isotopes and the wide range of application of these isotopes in research and industry.

It was pointed out that in the production of isotopes by (n, p) nuclear reactions special problems have to dealt with in the purification of the isotope produced. However, in (n, r) reactions, no elaborate purification problems were involved, but the specific activity of the isotope produced was quite low as in case of Cobalt^{60} and I^{131}. In the case of production of C^{14}, aluminium nitride in kilogram quantities is subjected to neutron bombardment for several years. About 300 m.c. of $BaC^{14}O_3$ (Barium carbonate—C^{14}) was now produced annually at the Bhabha Atomic Research Centre. The reactor space needed was the limiting bottle-neck for producing larger amounts of carbon-14 which is useful for the synthesis of a variety of C^{14} labelled organic compounds useful in biological research. The production of Cobalt^{60} is now about 2×10^6 curies/year and it was estimated that it would be multiplied several folds and would be available for industrial applications.

Dr Iya gave specific examples of use of these isotopes in several areas of research and industry. Iodine (I_{311}) —131 was used in diagnosis and treatment of hyperthyroidism. About 800 patients have been treated using I^{131} produced at the Bhabha Atomic Research Centre. About 30 cobalt^{60} units were now in operation in the country for treatment of tumours and the phosphorus^{32} (P^{32}) produced had been specifically useful in the treatment of Polycythemia Vera a case of excessive production of red-blood cells.

Irradiation of foods to sterilize and prolong the storage life of perishable food materials at ambient temperature has been very extensively investigated and innumerable possibilities are open to exploration.

The use of irradiation in various polymerisation processes and the use of Co^{60}—B_{12} in controlling microbial production of vitamin B_{12} was pointed out.

In other industrial applications, the advantages of using a radiation source (radio camera) over X-ray methods was stressed. Industrial radiography using small units of radiation source could detect defects in machinery even in cases considered normally in accessible. In India, in several industries such as fertilizer, air-craft and oil industries, production work was controlled by radiography using Ir^{192} or Co^{60}.

About 200-300 such units designed at the Bhabha Atomic Research Centre have been introduced in India for gauging the thickness of steel. It was emphasized that over 7000-8000 such units are in routine operation in advanced countries such as U.S.A. and U.S.S.R.

The application of isotopes (tritium, SC^{46}) in hydrology in investigating ground water resources and seepage of water was highlighted.

Organization of Industrial Research in National Chemical Laboratory

Speaker: Dr B. D. Tilak, Director,

National Chemical Laboratory, Poona

Dr B. D. Tilak, Director of the National Chemical Laboratory, Poona, reviewed the problems encountered in organization of industrial research with particular reference to the National Chemical Laboratory (N.C.L.).

The N.C.L. was founded in 1950; a Reviewing Committee which assessed the work of the laboratory in 1963 recorded, that much greater attention had to be given to applied work in the programme of research. Dr Tilak, pointed out that hardly any significant complex of chemical industry existed in India in 1950 and the spectrum of Indian chemical industry was poor being restricted to manufacture of dyes and perfumes. Scientists in India had adequate university training but hardly any industrial training with the result that entrepreneurs establishing new chemical industries had to go in for foreign collaboration. It was also true that there was very little mutual interest between the laboratory and the industry. Consequent to these factors, the research programme of the Laboratory evolved was based largely on the interest of individual members.

With this background, the need for the National laboratories to go out to industry to fulfil their role of providing the 'know-how' to industry was emphasised by Dr Tilak. He outlined the five cardinal principles to be followed in a logical and systematic manner for an effective utilization of research by the industry.

Identification of problem: Any industrial process for the manufacture of a chemical must be investigated after the problem was identified in clear-cut terms. The economic size of the problem, the urgency and the *level of technology* needed are of utmost importance. For instance, the total requirement for ethanolamine in India is about 2,000 tonnes. All the plants available abroad for manufacture of this item are units producing 15,000-20,000 tonnes. It should also be recognised that the motivation for industrial research, barring such exceptions as Defence needs, is *return* on investment. Prospects of obsolence of any process must be clearly kept in mind. In the manufacture of phenacetin an investment of 2 crores of rupees was made for its production in Hyderabad, but the drug became obsolete even before its production was started.

The N.C.L. kept a close contact with the industry through units and discussions and the staff were encouraged to act as paid consultants. Discussions with the industry were also held through the Liaison Unit of the C.S.I.R. It was pointed out that 20 or more of the research projects at N.C.L., were now supported financially by the industry.

Alternative solutions to a particular problem: The need for critical assessment of alternative methods or processes available for the manufacture of a chemical was important. The choice of the alternative solution was governed not only by technical feasibility but by the capital investment needed and the equipment available.

Detailed planning for execution of a research project: was very necessary particularly for a time targeted programme. It must be remembered that administrative support to provide chemicals and equipment in time was an essential prerequisite for completion of the research project in time.

Laboratory and pilot-plant work: Design cell and other groups working in close liaison and wherever necessary in collaboration with industry is the next step for a successful implementation.

The industry needs a 'turn key' job or process with full details worked out. In the N.C.L., this purpose is achieved through consulting engineers, one or more to suit the needs of the industry. A critical evaluation of process is made before it is finally released to industry.

Of the several processes given over to industry, mention was made of manufacture of morphine, vitamin C and acetate pulp or fibre.

The Future of Cereal Technology Research

Prof. J. A. Shellenberger

Dept. of Grain Science and Industry, Kansas State University

Many popular slogans indicate that the world is engaged in an agricultural revolution. Advances in food production, storage, processing, and utilization have made wonderful strides year after year; but it is doubtful if the accomplishments have been revolutionary or are about to become so. Food supply has undergone many important changes from primitive times to the present. Much of the credit for the advances in food production has resulted from mechanical inventions, agricultural tools, and the use of power and, to a lesser extent, on improved seeds and the use of fertilizers. Only recently have crop yields been increased in an important manner.

The ideas associated with an agricultural revolution appear to be based on the concept of 'yield take-off' or a rapid increase in yield. However, the major sources of increased agricultural productivity such as hybrid seed, fertilizers, irrigation, herbicides, and pesticides are known and used extensively already. What new sources of increased productivity can be expected in the future?

Much of the optimism pertaining to the future of world food production stems from the hope that phenomenal increases will occur in countries where yields are low. There will, of course, be increases in productivity; but it requires relatively large inputs of capital, intelligent labour, and considerable time to bring about an improvement. What cereal scientists can do which is equally important to increased production is to work to improve the processing properties, nutritional values and over-all acceptability of cereals. There is little evidence that any important contribution has been made to these vital considerations. There is no evidence of having increased the protein content of cereals or the amino acid distribution of the protein. These are but a few of the many challenges that are waiting for the cereal scientist to solve.

Experimental Analysis of the Social Behaviour of Wild Rats

S. A. Barnett

Glasgow University, Scotland

The common 'brown' rat, *Rattus norvegicus*, of Europe and elsewhere can live in crowded colonies; but its social behaviour also includes dispersive elements. Accordingly, there are species-characteristics social signals, some of which encourage approach while others induce withdrawal. These signals include postures, contacts, sounds and odours.

Threat and attack, which induce withdrawal, occur especially in territorial situations, that is, when one individual on its own ground encounters a stranger. In this species territorial clashes occur only between adult males, and the attacked rat rarely, if ever, fights back. Clashes do not, as a rule, lead to severe wounding; but, at least in the laboratory, an attacked rat may collapse and die without an obvious cause of death; there is, then evidence of greatly increased activity of the adrenal cortex. The adrenal glands of rats which have done much attacking are also larger than those of controls which have lived peacefully in small cages.

The intensity of dispersive behaviour varies with the conditions in which rats are living. The presence of females increases the readiness with which males come into conflict, although males do not fight for females. In addition, the fertility of females declines with increasing density.

Probably, the social behaviour of this (and other) species tends to regulate the growth of population. One practical implication is that if, say, forty to eighty per cent of a population is killed, the remainder will breed at nearly their maximum rate and numbers will be rapidly restored.

Dr H. A. B. Parpia, Director, CFTRI, Mysore and past President, Association of Food Technologists, India inaugurated the Convention

CONVENTION

Flour Milling and Baking Industry in India

The Association of Food Technologists (India) organised a Convention on 'Flour Milling and Baking Industry in India' on 14-15 November 1968 at the Central Food Technological Research Institute, Mysore. Over hundred delegates consisting of scientists, technologists and representatives of the industry, FAO and USAID, participated in the Convention.

Welcoming the delegates, Dr B. L. Amla, President of the Association said that the Convention would provide a forum for discussing the technical problems faced by the flour milling and baking industries and an opportunity to exchange views and information between the representatives of the industry and the scientists and technologists. He stressed the need for introducing ready-to-serve food products, as the consumer was now more and more inclined to go in for such products to save time and labour and called upon the industrialists to give due consideration to this.

Inaugurating the Convention, Dr Parpia, Director, CFTRI, Mysore referred to the considerable scope for development of flour milling and baking industries in India utilising the installed capacity to the maximum extent. The processed food costs are more in India because of inadequate turn over, high expenditure in marketing and inefficient capital utilisation. If the rate of rise of production of wheat and other cereal crops continues, a time would come when perhaps the restrictions on milling would be removed. When such a thing happens, which is bound to happen at least at a future date, it would be a major turning point in the history of the flour milling industry. Dr Parpia added that we should follow examples of other countries and introduce at reasonable prices, ready to serve foods. The time had come to consider the selection of suitable packaging material for unit packagings, study of marketing trends, consumer needs and manufacture of machinery required for this purpose and producing ready to serve products

Dr B. Panda, Executive Secretary, proposing the vote of thanks. Dr B. L. Amla, President, AFT and Dr H. A. B. Parpia

Technical Sessions I. Shri Santanu Chowdhuri, (Right) Chairman, Shri M. K. Panduranga Setty, Co-chairman, (Left)

Technical Session II. Dr D. V. Karmarkar, (Centre) Chairman, Shri R. B. Rao, (Left) Co-chairman and Shri G. S. Bains, convener, Technical Sessions

Concluding Session : Dr B. L. Amla delivering the concluding address. Dr P. K. Vijayaraghavan, (Left) President-Elect, Association of Food Technologists, presented the recommendations and Dr M. Narayana Rao, Joint Secretary, AFT

and supplying them at reasonable prices. Co-operative ventures for utilisation of by-products of flour mills were needed. A need for undertaking a systematic programme of market research and also diversification of products was stressed. Dr Parpia concluded by saying that the industrialists and research workers should come closer together to improve the operational efficiency of the industry and quality of its products.

Technical session I dealt with problems concerning Roller Flour Milling Industry under the chairmanship of Shri Santanu Chowdhuri and Shri M. K. Panduranga Setty. The different topics presented and discussed during this session were (*i*) Present status of Roller Flour Milling Industry in India by Shri Santanu Chowdhuri (*ii*) Practices, difficulties, problems and peculiarities of processing wheat in India by roller mills by Shri M. K. Panduranga Setty (*iii*) Quality control and specification in wheat products by Shri S. P. Virmani (*iv*) Milling characteristics of the classes of U.S. wheats by Mr R. A. Hunt and (*v*) Roller flour milling practices and resultant atta by Shri M. D. Mukherjee.

Technical session II dealt with problems concerning baking industry under the chairmanship of Dr D. V. Karmarkar and Shri R. B. Rao. The different subjects presented and discussed during this session were (*i*) Problems of baking industry in India by Shri R. B. Rao and Shri N. G. Sathe (*ii*) Baking machinery by Shri J. C. Shah and Shri J. Arjundas (*iii*) Problems of baking yeast industry in India by Shri V. Muthuswami and (*iv*) Problems of research development and training in flour milling and baking by Shri G. S. Bains.

Mr G. S. Bains, Scientist, C.F.T.R.I., Mysore was the convener of both the technical sessions.

The technical sessions were followed by a panel discussion presided over by Dr P. K. Vijayaraghavan, President-elect of the Association of Food Technologists (India). Representatives of both the flour milling and baking industry participated in the discussions.

Recommendations of the Panel Meeting of the Convention on Flour Milling and Baking held at C.F.T.R.I. on 15 November 1968

Raw Materials

The Convention was disturbed to note the deplorable quality standards of the raw materials supplied to the roller flour millers at present. It is therefore very essential that proper specifications should be laid down for the quality of raw materials. It is recommended that the Government agencies concerned, representatives of the flour millers and the research institutions should get together along with the Indian Standards Institution to work out the details.

1. It was recognised that the largest single factor which determines the quality of the milled flour was the raw material. Therefore every effort must be made to see that wheat of high quality which meets certain standard specifications is supplied to the millers.

2. The varieties of the imported wheat should be supplied to the flour millers in such a manner that they can meet the finished product requirements of the baking industry and the other consumers. This is particularly essential to permit blending of different varieties of wheat to suit the different consumer needs. In order to achieve this it will be necessary to build up reserve stocks of certain varieties of wheat used in blending.

3. It was heartening to note for the first time the Government of India has permitted the flour millers to use indigenously grown Mexican varieties of wheat. It was noted that these are being supplied in a mixed form. If these wheat varieties are to be utilised for the definite purpose to meet the consumer demand, the various varieties of the Mexican wheat should be supplied separately to the millers. The Food Corporation of India and the State Governments being the largest procurement authorities, should take care to see that these varieties were not intermingled.

4. It was brought out that the wheat supplied was highly infested. Therefore it is very essential to take adequate measures to control this infestation and also to avoid transit losses. Methods of infestation control used should be such that they not only control the adult insects but also the larval stages.

Technical Problems

The Convention realised the value of standardising the milling equipment. It was therefore recommended that in order to lay down specifications for the milling equipment to maintain high standards it was suggested that a committee consisting of millers, equipment manufacturers, technologists, and the licencing authorities, should work out the details. This committee would also recommend setting up suitable machinery for effective implementation of the recommendations.

Similar committee should be formed for assisting the baking industry.

Machinery and Equipment

1. The Federation of Flour Millers and Biscuit Manufacturers' Organisations would provide within the next three months lists of spare parts and certain items of equipment which they are not able to import so that their development could be undertaken in the country on high priority basis.

2. In order to have correct flour specifications, study on indigenous wheat should also be undertaken on very high priority basis to make recommendations for flour millers and biscuit manufacturers.

3. Work should be undertaken by operational research group of research institutions in collaboration with the Flour Millers Association to technologically upgrade the existing units by showing how to utilise machinery and equipment more effectively for manufacturing high grade products.

4. Any new items of equipment developed in the country should be carefully examined and studied by a body like C.F.T.R.I. who should certify that it will function as a substitute for the existing equipment before any orders are issued for stopping the import of similar items. Also the indigenous equipment now being manufactured should be assessed.

Marketing and Product Development

Every effort should be made to maintain close contact between the Flour Millers Federation and Biscuit Manufacturers Federation on the one hand and the Protein Food Association on the other, who are undertaking a survey of consumer food habits with the co-operation of USAID.

Research and development work on a very high priority basis on cereal based high protein food should also be undertaken.

The Convention also recommended the fortification of flours with vitamins and minerals.

Personnel Requirement

1. In order to upgrade the technological level of personnel working in the industry, it is necessary that at least one course is held every year in milling and baking technology.

2. Increasing emphasis on milling and baking should be provided in post-graduate courses.

Expansion and Addition of Research and Development Facilities for the Central Technology

The convention appreciated the awareness of the flour millers in supporting research and development activities and decided to request the Flour Millers Federation to work out a comprehensive scheme for this and suggest programmes of research to be undertaken by research institutions in consultation with their members and technological workers. A decision is likely to be arrived at by the end of January 1969.

Other Recommendations

1. Every possible step should be taken in the country to increase the production of yeast to meet both the qualitative and quantitative requirements of the baking industry.

2. A committee consisting of the President of the Association of Food Technologists, President of the Roller Flour Millers Federation and the President of the Baking Federation to chalk out the follow up programme of what has been recommended at the Convention.

3. It was decided that the Conventions of this nature between the industry and the technologists should be organised at periodical intervals so as to assess the accomplishments and also to indicate further development needed.

Book Reviews

Modern Cereal Chemistry: By KENT JONES AND A. J. AMOS, Food Trade Press, VI Edition, Price £9.10.0.

This well known text and reference book has appeared again as an enlarged edition. Naturally, it is an improvement over the earlier edition since it incorporates recent advances in the relevant fields covering the work of over 200 new publications. The authors have given their own critical appraisal of the advancing status of the subject. Copious references to the original authors are included.

The text deals with the subjects in their logical sequence starting from production and harvesting. Chemistry and technology of processing and utilisation including the storage and nutritional aspects is of course the main emphasis of the text. Methodology for quality evaluation of raw materials and finished products is also adequately covered. The chapter on balanced animal rations is almost a treatise on animal feeds and is relevant in the context of utilising the various cereals and their by-products.

The chapters on analytical procedures include those for moisture, proximate principles, enzymes, trace metals, poisonous constituents, flour additives and other extraneous matter, flour colour and quality, baking constituents, and insect filth. Methods for feed analysis are also included. A special chapter on amino acid and vitamin assay is also included. The analytical section is therefore of use for a variety of food and feed products.

The value of the edition as a text book on cereals will be further increased especially in oriental countries if one or two special chapters dealing comprehensively with the chemistry and technology of rice processing and utilizations are included since rice technology had come into its own as a special and distinct field of study. It is hoped that this will be taken note of while bringing out newer editions.

To the student, the cereal scientist and technologist, the miller and the baker the revised edition will certainly be an excellent companion volume for study, information, reference and consultancy.

H. S. R. DESIKACHAR

Food Flavourings Composition, Manufacture and Use: By JOSEPH MERORY. The AVI Publishing Co. Inc. Westport, Connecticut II Edition, 1967, Price $20.0.

Since the publication of the first edition in 1960, considerable headway has been made in the flavour field and the author has incorporated these aspects and specially the various parts in the appendix dealing with the Federal Drug and Cosmetic Act. Nearly 349 formulations are cited in this edition as against 280 in the first edition. The entire material is covered in 478 pages and includes good bibliography on the subject. The author being himself closely associated with the manufacture of flavours for nearly half a century has been able to present very valuable information thus far maintained as patented and kept as closely guarded secret. The author had the privilege of contacts with the purchasers and chemists who utilise food flavourings for human consumption besides the valuable suggestions of a number of technical experts in industry and Government agencies.

The four major sections which comprise this excellent presentation are:

1. Natural food flavourings; 2. Synthetic flavourings, additives and colourings, 3. Use of food flavourings and 4. Appendix dealing mainly with odour and taste classification, exemption of certain additives from requirements of tolerance, vanilla extract and related products and Food and Drug Administration definitions and standards of non-alcoholic beverages.

In the section dealing with natural food flavourings as many as sixty four formulae have been given which include the nature of the constituents and their proportions. A major proportion of these pertain to fruit flavours which include the typical flavours of cherries, citrus fruits, apricots, etc., which have been of topical interest in recent years. Useful information has also been added to the flavour constituents of spices, coffee, cocoa and chocolate.

The subject matter presented under the heads (*i*) sugar free fruit flavours and natural flavourings from vegetable plants is unique in that attention is focused on the novel procedures adopted to extract the flavourings and their constituents.

The chapter on imitation flavours which includes synthetic flavouring and additives, contains eighty formulations, based on a number of chemicals of which a few are, perhaps, not so commonly available. Due to the advent of vapour phase infra red spectroscopy etc., these components could also be properly identified so as to assess the edible nature of the formulation. It is hoped that the manufacturers of food products will utilise this information judiciously. The chapter on certified colours details the colours permitted in U.S.A. and deals broadly the factors responsible for their stability when added to foods.

The chapters on uses of food flavours describe mainly bakery products, meat, fish and salads, ice-

cream, sherbats and ices, soda flavourings, pudding flavourings, candy and chocolate confectionery, liquor flavourings and tobacco flavouring and the details on the influence of the mode of preparation on the flavour. A number of synthetic flavour mixtures to imitate mainly bakery products, meat products and frozen desserts have been presented.

In the appendix a few guide lines for organoleptic evaluation have been briefly indicated. A number of flavour additives which include mainly non-nutritive sweeteners, miscellaneous and general purpose food additives, spices and other natural seasonings, substances migrating to food from paper and paper board, etc., which are generally recognised as safe, have been listed. A brief mention has been made of the definitions and standards of identity of vanilla and related products and non-alcoholic beverages.

Flavour plays an important part in the psychological appeal of foods both in the choice and the plate. With the increasing use of processed foods and the need to produce foods of uniform quality, both from the chemical and the consumer acceptability points of view, the nature of the flavouring constituents has assumed great importance. The information provided in this book is highly useful to the manufacturer. The many formulae suggested will prove exceptionally helpful to flavour chemists, technologists and students who aspire to take up the profession of flavour technology.

L. V. L. SASTRY

Regional Research Laboratory, Hyderabad, Annual Report 1966-67, pp. 122.

The report summarizes the research and development activities of the Regional Research Laboratory, Hyderabad during 1966-67 in the various fields: Oils and fats, surface coatings and pigments, organic chemistry, drugs and pharmaceuticals, heavy chemicals and fertilizers, ceramics, paper and cellulose, biochemistry, entomology, crystallography, chemical and general engineering and operational research. During the year, the institution undertook many research projects financed by industry. Some of the important industrial projects of the laboratory relate to low temperature carbonisation of coal to produce smokeless domestic fuel, utilization of by-product tar, production of organic chemicals starting from toluene and manufacture of bleaching earths and activated carbons. The manufacture of pyrometric cones to meet the increasing demand of industry was continued and pilot plant studies on silicon carbide production and on glass lining of mild steel vessels were in progress. The oils and fats division which has made notable progress on the utilization of castor oil for the production of hydrogenated castor oil, dehydrated castor oil, tristearin and surfactants has also studied the nature of glyceride in a number of minor seed oils. The nature of phospholipids from mustard and coriander seeds and groundnut sludge has been studied using TLC and GLC techniques. Basic research of interest to biochemists and biologists carried out include studies on the properties of tissue cells in suspension, changes in the biochemical properties of bacteria during growth, biochemistry of reproduction and of ageing, metabolism of moulds, action of insecticides and insect control by biological methods.

More than 50 research papers on the various investigations were published and six new patent applications filed during the year. Processes released to industry through the NRDC are for the manufacture of benzyl chloride, pyrometric cones, light kaolin BP, cardonal, citicide (a new pesticide) and barium potassium chromate. Of special interest to food technologists and nutritionists is the setting up of a 10 tonne/day solvent extraction plant for the production of high-protein edible cottonseed flour.

The Regional Research Laboratory is mainly concerned with the utilization of raw materials of the region viz., coal, oilseeds and minerals and the development of process know-how for the setting up of new industries. The wide range of raw materials and the complexity of problems amply justify the wide range of research activities of the laboratory. The report will be of interest to both scientists, technologists and to the industry.

N. SUBRAMANIAN

Notes and News

Residual Solvent Determination in Food Products

The problem of determination of small quantities of solvents remaining in oil-seed meals after solvent extraction has engaged the attention of a number of people. A modified Pensky-Martins closed-cup flash tester (Sikes, J. K., *J.A.O.C.S.*, **37,** 84, 1960) and a copper cup flash tester with concentric rings as heating surfaces (Gastrock, E. N. *et al.*, *J.A.O.C.S.*, **37,** 1929, 1960) based on the flash point determination have been suggested for determination of solvent residues at 0.03 per cent level or more. A manometric method has also been suggested (Lewis, Y. S., *J.A.O.C.S.*, **41,** 211, 1964) based on the vapour pressure of the solvent in the head space of a container. A vapour phase chromatographic method wherein residual solvent in the solvent-extracted soybean flakes is extracted by iso-octane and the mixture injected in a VPC apparatus has been reported more recently (Black & Mustakos, *J.A.O.C.S.*, **42**, 62, 1965). By measuring the relative areas of the peaks corresponding to iso-octane and the solvent, the quantity of solvent residue can be determined. Watts and Holswade (*J.A.O.A.C.*, **50,** 717, 1967) worked out a gas chromatographic method for the determination of residual hydrocarbon solvents in edible oils, based on direct injection of these oils into the column.

In materials like oleoresin of spices, however, the limits of solvents permitted by the Federal Food, Drug and Cosmetic Act Regulations are very low—of the order of 30-50 parts per million. Unlike oil-seed meals, when the determination of solvent residue is important only from the point of view of fire-hazards in factories, in oleoresin the determination is for the purpose of avoiding health hazards. The very low limits prescribed permit the use of a method like vapour phase chromatography only. However, even in this method, the correct technique to be used is not yet very well defined. Oleoresins are a complex mixture of essential oils, pungent principles and other resinous matter. These cannot be directly injected into the apparatus. Also, a preliminary enrichment of solvent in some medium has to be done to make its quantitative determination feasible. Using solvents like ethylene, chloride hexane, acetone, etc., a VPC method for determining residues upto 50 p.p.m. in oleoresins was tested by Todd (*Food Tech.*, **14,** 301, 1960). An internal standard of benzene diluted in toluene was added to a 50 g. sample of the oleoresin and the oleoresin was distilled into a Clavenger trap. The benzene is present in a known concentration in the oleoresin, and the level of other solvents are then related to it by making gas chromatographic analysis of the distillate. A very sensitive VPC apparatus would be required for this method, since otherwise significant peaks will not be obtained.

A gas chromatographic headspace technique has been recently described (Labruyere B., *et al.*, *Perf. Ess. Oil, Rec.*, **59,** 206, 1968), for solvent residue determination in oleoresins. Infusion flasks with aluminium screw caps with rubber systems were used as containers, the oleoresins heated to 85° C, equilibrated at required temperature and samples of gas from headspace withdrawn using Hamilton gas-tight syringe and nitrogen. This was injected into a VPC apparatus with flame ionisation detector. Calibration was done with known amount of added solvents like hexane, heptane and benzene. The precision of operations involved was fairly good. However, results were too low when small samples of oleoresin were used, due to loss of solvent. By this technique fouling of columns due to fixed oils of resins, and contamination by essential oil components (since gas flow is reversed after solvent peaks appear) is avoided. Special type equipment would be needed for this method.

Preliminary results of a collaborative study of a VPC method for halogenated solvents like methylene chloride, ethylene dichloride etc., have been reported (*J.A.O.A.C.*, **51,** 825, 1968). The method employs a micro-coulometric gas chromatograph fitted with a Poropak Q column and is based on the volatility of the solvent residues, their retention times on a polyaromatic bead chromatographic column, and their detectability by a halide-specific microcoulometric method. Further study of the method has been recommended. Here again, a special set up of equipment is necessary for determinations.

Todd's method of using distilled samples seems to be capable of being more easily adapted for routine work than the other methods so far reported.

Manufacture of Modern Rice Mills Equipment

The use of modern rice mills containing rubber roller type shellers and air-cooled polishers is known to increase total rice out-turn as well as head (whole)

rice yield as compared with conventional type mills indigenously available.

In collaboration with their foreign counterparts, M/s G. G. Dandekars, Bhiwndi, Maharashtra and M/s. Damodar Enterprises, Calcutta have started manufacture of composite as well as individual rice mill units of modern design and could supply them to rice millers intending to modernise their mills.

High Protein Rice

A 'high protein rice' has been developed at the Japanese Agriculture-Forestry Ministry's Radiation-Plant Breeding Farm in Omiya. The farm has a gamma field to study plant breeding by means of irradiation.

The Omiya Gamma Field, built in 1960, has had some remarkable achievements. Among typical examples are rice plants with a short stem, which do not fall even in strong wind; rice plants which produce a larger amount of rice grains; and mulberry trees with leaves 30 per cent broader than those of conventional varieties. The farm has also successfully developed peach trees with the fruit ripening a week earlier than in normal trees.

'High protein rice' growing at the farm began in 1962, when several hundred varieties were planted. These plants were exposed to gamma rays for 20 hours a day during the whole period of their growth. This produced diverse mutations, such as short-stem rice plants and circular rice grains. The experiment even evolved rice plants which grew in a prostrate condition. About 70 varieties of rice, harvested from these mutants, were tested by the amino acid analyser at the Food Research Institute of the Ministry in February this year to measure their protein content.

This confirmed that the 4th, 5th and 177th rice planted since the start of the experiment in 1962-all of the 'Norin No. 8' variety contained unusually high percentages of protein. The original 'Norin No. 8' rice contains 5.5 per cent of protein. By contrast, No. 4 rice contained, 10.2, No. 5 rice, 9.5 to 11.3 and No. 117 rice, 8.9. Moreover, of the three mutants, No. 4 rice and No. 5 rice were found to ripen earlier than usual. The ears formed as many as about two months earlier than the original 'Norin No. 8'. The two mutants, therefore, are fit for double-cropping.

Five or six years hence, these mutant rice plants will be improved and will become fixed varieties, and their seeds will be distributed to farmers in the country.

At present, the average daily *per capita* intake of protein among the Japanese is placed at 74 g. Of this, vegetable protein accounts for 47 g. one-third of which is taken from rice. If the present rice meals are replaced with 'high protein rice', the *per capita* protein intake will rise to about 90 g. even if the present dietary pattern remains unchanged.

Yojana, 1968, **12** (22), E.13.

Cold Storage of Perishable Foods: Training Course Inaugurated

A eight-week training course in cold storage of perishable produce has commenced at the Central Food Technological Research Institute, Mysore on November 18, 1968.

Dr S. P. Manjrekar, Chairman of the Training Programme, welcoming the trainees said that the course is the result of requests from food industry for providing training to their technical personnel on various aspects of cold storage of perishable produce.

Inaugurating the course, Dr H. A. B. Parpia, Director, C.F.T.R.I. said that about 20 per cent of food available in India is of highly perishable nature and therefore cold storage industry for preservation of perishable food has an important place in the country. The present storage capacity of the perishable food industry is about 8.7 lakh tonnes which is expected to increase six to seven times at the end of the 4th Five Year Plan period. The major weak-spots of the Indian cold storage industry are inadequate utilization of space and uneconomic operation.

Dr Parpia stressed that in order to overcome food losses and make available more food for human consumption and raise nutritional standards, it is necessary to build up cold storage industry on more healthy lines. It is important that cold storages have to be built up in right places.

Twenty-two trainees from the industry and from the Central and State Governments are undergoing the course.

18th Indian Veterinary Science Conference

The 18th Indian Veterinary Science Conference was held at Hyderabad from 3 to 6 June, 1968. Shri Khandubhai Kasanji Desai, Governor of Andhra Pradesh inaugurated and Dr C. M. Singh, Director, Indian Veterinary Research Institute, Izatnagar, presided over the conference. About one thousand and two hundred delegates from all over the country and abroad participated in the conference. Pharmaceutical concerns, animal industries and farmers from rural areas also took part and attended the conference in full recognition of the contribution of the Veterinary profession for the national economy and welfare of the

country. Discussions on several important topics concerning Veterinary Science and Animal Husbandry were organised and fifty technical papers were presented in the scientific sessions. Some of the papers which are of interest to scientific workers dealing with food science and technology are:

1. Measures to prevent public health hazards through proper preservation of eggs—B. Panda and P. C. Panda.
2. Preliminary studies on the relationship of carcass yield, certain wholesale cuts and offals to the live weight in pigs—P. L. Narayana Rao, K. S. Reddy, K. J. Pillai, N. Subba Rao and P. Varadrajulu.
3. A review on the incidence of aflatoxicosis in India—T. Gopal.
4. Cross breeding for more milk—Maximum initial milk yield—G. Venkatratnam and D. Venkayya.
5. Influence of dietary source of grain on laying performance of egg production stock—C. V. Reddy and D. R. Reddy.
6. Establishment of modern slaughter houses in India—A. H. Khan.
7. Use of rodenticides for rat control in poultry and live-stock farms—M. J. Rajaram.

The conference was of vital interest to workers dealing with veterinary science, public health, food science and other allied subjects.

Pesticides and Liver Damage

Pesticides containing organochlorines appear to cause liver damage. In a strongly worded report the World Health Organization declares that, despite the fact that agents such as DDT are used universally with excellent results, mounting evidence from laboratories and medical institutes suggests that the pesticides are persistent and cumulative in both animals and man. Aldrin, dieldrin, heptachlor and gamma benzine hexachloride, or Lindane, are organochlorines in wide use in many parts of the world. Even in low doses, says the WHO panel, such compounds injure the liver by stimulating microsomal enzymes in the liver cells, and these enzymes probably affect the metabolism of other compounds. The working party recommends that WHO should encourage urgent investigations to nail down the toxicological implications.

Testing Frozen Foods with Ultrasound

New ultrasonic studies at the National Research Council of Canada suggest that a simple and effective method of making a post-freezing assessment of meat and fish could be developed in the near future. The studies form part of a research programme started two years ago by NRC's Division of Applied Physics on physical methods applicable to quality determination and control of fish.

One of the basic requirements was for a simple method of showing whether fish had been frozen previously and also how long and how fast thawed fish had been frozen. Dr David Makow, who has been working with ultrasound for some time, undertook exploratory work on such a method using ultrasonic techniques. The propagation conditions of ultrasound depend on the physical properties and structure of the tissue. If the tissues were affected by the freezing process, reasoned Makow, then ultrasound would probably reveal these changes.

Experiments were conducted with micro-second ultrasound pulses at a frequency of three to five million Hertz. The reflections received from the various interfaces of tissue inside the sample were studied both for fresh fish samples and samples which had been frozen and thawed. The equipment used consisted of a small tank of water and ultrasonic transducer, a transmitter and receiver and an oscilloscope. The tissue sample was placed in the tank with the transducer and ultra-sound pulses from the transducer were directed at the tissue. The echo returned to the transducer and were then amplified in the receiver and displayed on the oscilloscope as a tracing.

A definite correlation was found between the freezing history of the sample and the number and amplitude of the received echoes. The thawed fish tissue showed an echo pattern of larger amplitude and number as compared with fresh tissue. The work was extended to determine whether similar effects could be obtained with mammalian tissue. Samples of beef *filet mignon* were tested and the echo patterns had similar characteristics to those obtained in the fish tests. Makow and his colleague, Manfred Freese, expect that the method will find use in food inspection services. The quality of fish and meat depends to some degree on whether it has been frozen at all, whether it has been frozen for a short or long period, whether it has been frozen and thawed several times, and the speed at which it was frozen.

Germans dehydrate food by diffusion

A new large scale dehydration process which is capable of drying large quantities of solutions, emulsions or pastes at room temperature has been developed by a group under Professor W. Groth in the department of physical chemistry at the University of Bonn. Existing food dehydration processes used in industry are conducted at either high or very low temperatures, and this can lead to certain irreversible cell changes. The new process—known as diffusion drying—is claimed to preserve the full nutritive value and flavour of the substances being dried, and it is therefore believed that it could help to solve problems of food supply to developing countries.

The material to be dehydrated is spread in a layer 1-10 cm. thick on a membrane made of plastics fibres with a mesh width of 10-100 microns. Dry gas forced up through this membrane is dispersed into millions of minute bubbles which then pass up through the material and become saturated with water vapour. The layer gradually becomes viscous and begins to solidify from the bottom up leaving a porous layer. This porous layer is less resistant to the gas flow than the original liquid or paste and drying therefore proceeds rapidly. Water is extracted from the gas in silica gel adsorption chambers and the dry gas can be re-cycled.

Air can be used as the drying gas provided that the substance being dried does not react with oxygen; if this is the case an inert gas such as carbon dioxide or nitrogen must be used in its place.

Sci. J., 1968, **4** (7), 19.

Ready to Serve Mutton Sausages

A basic composition for making ready-to-serve mutton sausages has been standardised by the Central Food Technological Research Institute, Mysore.

These brown and serve mutton sausages are delicious, nutritionally well blended and balanced and seasoned with popular spices and flavoured with select condiments to satisfy discriminating tastes. Packed in casings, they keep well longer than fresh meat, that is about a week at a temperature of 4-5° C. They are fortified with vitamins and minerals.

The mutton sausages are pre-cooked and need only very little further cooking. All that one has to do is to roast them on a flat frying pan or kitchen skillet smeared thinly with any edible cooking fat for 10—12 minutes at medium heat, to the desired browning. While frying, turn them over or roll them from time to time in order to get uniform browning.

The sausages are suitable for all occasions, served hot at breakfast, lunch or dinner. For snacks, school lunch boxes, and cocktail parties, the sausages can be an exciting item.

Association News

The Eastern Regional Branch of the Association of Food Technologists (India) has planned to hold a two-day Seminar with four sessions in which papers on the following subjects will be presented:

(*a*) Sources and production of protein isolates for fortification of foods.

(*b*) Foods suitable for fortification, technological and socio-economic considerations.

(*c*) Food habits and protein requirements with special reference to protein requirements in Eastern India.

(*d*) Economics of protein fortification.

Further particulars may be had from Shri K. C. De, Hony. General Secretary, Eastern Regional Branch, Association of Food Technologists (India), Jadavpur University Campus, Calcutta 32.

List of New Members

1. Mr S. V. Krishnaswamy, Parle Products, Vile Parle, Bombay 57.
2. Mr E. R. Suresh, M.Sc. Student, (Associate Member), F.A.O., I.F.T.T.C., C.F.T.R.I., Mysore 2A.
3. Mr S. N. Mujumdar, 8/12 Bern Road, Calcutta 19
4. Mr Sheo Shankar Prasad, FAO, IFTTC, CFTRI (Associate Member), Mysore 2A.
5. Mr Suresh K. Modi, Modi Flour Mills, Delhi 20.
6. Dr D. V. Karmarkar, 20-D, West Nizamuddin, New Delhi 13.
7. Mr B. Bhavani Shankar Rao, 18, Anandashram, 10th Main Road, Malleswaram, Bangalore 3.
8. Mr Krishna Gopal, Sheo Rice and Flour Mills, Bahraich U.P.
9. Mr Maruthai Pillai, 330, Thambuchetty Street, Madras 1.
10. Mr Ashok Kumar Mathanhelia, Sheo Rice Mills, Bahraich U.P.
11. Dr M. P. Arumugum, Reader, Department of Meat Sciences, Madras Veterinary College, Madras 7.
12. Dr P. B. Deshpande, Associate Professor of Chemistry, College of Agriculture, Hebbal, Bangalore 24.
13. Mr Mukthiar Singh Saimbhi, Research Assistant (Vegetable) P.O. Agricultural University, Hissar (Haryana).
14. Dr G. D. Ramaiah, Marketing Executive, Glaxo Laboratories Ltd., (Worli) Bombay 16.
15. Mr B. V. Randheria, Dianath Building, 2nd Floor, Block No. 13, 94, Cadell Road, Mahim, Bombay 16.
16. Dr S. M. Gupte, B/3, Empress Mahal, Dadar, T. T. Bombay 14.
17. Mr Naveen Kumar, Instructor in Canning and Food Preservation, Food Craft Centre, Alto-Betim, Goa.
18. Mr G. B. Goshi, Food Research Laboratory, His Majesty's Government of Nepal, Babar Mahal, Kathmandu, Nepal.
19. Dr T. V. Krishna Reddy, Quality Control Officer, Foods, Fats and Fertilisers Ltd., Tadepalli-gudem (A.P.).

Change of Addresses

1. Dr N. N. Dastur, Director, National Dairy Research Institute, Karnal, Haryana.
2. Mr A. K. Sachdev, Institute of Hotel Management, Catering and Nutrition, Pusa, New Delhi 12.
3. Mr Sushil Kumar, c/o Sri Haripat Rai Gupta, Office of the Salt Commissioner, Government of India, Jaipur, Rajasthan.
4. Major O. P. Kapoor, Officer commanding, Composite Food Laboratory ASC, Old Secretariate Building, Delhi 6.
5. Mr S. K. Dublish, Jagatjit Industries Pvt. Limited, P.O. Jagjitnagar, Dist. Kapurthala, Punjab.

Dr B. Panda

Prof. E. Penionzhkevich of USSR, President of the World's Poultry Science Association has nominated Dr B. Panda, Executive Secretary of the Association of Food Technologists (India) to represent India in the Council of the World's Poultry Science Association, with effect from 1969.

The Secretary, World's Poultry Science Association has nominated Dr B. Panda, Scientist, Central Food Technological Research Institute, Mysore, as a member of the International Committee on 'Nutrient Requirements for Poultry', to represent India. The International Committee is headed by Dr H. R. Bird of the University of Wisconsin, U.S.A.

Dr B. Panda, Scientist, CFTRI, Mysore has been elected unanimously at the Annual General Body Meeting of the Indian Poultry Club as the Secretary of the Indian Poultry Club and Editor of the Indian Poultry Gazette with effect from January, 1969.

Food Science and Technology Abstracts

1. General

1.16 *Sorption phenomena in foods*, T. P. LABUZA, *Fd Technol. Champaign*, 1968, **22** (3), 263.

Review. 38 references.

1.17 *Some aspects of the implementation of the food policy*, H. R. BARNCELL, T. J. COOMES AND DOROTHY F. HOLLINGSWORTH, *Proc. Nutr. Soc.*, 1968, **22** (1), 8.

Review. 20 references.

1.18 *Nutritional aspects of food policy*, W. T. C. BERRY, *Proc. Nutr. Soc.*, 1968, **27** (1), 1.

Review. 12 references.

1.19 *Manufacturers and suppliers, products and brand names, and uses of raw materials and ingredients in food industries*, *Fd Mf*, 1968, March 22.

An exhaustive directory of raw materials and ingredients used in food industries covering 23 categories, the most important among them being: cereal products, flavours, colours, dietary supplements, curing compounds, emulsifiers and stabilisers, enzymes, fats and oils, fruit, vegetable, milk and meat products and preservatives. The brand name of manufacturer, composition, applications and processing conditions for each proprietory product are also presented. Addresses of 190 manufacturers and suppliers of these products are provided.

B. S. N.

2. Cereals

2.82 *Cereals in the national diet*, *Milling*, 1967, **150** (3), 24.

2.83 *Enrichment and fortification of cereals and cereal products with vitamins and minerals*, CLINTON L. BROOKE, *J. agric. Fd Chem.*, 1968, **16** (2), 163.

Review. 20 references.

2.84 *Fortification of cereals and cereal products with proteins and amino acids*, GEORGE K. PARMAN, *J. agric. Fd Chem.*, 1968, **16** (2), 168.

Review. 11 references.

2.85 *Relative yield of total and head rice from raw and parboiled paddy*, H. S. R. DESIKACHAR, M. K. BHASHYAM AND H. A. B. PARPIA, *J. Fd Sci. Technol.*, 1967, **4** (4), 156.

2.86 *Studies on some comparative milling properties of raw and parboiled rice*, S. N. RAGHAVENDRA RAO, M. N. NARAYANA AND H. S. R. DESIKACHAR, *J. Fd Sci. Technol.*, 1967, **4** (4), 150.

2.87 *Physico-Chemical studies of five Australian wheat varieties*, A. K. KAUL, *J. Fd Sci. Technol.*, 1967, **4** (3), 111.

2.88 *National policy on processing and milling of foodgrains. I. Wheat and wheat products*, G. S. BAINS, *Res. & Ind.*, 1967, **12** (4), 254.

Desirability of having a national policy not only for increasing out-turn, but also for dove-tailing processing technology for extending and economising wheat supplies is discussed. Application of scientific methods to avoid, or to minimise or to compensate the undesirable consequences of milling wheat flour is described.

B. S. N.

2.89 *Amino acid composition of South African and Australian wheat varieties as a function of their nitrogen content*, D. W. ROBINSON AND R. SAGEMAN, *J. Sci. Fd Agric.*, 1968, **19** (1), 9.

Six varieties of wheat containing 2.42 to 3.86 per cent of nitrogen showed no major change in the proportions of the amino acids. An inverse relationship between lysine and nitrogen content could not be demonstrated.

K. A. R.

2.90 *Inhibition of wheat α-amylase by bran phytic acid*, R. W. CAWLEY AND T. A. MITCHELL, *J. Sci. Fd Agric.*, 1968, **9** (2), 106.

A proportion of the wheat samples tested for α-amylase activity by the Hagberg penetrometer method gave higher results on flours than on wheat meals milled from the same wheats. This effect is due to the lower level of calcium available as enzyme cofactor in the meals, caused by combination with phytic acid. Because of this effect and because the internal distribution of α-amylase in wheat grains is variable, testing for sprout damage in milling wheat is best carried out on flours rather than wheat meals.

A. A.

2.91 *Hagberg penetrometer method for α-amylase activity in sprouted grain: Prediction of activity of flour blends*, T. A. MITCHELL, *J. Sci. Fd Agric.*, 1968, **19** (2), 102.

The pressure-sustaining capacity of the flour gels, as calculated from the penetrometer readings, is inversely proportional to the enzyme activity. The penetrometer number appears to be primarily determined by the α-aymlase activity of the flour from sprouted grains and to be unaffected by the variations in the level of 'damaged' starch in the flour. A method is proposed whereby the amounts of sprouted lines of wheat necessary in a grist, to produce flour with a predetermined level of activity, may be calculated.

K. A. R.

2.92 *Effect of loaf specific volume on the rate and extent of staling in bread*, D. W. E. AXFORD, K. H. COLWELL, S. J. CORNFORD AND G. A. H. ELTON, *J. Sci. Fd Agric.*, 1968, **19** (2), 95.

Loaf specific volume is a major factor in determining both the rate and extent of staling, both of which decrease in a linear manner, as the loaf volume increases. Bread making process and the storage temperature significantly influence these curves. Bread made by the Chorleywood Bread Process stales less rapidly than bread made by the conventional bulk fermentation process. The effect of loaf specific volume on the rate of staling is more marked as the storage temperature is lowered.

K. A. R.

2.93 *Milling of solvent extracted wheat, semolina and flour. I. Effect on endosperm fragmentation and protein shifting*, N. L. KENT AND A. D. EVERS, *J. Sci. Fd Agric.*, 1968, **19** (1), 20.

The degree of endosperm fragmentation in milled flour and degree of protein shifting in air-classified fractions were slightly augmented by pre-milling treatment of Manitoba wheat and milled products with acetone; they were

more markedly affected by treatment with methanol if the residual solvent was promptly removed after treatment. In these circumstances gluten could be removed from the flour. Action of methanol on wheat, semolina or flour for extended periods showed deleterious effects on protein by reducing endosperm fragmentation and preventing gluten recovery from milled flour; aqueous butanol had similar effect. A. A.

2.94 *A design for a compact and efficient basic plant for the continuous manufacture of high grade wheat starch*, F. MORTON, *Fd Technol. Aust.*, 1968, **20** (1), 12.

2.95 *Soft wheat test baking in the presence of silicone grease*, LEO T. KISSELL AND JOHN R. DONELSON, *Cereal Sci. Today*, 1968, **13** (1), 7.

Certain silicone greases were found to be the source of defective baking in cookies. Experimental work and results are described on the effects of grease types, mode of contamination and their concentrations on several flours of cookie and cake formulations. J. V. S.

2.96 *Sponge-and-dough-type bread from mechanically developed doughs*, R. H. KILBURN AND K. H. TIPPLES, *Cereal Sci. Today*, 1968, **13** (1), 25.

By using a no-dough-time mechanical development method it was possible to prepare a bread indistinguishable from a bread made by the sponge and dough process. J. V. S.

2.97 *Gas production and retention during proofing of bread doughs*, CECYLIA J. MARCK, W. BUSHUK AND G. N. IRWINE, *Cereal Sci. Today*, 1968, **13** (1), 4.

Increasing concentrations of bromate increased the gas retention of dough. Low quantities of iodate increased gas retention but higher concentrations produced the reverse effects. This negative effect at higher levels could be overcome by increased mixing. Fat showed no effect in optimally matured dough but improved the gas retention in dough with low retention capacity. Cysteine and bromate showed synergistic effects in gas retention. Ascorbic acid also appeared as effective as bromate in its ability to increase gas retention. J. V. S.

2.98 *Functional bread baking properties of wheat flour lipids*, Y. POMERANZ, M. SHOGREN AND K. F. FINNEY, *Fd Technol. Champaign*, 1968, **22** (3), 324.

Addition of vegetable shortening to original flours increased loaf volume and crumb grains of breads, while its addition to defatted flours produced breads of impaired crumb grains. Shortening added to defatted strong flours decreased the loaf volumes of their bread. In poor flours, addition of shortening to dough formula increased loaf volume. The shortening response of strong flours was completely restored by adding lipids extracted from the test flours. The amount of lipids needed to give the original loaf volume was at least half of the original amount. J. V. S.

2.99 *Functional bread making properties of wheat flour lipids. 2. The role of flour lipid fractions in breadmaking*, R. D. DAFTARY, Y. POMERANZ, M. SHOGREN AND K. F. FINNEY, *Fd Technol. Champaign*, 1968, **22** (3), 327.

Free as well as bound lipids were extracted from different flours and fractionated into polar and non-polar fractions. Free polar lipid substantially increased loaf volume; the increase in loaf volume was lesser by adding bound polar lipid. Total free lipids containing polar and non-polar (1:3) fractions showed lesser improvement in bread quality than polar lipids alone. Non-polar lipids decreased loaf volume and crumb grain of breads made from petroleum ether extracted flours; the effects were counteracted by polar lipids. Galactosyl glycerides increased loaf volume of bread baked from petroleum ether extracted flours more than phospholipids. J. V. S.

2.100 *Kaffir corn malting and brewing studies. XIX. Gibberellic acid and amylase formation in Kaffir corn*, K. H. DAIBER AND L. NOVELLIE, *J. Sci. Fd Agric.*, 1968, **19** (2), 87.

Gibberellic acid had little effect on amylase development; only immature seeds and large grains produced more amylase, but this effect was smaller as compared to barley. Addition of gibberellic acid to isolated endosperms failed to stimulate significant amylase formation. Isolated endosperms after normal contact with their embryos for up to 48 hours of germination failed to produce amylase. K. A. R.

2.101 *Studies on the protein content and amino acid composition of some varieties of grain sorghum*, T. K. VIRUPAKSHA AND L. V. L. SASTRY, *J. agric. Fd Chem.*, 1968, **16** (2), 199.

Prolamine and glutelin are the chief protein fractions in endosperm of five varieties of grain sorghum investigated. Increase in prolamine content mostly accounts for a rise in protein level. Lysine is present in larger amounts in sorghum of high-genetic varieties. B. S. N.

2.102 *On plant phosphatases. III. Chromatographic separation of oat phosphatases*, J. SCHORMULLER, D. PAPAMICHALIS AND H. D. BELITZ, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (1), 9.

Phosphatase preparate obtained from oats by fractional precipitation with acetone was further separated into four fractions by chromatography on SE and CM-Sephadex at pH 4.5. Rechromatography under the same conditions and electrophoresis on polyacrylamide gel (pH 3, pH 8.6 and pH 11) proved that the fractions were uniform. Two of the enzyme fractions were analysed for their amino acid composition. K. M. D.

2.103 *On plant phosphatases. IV. Properties of the oat phosphatases*, J. SCHORMULLER, D. PAPAMICHALIS AND H. D. BELITZ, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (2), 49.

The four phosphatase fractions isolated from a yellow oat variety 'Flamingskrone' appear to be multiple forms (isoenzymes). They are fairly unspecific and hydrolyse the most varied substrates. Their great activity against a number of nucleotides is noteworthy. As the cationic character of the enzymes increases, (*a*) the range of optimal activity grows wider in direction of increasing pH, and (*b*) the Michaelis content for the splitting of p-nitrophenyl phosphate becomes smaller. The activation energies also form a sequence between 4330 and 8980 cal/mol.

Reagents acting on SH-groups have no influence on the activity of the phosphatases; but NAF and EDTA are powerful inhibitors. Inhibition by EDTA can be reversed by dialysis and addition of Mg^{++} ions.

2.104 *High protein fortification for rice*, FRED H. HOSKINS AND JAMES E. RUTLEDGE, Jr., *Rice J.*, 1968, **71** (3), 28.

Fortification of rice with soyabean protein and methionine in the form of protein granules is discussed.

K. A. R.

2.105 *Evaluation of milling products by colour*, R. ZIMMERMANN, *Nahrung*, 1967, **11** (218), 837.

A wet method for colour grading of flours, middlings, semolina and breaks of wheat and rye is described. Light reflection is measured in a flour suspension with smooth surface by the leukometer of VEB Carl Zeiss Jena. Measuring precision is 0.3 per cent reflection and the time taken for duplicate measurements is 10 min.

A. A.

2.106 *Researches on wheat proteins. II. Influence of local conditions on the electrophoretic behaviour of gliadine, glutenine and total gluten*, G. KLOOS, *Z. Lebensmitt. unters. u. Forsch.*, 1968, **136** (2), 65.

Some differences were observed in the electrophoretic behaviour of gliadine, glutenine and total gluten of 2 varieties of wheat grown at three different places in Bavaria. Influence of place of cultivation was most marked in the component ratio of gliadine. Influence of variety was also observed in the component having the least mobility. No specific varietal difference could be established in the case of glutenine and total gluten. The component ratio of total gluten was influenced by place of cultivation and variety in the same manner as gliadine.

K. M. D.

2.107 *Comparison of wheat varieties by starch gel electrophoresis of their grain proteins*, G. J. DOEKES, *J. Sci. Fd Agric.*, 1968, **19** (3), 169.

Single extraction of wheat flour with water proved to be sufficient for obtaining clear electrophorograms of the albumin/globulin fraction; triple extraction was required to obtain a clear distinction of the gliadin components. As the electrophoretic mobility does not have a constant value, the Rv value, analogous to the Rf value in chromatography is suggested as a measure of the relative mobility of the components.

K. A. R.

2.108 *Integrity of gluten components labelled with* ^{14}C, J. W. LEE, *J. Sci. Fd Agric.*, 1968, **19** (3), 157.

Wheat protein was labelled with ^{14}C by exposing immature wheat ears to uniformly labelled ^{14}C glycine. Labelled gluten proteins were fractionated on CMC and the labelled fractions obtained were mixed with unlabelled and unfractionated protein. Study of the distribution of ^{14}C after electrophoresis on starch gel showed that each protein band examined retained its identity, and there was no evidence of *in vitro* protein hybridisation.

A. A.

2.109 *Biscuit manufacture*, H. R. STAFFORD, *Process Biochem.*, 1968, **3** (3), 59.

Review. Eight references.

3. Pulses

3.14 *Physiology of Bengal gram seed. III. Changes in the phosphorus compounds of the seed parts during ripening of the seed*, B. M. LAL AND S. C. VERMA, *J. Sci. Fd Agric.*, 1968, **19** (2), 113.

Except for the phytin phosphorus in the cotyledons and phytin and total phosphorus in the embryo (i.e., excluding the cotyledons), all phosphorus fractions decreased over the period of sampling. Largest decrease occurred in the seed coat which is commensurate with its matabolic necessity. Cotyledons contribute largest amounts to the content of the phosphorus fractions in the whole seed though at early stages of maturity, the seed coat also contributes a fairly large proportion.

K. A. R.

3.15 *Cooking rates of dry beans as influenced by moisture content and time and temperature of storage*, HORACE K. BURR, SAMUEL KON AND H. J. MORRIS, *Fd Technol. Champaign*, 1968, **22** (3), 88.

High temperature, high moisture content and long storage impaired cookability in *Pinto*, *Large Lima* and *Sanilac* beans. A few-fold increase in cooking time was observed in beans held under conditions that may be encountered during distribution i.e., one year at 70° F and a moisture content below 18 per cent. Beans which had become very slow to cook rehydrated as quickly as normal beans.

A. A.

3.16 *Chemical action of ethylene on frozen peas during storage*, FRANK A. LEE, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (2), 64.

The peroxide content of unshelled and hand-shelled peas was higher in gas mixtures having smaller quantities of ethylene. Differences in the content of unsaturated carbonyl compounds were observed only in unshelled peas after prolonged storage; they contained less than the other samples.

Peas damaged at the beginning of storage often developed a bad taste. The substances responsible for the bad taste appear to dull the taste nerves so that the intensity of the unpleasant taste decreases perceptibly when larger quantities of these peas are consumed.

K. M. D.

3.17 *Nucleosides and heterocyclic bases of peas (Pisum sativum). Possible changes during the enzymatic phase, of the cooking process*, J. SCHORMULLER AND W. GROSCH, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (3), 162.

Compounds detected in ripe pea seeds were: uridine, xanthosine, guanosine, adenosine, trejonelline, adenine, xanthine nicotinic acid and/nicotinic acid amide, and traces of uracil and hypoxanthine. Concentrations of the first seven compounds were measured in two varieties of peas; very wide differences were observed in the uridine and adenosine contents.

When pea meal suspensions are tempered at 40° C, there is a phase when enzymes become active, and nucleosides and bases are formed or decomposed, the free bases hypoxanthine and uracil increase considerably, and uridine decreases. Heating for short periods, as when peas are steamed prior to milling, does not cause any noticeable inactivation of the enzymes which bring about changes in nucleosides and bases.

K. M. D.

3.18 *Enzymic formation of neutral carboxyl compounds from the lipids of the pea (Pisum sativum* var. *Gottinga)*, W. GROSCH, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (2), 75.

Except for the large quantity of acetaldehyde, all other carboxyl compounds responsible for off-flavour in peas stored for 2 years at —17.8°C are formed by the action of a lipoxygenase which acts on lipoids containing linoleic and linolenic acids. The decomposition products of these acids are being identified. The possible role of a peroxidase which may produce carooxyl compounds from the hydroperoxides arising from the lipoxygenase reaction is under investigation.

K. M. D.

3.19 *An estimation of protein, ascorbic acid and mineral matter content in some indigenous and exotic varieties of gram,* (*Cicer arietinum* L.,) S. CHANDRA AND S. K. ARORA, *Curr. Sci.*, 1968, **37** (8), 237.

4. Fruits, Vegetables and Tubers

4.87 *Enrichment of fruit and fruit products,* R. H. BUNNEL, *J. agric. Fd Chem.*, 1968, **16** (2), 177.
Review. 31 references.

4.88 *Food cannery wastes treatments,* C. D. PARKER, *Fd Technol. Aust.*, 1968, **20** (2), 74.

4.89 *The composition of tomato peel. II. Alkali soluble components,* C. H. BRIESKORN AND H. REINARTA, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (2), 55.

That component of tomato peel which is insoluble in organic solvents consists of cutin and a polysaccharide soluble in cuprous-tetramminhydroxide. Tomato peel cutin is built up mainly from 10, 16-dihydroxyhexadecanic acid. Smaller proportions of 16-hydroxyhexadecanic acid, 9, 10, 16-trihydroxyhexadecanic acid and 9, 10, 18-trihydroxyoctadecanic acid. Hydrolysis of the polysaccharide yields glucose, xylose and arabinose. During gas chromatography of the hydroxy fatty acids, the silyl ethers retain their methyl ester.

K. M. D.

4.90 *Ripening tomatoes: ethylene, oxygen and light treatments,* A. A. BOE AND D. K. SALUNKHE, *Econ. Bot.*, 1967, **20** (4), 312.

Ethylene treatment increased the respiration rates and ripening, increased beta carotene, lycopene and citric acid. Oxygen treatment decreased reducing sugars and at high concentrations showed no effect on lycopene synthesis. Light treatment increased the per cent acid, reducing sugars and colour of the ripened fruit. Increase in colour was related to an increase both in beta carotene and lycopene. Light treatment decreased the respiration rate of the fruit not treated with ethylene.

K. A. R.

4.91 *Quantitative comparison of isoamyl, pentanol and 3-hexenol-1 in tomato juice: varietal and harvest differences and processing effects,* JOHN HAL JOHNSON, W. A. GOULD, A. F. BADEN HOP AND R. M. JOHNSON, *J. agric. Fd Chem.*, 1968, **16** (2), 255.

A method for obtaining a three fold concentrate of tomato juice volatiles and to remove solvent with minimal contamination of a small final volume and analysis of volatiles by GC technique is outlined. The method is repeatable within 4 per cent average of replicates. The variety and time of harvest played an important role in the amounts of iso-and active amyl alcohols, n-pentan ol-and cis-3 hexanool present. In fresh juice, amyl alcohols varied between 1.8-13.4 ppm among varieties and at 4.8 ppm between harvests cf a variety. The corresponding values for n-pentanool and cis-3-hexanool are: 0.3-1.8 ppm and 1.1 ppm; 4.0-30.2 ppm and 16.3 ppm. The total amount of three volatiles present in tomato ranged from 7.4-40. 2 ppm.

B. S. N.

4.92 *Irradiation effects on the ripening of Kent mangoes,* R. A. DENNISON AND E. M. AHMED, *J. Fd Sci.*, 1967, **32** (6), 702.

Kent mango fruits irradiated with 0, 100, 200 and 300 krad were ripened at 20°C for 0, 4 and 8 days. Irradiated mangoes were less firm, contained higher water soluble and versene-insoluble pectic fractions, and exhibited higher pectinesterase activity than control. Irradiated fruit contained higher alcohol insoluble solids and lower soluble solids than control. No differences in sucrose content were found but fruit irradiated with 300 krad contained less reducing and total sugars.

K. A. R.

4.93 *Carotenogenesis in ripening mangoes,* V. V. MODI AND V. V. R. REDDY, *Indian J. exp. Biol.*, 1967, **5** (4), 233.

In ripening mangoes the concentration of citric and malic acids decreases and concentration of pentoses and hexoses increases. Synthesis of fructose during ripening was observed and it is one and half times that of glucose. These suggest the operation of hexose monophosphate (HMP) shunt which regenerates reduced NADP. The activity of NADP dependent malate, glucose-6-phosphate and 6-phosphogluconic dehydrogenases is increased during ripening. Geraniol and farnesol are the precursors of carotenoids; the latter is utilized to a lesser extent than former.

K. A. R.

4.94 *Removal of limonin from bitter orange juice,* B. V. CHANDLER, J. F. KEFFORD AND G. ZIEMELIS, *J. Sci. Fd Agric.*, 1968, **19** (2), 83.

Treatment of orange juice with polyamides can bring down the concentration of limonin below the organoleptically detectable level. One or two treatments may be required depending upon the juice.

K. A. R.

4.95 *Volatiles from injured and uninjured Valencia oranges at different temperatures,* S. NORMAN, C. C. CRAFT AND P. L. DAVIS, *J. Fd Sci.*, 1967, **32** (6), 656.

Volatiles emanating from injured and uninjured Valencia oranges increased in number and amount with increasing temperature. The amount of emanated volatiles increased about 20-fold from uninjured fruit and about 50-fold from injured fruit between holding temperatures of 2 and 38° C. The average amount of volatiles emanating from injured oranges was nearly 75 times as great as that from uninjured fruit; the number of components did not increase.

A. A.

4.96 *Volatiles from oranges. 6. Constituents of the essence identified by mass spectra,* T. H. SCHULTZ, D. R. BLACK, J. L. BONBEN, T. R. MON AND R. TERANISHI, *J. Fd Sci.*, 1967, **32** (6), 698.

California orange essence, concentrated to 150-fold indicated the presence of 150 constituents: 39 of these were identified. Compounds previously unreported as orange volatiles are: 1-penten-3-ol, methyl butyrate, methyl hexanoate, benzaldehyde, and gama-decanolactone.

K. A. R.

4.97 *An instrument for evaluating firmness of grape fruit sacs*, H. C. MANNHEIM AND A. BAKAL, *Fd Technol. Champaign*, 1968, **22** (3), 331.

The instrument to evaluate firmness of grape fruit segments (as defined by the tendency to break-up) is based on weighing the per cent of juice sacs that can be floated free under standard conditions. The Kramer sheer press was also modified to measure grape fruit segment firmness. Results show that the floatation test can be used to evaluate raw material and general appearance of final product.

J. V. S.

4.98 *Problems associated with pineapple products*, R. E. LIVERINGTON, *Fd Technol. Aust.*, 1967, **20** (1), 20.

4.99 *Effect of pre-harvest application of growth regulators on the control of berry drop in Bangalore Blue grapes*, P. NARASIMHAM, M. MADALAGATTI RAO, N. NAGARAJA AND B. ANANDASWAMY, *J. Fd Sci. Technol.*, 1967, **4** (4), 162.

4.100 *Some volatile components of Vitis vinifera variety white Riesling. 1. Grape juice*, C. J. VAN WYK, A. D. WEBB AND R. E. KEPNER, *J. Fd Sci.*, 1967, **32** (6), 660.

Major components are: ethanol, isobutanol, 2-methylbutanol, 3-methylbutanol, 2-hexenal, n-hexanol, trans-2-hexen-1-ol, and 2-phenethanol. Alcohols present in relatively smaller amounts are: methanol, n-butanol, n-pentanol, n-heptanol, linaool, n-octanol, n-decanol and benzyl alcohol. Acids constitute only a small part of the total volatiles, the major acids being: acetic, n-caproic, 2-hexenoic, n-caprylic, n-pelargonic and n-capric. Acids present in trace amounts are: propionic, isobutyric, n-butyric, 2-methyl butyric, isovaleric, isocaproic, n-heptanoic, succinic and ethyl acid succinate.

A. A.

4.101 *Some volatile components of Vitis vinifera variety white Riesling. 2. Organic acids extracted from wine*, C. J. VAN WYK, R. E. KEPNER AND A. D. WEBB, *J. Fd Sci.*, 1967, **32** (6), 664.

The major acids identified in wine made from *Vitis vinifera* var. *White Riesling* are: acetic, n-butyric, n-cupric, n-caprylic, n-capric, 9-decenoic, succinic, and ethyl acid succinate.

K. A. R.

4.102 *Some volatile components of Vitis vinifera variety of Riesling grapes. 3. Neutral components extracted from wine*, C. J. VAN WYK, R. E. KEPNER AND A. D. WEBB, *J. Fd Sci.*, 1967, **32** (6), 669.

The neutral essence consisted principally of alcohols; the major ones: ethanol, n-propanol, isobutanol, 2-methyl butanol, 3-methyl butanol, n-hexanol, levo-2, 3, butanediol and 2, phenethanol. The second most common class of substances in the essence was esters; the major ones were: ethyl acetate, isoamyl acetate, ethyl n-caproate, ethyl-n-caprylate, n-hexyl acetate, 1, 3-propanediol monoacetate and 2-phenethyl acetate.

A. A.

4.103 *Apple anthocyanins: Identification of cyanidin-7-arabinoside*, B. H. SUN AND F. J. FRANCIS, *J. Fd Sci.*, 1967, **32** (6), 647.

The major pigment in Red Delicious apple (*Malus sylvestris* Mill) was cyanidin-3-galactoside. The minor pigments were cyanidin-3-arabinoside and cyanidin-7-arabinoside. Cyanidin-7-arabinoside was isolated from a natural source for the first time. Three pigments were isolated from 74 varieties of apples, two from six varieties and only one from two varieties.

K. A. R.

4.104 *Lactonic compounds of apricot*, C. S. TANG AND W. G. JENNINGS, *J. agric. Fd Chem.*, 1968, **16** (2), 252.

On repetitive gas chromatographic separation and infrared spectroscopy of isolated components, a charcoal adsorption essence of Blenheim apricot gave for the first time, benzyl alcohol, caproic acid, epoxydihydrolinalool IV, 7-caprolactone δ-octalactone and δ-decalactone 7-dodecalactone.

B. S. N.

4.105 *Influence of phosphate compounds on certain fungi and their preservative effects on fresh cherry fruit (Prunus cerasus*, L.), F. J. POST, T. W. COLENTZ, T. W. CHOU AND D. K. SALUNKHE, *Appl. Microbiol.*, 1968, **16** (1), 138.

Fresh cherries (*Prunus cerasus* L.) normally infested with *Penicillium expansum*, *Rhizopus nigricans* and *Botrytis* sp. during storage, may be kept for 30 days at 1.1 °C and R.H. 94 without molding by treating them with a 10 per cent dip of sodium tetraphosphate.

B. S. N.

4.106 *Methods for estimating oxygen demand of liquid peach waste*, P. S. OPLIGER, *J. Fd Sci.*, 1967, **32** (6), 675.

The amount of total solids (TS) in liquid peach waste had high correlations with biochemical oxygen demand (BOD) and chemical oxygen demand (COD) and determination of TS required less time, equipment and technique than the other methods for estimating oxygen demand. In a small number of observations removing large suspended particles from the waste by filtering or settling decreased COD, but the treatment effects of BOD were inconsistent. BOD changed with time at temperatures above freezing, but COD did not.

A. A.

4.107 *Spoilage bacteria in canned foods. I. Flat sour spoilage bacteria in canned asparagus and the thermal death time*, CHAU-CHING LIN, BIN-KENG WU AND DARKUAN LIN, *Appl. Microbiol.*, 1968, **16** (1), 45.

Bacillus stearothermophilus was found to be a cause of spoilage in asparagus canned in Taiwan. The F_{250} and Z values of the isolates were 14.2 min. and 17.8 F (-7.9°C) respectively.

A. A.

4.108 *Contamination of potatoes by dipping in ^{90}Sr or ^{137}Cs solutions*, K. PAULUS, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (3), 126.

The uptake of radionuclides depends on the state of the material under test, and also on the nuclides themselves. The mathematical function which characterizes the uptake of radio nuclides by a given material reaches a constant value after some time. The capacity of different products to take up various radionuclides can be compared by determining this constant, keeping other parameters the same.

Tests with potatoes showed that 95 per cent of the radioactive contamination remains on the outer surface, so that peeling is an effective counter-measure.

K. M. D.

4.109 *Recommendation for sulphiting cut fruit before drying*, D. McBEAN, *Fd Technol. Aust.*, 1968, **20** (3), 113.

4.110 *Some storage diseases of fruits*, M. P. SRIVASTAVA AND R. N. TANDON, *Curr. Sci.*, 1968, **37** (10), 292.

The organism responsible, agent, genesis and onset of *Anthracnose* of *Averrhoa carambola*, *Aspergillus* rot of *Spondias mangifera* and scald of *Pisum sativum* are reported.

B. S. N.

4.111 *Properties of succinate oxidation in tomato mitochondria*, ROBERT E. DRURY, JOHN P. MCCOLLUM AND STEPHEN A. GARRISON, *Pl. Physiol. Wash.*, 1968, **43** (2), 248.

4.112 *Consistency of tomato products. 3. Effects of pH adjustment during tomato juice preparation on pectin contents and characteristics*, R. BECKER, J. R. WAGNER, J. C. MIERS, D. W. SHANSHUCK AND W. C. DIETRION, *Fd Technol. Champaign*, 1968, **22** (4), 503.

The changes occurring in amounts and properties of pectin in tomato juices due to the adjustment of pH during breaking and heating have been discussed. The results support the view that the observed changes are partially due to control of pectin esterase and polygalacturonase prior to their destruction by heat. Direct effects of pH on pectin or pectin containing structures are not excluded.

J. V. S.

4.113 *Preparation of dehydrated tomato powder samples for Howard mould count*, BENJAMIN KRINITZ, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 75.

The modified AOAC procedure 36.069 (mixing 6 g. of sample with water to give a refractive index of 1.3447 to 1.3460 for 8.37 per cent solids and 1.304 and 1.307 for 5.5 per cent solids) was found suitable for preparing tomato powder samples for analysis by the Howard mold count method.

J. V. S

4.114 *Changes in ascorbic acid and reductone contents in dried tomatoes and carrots*, J. SCHORMULLER AND K. H. MULLER, *Nahrung*, 1967, **11** (718), 698.

Changes in ascorbic acid and reductones in mixtures of dried tomatoes and carrots were studied during a storage time of 1½ years at 30° C and 70 per cent R.H. Addition of ascorbic acid alone or with citric acid increased the formation of reductones in the substrate during storage.

K. A. R.

4.115 *Changes of organic acids in apples,'KOKKO' during storage*, TAKESHI MORI, NABUO MURAOKA AND HANAO SHITOMI, *Rep. Fd Res. Inst. Japan*, 1968, No. 23, 29.

Two sets of apples were wrapped in 0.07 mm polyethylene films, packed in hand boxes, and stored at room temperature for 6 months. Malic acid was the main acid in the flesh. The total acid remained unchanged throughout the storage period. Malic acid decreased rapidly during first 4 months. Citric acid increased during first 2 months, but decreased to initial concentration during next 4 months.

J. V. S.

4.116 *Sucrose dehydration in osmofreeze dehydration of apple slices*, C. Y. LEE AND D. K. SALUNKHE, *Curr. Sci.*, 1968, **37** (10), 297.

Fresh apple slice placed in 50 ml of 2.0 M sucrose solution and frozen at—50° C for 20 minutes showed increased soluble solids content. Autoradiograph studies for each apple slice immersed in each concentration of ^{14}C labelled sucrose solutions indicated that the degree of radio activity on the surface area of slices was proportional to concentration of sucrose.

B. S. N.

4.117 *Metabolism of sugars and organic acids in immature grape berries*, P. J. HARDY, *Pl. Physiol. Wash.*, 1968, **43** (2), 224.

Individual, intact, excised, immature *Sultana* grape berries were fed ^{14}C-sugars and organic acids; when ^{14}C—hexoses were supplied, malic and tartaric acids accounted for 25 per cent and 10 per cent of the total activity extracted after 24 hours and sucrose was synthesised. It is proposed that the changes in the levels of organic acids during ripening are related to changes in the ability of the body to synthesise them. Although administration of uniformly labelled sucrose resulted in the unequal labelling of glucose and fructose, the results indicate breakdown of sucrose by invertase.

A. A.

4.118 *Effect of chlorophenoxyacetic acid growth regulator sprays on residues in canned apricots and grapes*, Y. N. LEE AND B. S. LUH, *J. Fd Sci.*, 1968, **33** (1), 104.

The new technique involves the conversion of acid to its methyl ester with diazomethane chromatography on a 5 per cent silicone grease SE-30 column at 210° C and subsequent detection of the compound by electron capture detector. As low as 0.02 ppm of residue could be detected and parachlorophenoxyacetic acid, 2, 4-D and 2, 4, 5-T could be detected simultaneously.

K. A. R.

4.119 *Studies on controlled atmosphere storage of peaches. 3. Effects of concentration of carbon dioxide on the storage life of white peaches*, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 33.

Okubo variety peaches stored in 2-4 per cent or 7-9 per cent CO_2 atmosphere preserved well for 28 days retaining good quality features.

J. V. S.

4.120 *Post-harvest changes of Broccoli stored in modified atmospheres. 1. Respiration of shoots and colour of flower heads. 2. Acidity and its influence on texture and chlorophyll retention of the stalks*, K. W. LEBERMANN, A. I. NELSON AND M. P. STEINBERG, *Fd Technol. Champaign*, 1968, **22** (4), 487, 490.

1. Broccoli shoots were stored at 34 and 45° F in atmosphere containing 2-20 per cent of O_2 and 0-20 per cent of CO_2. Respiration was reduced by progressive increases in CO_2 and decreases in O_2. Chlorophyll retention was increased and organoleptic colour scores improved by progressive increases in CO_2 and decreases in O_2. A high level of CO_2 was, however, more effective in retaining chlorophyll than a low level of O_2.

2. Broccoli shoots were stored in modified atmosphere and air at 45 °F. Titractable acidity and pH changes were measured and correlated with colour and texture after cooking.

J. V. S.

4.121 *Dielectric properties of potatoes and potato chips*, W. E. PACE, W. B. WESTPHAL, S. A. GOLDBLITH AND D. VAN DYKE, *J. Fd Sci.*, 1968, **33** (1), 37.

Potato chips show a rapidly decreasing dielectric loss as moisture content is reduced; the loss values of the chips approach those of the oil used for frying them after moisture has been reduced to approximately 3 per cent and the oil content has been increased accordingly. For finish drying of potato chips, a frequency of 3,000 meghertz (MHz) will result in 3-4.5 times greater power production in the chips than will the use of frequency of 1,000 (MHz).

A. A.

4.122 *Studies on the prevention of the browning in Bakeri garlic*, HIDEO SATAKE AND HONAO SHITOMI, *Rep. Fd Res. Inst. Japan*, 1968, No. 23, 28.

Citric acid prevented browning at pH 1.9 or less; whereas pH 3.3 or less was optimum when acetic acid and burnt alum were added. The pickle to which both acetic acid and burnt alum were added was slightly firmer than others even after storage for 120 days at room temperature.

J. V. S.

5. Oilseeds and Nuts

5.33 *Chlorogenic and quinic acids in sunflower meal*, B. MILIC, S. STOJANOVIC, N. VUCUREVIC AND M. TURCIC, *J. Sci. Fd Agric.*, 1968, **19** (2), 108.

Chlorogenic and quinic acids were isolated by column chromatography. The contents of both acids in the kernel and hull of sunflower seeds were determined and the conversion of chlorogenic acid into quinic acid at temperatures of 100 and 135°C was followed. During storage of sunflower meal re-synthesis of chlorogenic acid was observed. Effects of isolates of chlorogenic acid and quinic acids on α-amylase, trypsin and lipase activity were detected.

A. A.

5.34 *Effect of organic solvents on the proteins extracted from peanuts*, N. J. NEUCERE AND R. L. ORY, *J. agric. Fd Chem.*, 1968, **16** (2), 364.

Many changes in the chromatograms of peanut proteins (affecting their utility in artificial milk type beverages) were observed when defatted peanuts were treated with three organic solvents. Conarachin and albumin appear to be much effected regarding their solubility; pattern of elution of arachin is effected by acetone extraction. Change in molecular configurations of proteins are also indicated.

B. S. N.

5.35 *Build up of free fatty acid in Northern Nigerian groundnuts*, D. HALLIDAY, *Trop. Sci.*, 1967, **9** (4), 210.

Review. 21 references.

5.36 *Effect of processing conditions on the nutritive value of isolated soybean proteins*, URICOGAN, ANINA YARON, ZEKIBERK AND GIDEON ZIMMERMANN, *J. agric. Fd Chem.*, 1968, **16** (2), 196.

PER of isolated soybean protein, intermediate fractions obtained during isolation and filtered extract were lower than that of the original meal. PER of spray dried isoelectric proteins was higher than corresponding freeze dried samples, whereas isoelectrically precipitated protein and calcium salt of coagulated protein had almost the same PER. Nutritive value did not improve by toasting spray dried protein. Unheated and toasted meal isolates had identical PER values.

B. S. N.

5.37 *Nutritive value of groundnut (Arachis hypogea)-1, Amino acid composition of different varieties of groundnuts grown in the Punjab*, A. K. CHOPRA AND G. S. SIDHU, *Br. J. Nutr.*, 1967, **21** (3), 519.

Nine important varieties of groundnut (*Arachis hypogea*) were analysed for amino acid composition by an ion exchange chromatographic procedure.

A. A.

5.38 *Miso manufacturing from dehulled soybeans. 2. Evaluation of dehulled soybeans for making miso*, HIDEO EBINE AND KOKI YAMAMOTO, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 1.

Miso prepared from dehulled soybeans was better than that made from whole soybeans. Dehulled soybean—*miso* and whole soybean—*miso* did not show significant differences in physical and chemical properties. When dehulled soybeans were soaked in water and cooked under specific conditions, the amount of water soluble material lost was more than 15 per cent of dry material. Data are provided on chemical composition of water soluble matter and also on the chromatographic analysis of unhydrolysed as well as hydrolysed proteins.

J. V. S.

5.39 *On the manufacture of enriched miso. 7. Addition of L-and DL-form of methionine and methionine sulfoxide*, HIDEO EBINE, MASAHIRO NAKANO AND ICHIBO KUROHA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 13.

Two varieties of *miso* (light yellow rice *miso*, and dark coloured rice *miso*) were enriched with L-methionine, DL-methionine and methionine sulfoxide at 0.2 per cent level. The treated *miso* were divided into two groups, one of which was heat pasteurised and other was the control. Both were stored at 30°C for a month. No differences were formed in methionine, but generally non-pasteurised *miso* was preferred to pasteurised *miso*.

J. V. S.

5.40 *Removal of cyclopropenoid fatty acids from cottonseed meals by solvent extraction*, H. G. REILISH, H. J. O'NIELL, R. S. LEVI AND T. YAMAUCHI AND W. A. PONS JR, *J. Am. Oil Chem. Soc.*, 1968, **45** (3), 185.

A simple stepwise extraction with acetone/hexane/water azeotrope was found suitable for the removal of up to 88 per cent of the original CPA content of the meal.

A. A.

5.41 *Comparative analytical studies on soybean and rape seed phosphatides*, F. LINOW AND G. MIETH, *Nahrung*, 1967, **11** (7/8), 663.

5.42 *The Macadamia nut industry—problems and prospects*, D. WINTERTON, *Fd Technol. Aust.*, 1968, **20** (3), 119.

5.43 *In shell storage effects on quality of processed Macadamia nuts*, CATHARINE G. CAVELETTO, EDWARD ROSS AND HARRY Y. YAMAMOTO, *Fd Technol. Champaign*, 1968, **22** (4), 516.

The results indicate that roasted Macadamia kernels prepared from nuts having 12 months in-shell storage at 1.2 per cent kernel moisture have roasting quality and shelf-life comparable to kernels prepared from freshly harvested nuts.

A. A.

6. Oils, Fats and Waxes

6.34 *Information about fats containing sulfur and their behaviour during hydrogenation*, J. BALTES, *Fette Seifen Anstrichmittel*, 1967, **69** (7), 512.

Commercial marine oils—whale oil and fish oil—can contain combined sulfur, which cannot be eliminated by means of the normal refining and therefore causes considerable difficulties during the hydrogenation. An analytical method for the determination of sulfur in fats is described. This method allows the quantitative determination of 0.5 to 100 μg. sulfur per gram fat with an exactness of 0.2 μg. sulfur per gram fat. Semi-refined fats to be hydrogenated, containing more than 2 μg. sulfur, should be subjected to a hydrogenating desulfurization with nickel contacts at 120° to 130°C. By means of the method described a complete desulfurization is attained without any noticeable hydrogenation or isomerisation of the unsaturated fat constituents. Such pretreated fats can be hydrogenated as usual. Also rapeseed oil, sometimes containing sulfur constituents not easily eliminated can be desulfurized in the same way.

A. A.

6.35 *5 α-androst-16-ene-3-one-compound responsible for taint in boar fat*, R. L. S. PATERSON, *J. Sci. Fd Agric.*, 1968, **19** (1), 31.

The compound responsible for the taint of boar fat has been isolated and identified by mass spectrometry as 5 α-androst-16-ene-3-one. It has the unpleasant odour of perspiration and is detectable in most boars of 200 lb. live weight and over, but not in hogs or gitts.

K. A. R.

6.36 *Detection of argemone oil in edible oils by paper chromatography*, P. S. NATARAJA SARMA AND V. V. NITHYANANDAN, *Res. & Ind.*, 1967, **12** (3), 167.

By a paper chromatographic technique described here the presence of argemone oil (in excess of 2 per cent) can be detected in edible oils. By employing the UV light, fluorescence is detected and later on adding Draggendroff's reagent, a brick red colour develops if the adulterant is present.

B. S. N.

6.37 *Dielectric properties of commercial cooking oils*, W. E. PACE, W. B. WESTPHAL AND S. A. GOLDBLITH, *J. Fd Sci.*, 1968, **33** (1), 30.

The differences in dielectric properties among fats and oils appear to be attributable to the solid vs. liquid phase of the material and generally correspond to the degree of unsaturation. The differences in loss factors among these fats and oils at any given temperature and frequency are too small to be of any practical importance in selecting any one of them for use in heating process using microwaves.

A. A.

6.38 *The dehydration of foods in edible oil in vacuo. 1. Stability of the drying medium*, N. ABRAHAMI AND D. J. NAISMITH, *J. Fd Technol.*, 1968, **3** (1), 55.

Arachis oil showed considerable resistance to autoxidation. The processing of cabbage, lean horse meat and herring had the effect of increasing the stability of the drying medium. Free fatty acids did not rise by the continuous use of the oil. Neither the drying medium nor the adherent oil became rancid after storage for many weeks. Synthetic antioxidants like BHT and sesamol added to the arachis oil before heating, acted synergistically with the natural antioxidants of the foodstuffs. The NPU of herring dried in arachis oil *in vacuo* was as high as that of freeze dried herring.

K. A. R.

6.39 *Studies on frying fats. On the determination of oxidized fatty acids*, A. SEHER, *Nahrung*, 1967, **11** (7/8), 829.

By TLC it has been found that the most polar compounds are insoluble in petroleum ether. Other oxidative and thermal degradation products remain with the soluble fatty acids. This is useful in evaluating the quality of frying fats.

A. A.

6.40 *Essential oils from some exotic plants raised in Kumaon*, R. K. BASLAS AND K. K. BASLAS, *Perf. essent. Oil Rec.*, 1968, **59** (2), 110.

Data on Dill oil and Mentha (Spp. *dil*) are particularly useful to food technologists.

J. V. S.

6.41 *Chemistry of Indian essential oils. V.*, K. K. BASLAS, *Perf. essent. Oil Rec.*, 1968, **59** (2), 103.

Of special use to food technologists, are the data on *Oscimum*, *Pinus*, *Passiflora edulis*, *Piper cubeba* (pepper) and *Pistachia* oils. Sixty six references.

J. V. S.

6.42 *Selective hydrogenation of soyabean oil. III. Copper-exchanged molecular sieves and other supported catalysts*, SAMBASIVA RAO KORITALA, *J. Am. Oil Chem. Soc.*, 1968, **45** (3), 197.

Copper chromium catalysts promote selective reduction of linolenyl groups in soybean oil. This investigation reports the preparation and performance of copper catalysts prepared on several supports such as silica, alumina and molecular sieve.

J. V. S.

6.43 *New process for the production of better quality rapeseed oil and meal. 1. Effect of heat treatments on enzyme destruction and color of rapeseed oil*, K. E. EAPEN, N. W. TAPE AND R. P. A. SIMS, *J. Am. Oil Chem. Soc.*, 1968, **45** (3), 194.

In commercial practice the enzyme responsible for the liberation of toxic principles from thioglycosides is destroyed by a dry heat treatment, but no attempt is made to remove thioglycosides or the fibrous matter from the meal. The new wet heat method of processing to inactivate myrosinase also results in the production of improved quality oil.

A. A.

7. Starch, Sugar and Confectionery

7.16 *Enrichment of sugar and sugar products*, JUAN M. NAVIA, *J. agric. Fd Chem.*, 1968, **16** (2), 172.

Review. 53 references.

7.17 *Studies on the utilisation of isomerised liquid sugar. I. Utilisation of isomerised liquid sugar in bread making*, YASUO TANAKA, YOSHIKO KOYANAGI, NOBUZO TSUMURA AND TOMATARO SATO, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 137.

Isomerised liquid sugar (ILS) was prepared from glucose by the action of *Streptomyces phaeochromogenus*. It contained: water, 20; fructose, 38.8; and glucose, 40.4 per cent.

The amount of sugar added as dry matter was 4 per cent in white bread dough and in sweet bread dough on flour basis. The quality of white bread was improved by addition of ILS when compared to sucrose addition. In sweet dough, the addition of ILS reduced the loaf volume but this could be corrected by extending the proofing time, and the bread produced thereafter was comparable to sucrose-bread in quality and volume. In sweet dough breads made with the addition of ILS and sucrose, the former was sweeter. J. V. S.

8. Spices and Condiments

8.3 *Production of white pepper, pepper oil and oleoresin*, C. P. NATARAJAN, Y. S. LEWIS, E. S. NAMBUDIRI AND N. KRISHNAMURTHY, *Indian Spices*, 1967, No. 3, 41.

Mature green pepper is steamed or boiled in water until skin is soft and the skin is rubbed off and berries dried. One tonne of green pepper will yield 200 kg. of white pepper and 1 kg. of pepper oil. From light pepper it is possible to prepare either oleoresin or pepper oil. About 2-2.5 per cent oil can be recovered even from low quality light pepper.

K. A. R.

8.4 *Grading of black pepper at the level of farmers through the grower co-operatives*, T. K. VISWANATHAN, *Indian Spices*, 1967, No. 3, 27.

8.5 *Chemical composition of cardamom*, M. N. KRISHNAMURTHY, R. PADMA BAI AND C. P. NATARAJAN, *J. Fd Sci. Technol.*, 1967, **4** (4), 170.

8.6 *Detection of colophony in asafoetida (Hing)*, A. R. S. KARTHA AND D. N. SHARMA, *Res. & Ind.*, 1967, **12** (4), 248.

The modified Liberman starch test developed involves removal of incidental impurities by extracting colophony through cold percolation with petroleum ether (b. p. 40-60° C) and the residue in percolate after solvent removal is estimated by the original procedure laid down. Even 0.25 per cent of colophony present in asafoetida may be detected.

B. S. N.

8.7 *Flavours—their uses and abuses: Natural spice*, F. A. GOUGH, *Fd Technol. Aust.*, 1968, **20** (4), 164.

9. Meat, Poultry and Fish

9.133 *Some data on meat consumption in the world*, J. BUDAVARI, *Husipar*, 1967, **16** (5), 232.

A survey based on FAO data on meat consumption in the world, region and country-wise consumption capita and income and meat consumption relationship.

B. S. N.

9.134 *Use of smoke solutions in the meat industry*, M. CSELKO AND IDA SZEREDY, *Husipar*, 1967, **16** (5), 197.

Use of smoke solution in place of traditional smoking of meat results in better sanitary conditions during processing, cheaper costs and greater durability of equipment.

B. S. N.

9.135 *Comminuted meat emulsions, differential thermal analysis (DTA) of fat transitions*, W. E. TOWNSEND, L. P. WITNAUER, J. A. RILOFF AND C. E. SWIFT, *Fd Technol. Champaign*, 1968, **22** (3), 319.

DTA was used for analysing fats in raw materials, with special interest in any possible relation of fat melting to emulsion stability. DTA curves revealed that there were two primary ranges of melting in the beef (18-30°C) and pork (14-18°C) fats, whether in raw materials or in raw and cooked emulsions. The instability of emulsions comminuted to more than 18.5°C coincided with the onset of melting of the high melting portions of fats.

J. V. S.

9.136 *New data on the acid phosphomonoesterase of meat*, L. KORMENDY AND G. Y. GANTNER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (3), 141.

When meat extract or press juice containing the dissolved enzyme phosphatase is heated, most of the activity is found in the precipitate (coagulated protein), and the balance in the supernatant. The non-linear relationship between enzyme concentration and initial velocity of reaction can be explained by the presence of endogenous inhibitors, mainly phosphates, in the meat. The stationary phase of the saturation curve is sometimes not reached by increasing the substrate concentration. The sensitivity to inhibitors of the enzyme reaction is reduced by raising the substrate concentration. Sodium diphosphate acts like an inhibitor, but also increases the heat tolerance of the phosphatase, which is maximal at pH 5.9. The optimum pH for enzyme activity is 5.6. Determination of residual phosphatase activity is one possible method of testing whether meat products have had sufficient heat treatment.

K. M. D.

9.137 *Composition of lipids in some beef muscles*, I. HORNSTEIN, P. F. CROWE AND R. HINER, *J. Fd Sci.*, 1967, **32** (6), 650.

Analysis of the lipids extracted from five different muscles of four Angus steers indicated that phospholipid concentration for a given muscle was relatively constant in all four animals. The concentration of total lipids varied considerably more than that of phospholipids. The diaphragm had the highest total lipid and phospholipid content and it differed from the other muscle in the palmitic and stearic acid concentration of the phospholipids.

K. A. R.

9.138 *Influence of the physical state of tissue during rigor mortis upon protein solubility and associated properties of bovine muscle*, C. F. COOK, *J. Fd Sci.*, 1967, **32** (6), 618.

Stretched muscle exhibited greater protein solubility, higher pH values and longer sarcomeres than the remaining samples. For post rigor muscle, protein solubility may be related to sarcomere length and moisture press ratio. Variations in sarcomere length may be related to post mortem changes in pH.

A. A.

9.139 *Effect of storage and cooking on qualities of loin and top round steaks*, H. M. LAW, S. P. YANG, A. M. MULLINS AND M. M. FIELDER, *J. Fd Sci.*, 1967, **26** (6), 637.

Storage up to 6 months had little effect on loin steaks with the exception of TBA values, but significant changes occurred between 6 to 9 months. Loin steaks had increased cooking losses and decreased juiciness scores, per cent moisture, and juice content. TBA values increased with each storage period. Top round steaks at the 9 month period showed a decrease in collagen content and juiciness and flavour scores, and an increase in TBA values. Storage

up to 9 months did not influence tenderness in either muscle.

A. A.

9.140 *Salmonellae associated with further processed Turkey products*, FRANK L. BRYAN, JOHN C. AYRES AND ALLEN A. KRAFT, *Appl. Microbiol.*, 1968, **16** (1), 1.

The study shows that inadequately cooked 'further processed' Turkey products, or not properly refrigerated products are responsible for transmitting human salmonellosis directly or introducing it into other food preparations.

B. S. N.

9.141 *Magnesium content of the egg shells of poultry and birds with a special view to the possibility of detecting duck's egg*, H. WETZEL, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **133** (6), 353.

Magnesium content of egg shells with and without the shell membrane was measured photometrically at 530 or 535 mμ, using titanium yellow. The egg shells of ducks had a much lower magnesium content (0-0.02 per cent) than those of the hen (0.2-0.52 per cent), the turkey (0.22-0.47 per cent), the goose (0.05-0.17 per cent), the sea-gull *Larus camis* (0.05-0.08 per cent), or the pigeon (0.17-0.22 per cent). Thus, detection of duck's eggs is certain whenever fragments of the egg shell are available. A rapid method of detection is also described.

K. M. D.

9.142 *Lipid changes in shell egg composition during storage*, J. E. MARION AND J. G. WOODROOF, *Fd Technol. Champaign*, 1968, **22** (3), 333.

Between fresh and stored (12.8°C for 28-40 days) shell eggs, there were little differences in values of total lipids, individual lipid fractions, total FFA, or fatty acid composition of lipid fractions. The fatty acid compositions of non-phospholipids, phosphatidyl ethanolamine, phosphatidyl serine, phosphatidyl choline and sphingomyelin have been characterised.

J. V. S.

9.143 *Influencing the yolk colour of hen's eggs by addition of carotenoids to the feed*, I. WILDFEUER AND L. ACKER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **133** (6), 341.

Review.

9.144 *Survival and outgrowth of Clostridium botulinum type E spores in smoked fish*, LEEN CHRISTIANSEN, JANET DEFNER, E. M. FOSTER AND H. SUGIYAMA, *Appl. Microbiol.*, 1968, **16** (1), 133.

Chub injected in the loin muscle with 10^6 *Clostridium botulinum* type E spores were smoked to an internal temperature of 180°F (82.2°C) for 30 min., sealed in plastic bags and incubated at room temperature (20-25°C) for 7 days. Viable type E spores were found in practically all such fish. Toxin formation by the survivors in the smoked fish was dependent on the brine concentration of the smoked fish. A brine concentration of 3 per cent or higher, as measured in the loin muscle, inhibited toxin formation. Six different type E strains gave similar results. Only a few hundred of the million spores in the inoculum survived the smoking. Moisture in the atmosphere during smoking did not reduce the incidence of fish with type E cultures.

A. A.

9.145 *Bacteriological survey of frozen prepared foods industry. IV. Frozen breaded fish*, BERNARD F. SURKIEWICS, RALPH J. GROOMES AND L. ROBERT SHELTON, JR, *Appl. Microbiol.*, 1968, **16** (1), 147.

During sanitation-inspections of 23 breaded fish processors, 573 finished product units and 604 line samples were collected and analyzed bacteriologically.

A. A.

9.146 *Changes in fish proteins caused by storage in saline solution and their inhibition by phosphates. Study of the reaction mechanism by tracer technique*, O. E. NIKKILA, T. KUUSI AND R. KYTOKANGAS, *J. Fd Sci.*, 1967, **52** (6), 686.

Study of the immigration of traces of pyro-phosphate showed that within 24 hr the fillets were completely marked. Studies were also made of the changes in the phosphorus fractions of the fillets during the course of standing using 1 per cent pyrophosphate and maximal standing time of 5 days. Initially there was rapid loss of phosphorus compounds from fillets.

K. A. R.

9.147 *Bacterial studies on irradiated tropical fish—Bombay-duck (Harpodon nehereus)*, S. S. MAVINKURVE, S. V. GANGA, P. L. SAWANT AND U. S. KUMTA, *J. Fd Sci.*, 1967, **32** (6), 711.

Micrococcus, Pseudomonas, Achromobactor, Flavobacterium, Microbacterium, Bacillus, Alkaligenes and *Sarcina* which comprised the initial flora were predominated by *Proteus, Bacillus, Aeromonas, Micrococci* and *Neisseria* in spoiled samples after 4 days of storage at 10-12°C. Gamma irradiated (0.4 Mrad) samples stored for 14 days at 10-12°C had 85 per cent gram positive cocci, 7.5 gram positive asporogenous rods and 7.5 per cent *Bacillus*.

K. A. R.

9.148 *Studies on discoloration of fishery products. III. Participation of ribose in rusting of fish muscle in model dehydrated systems*, MASAMICHI TOYOMIZU, TUNEMICHI YAMAZAKI AND YOSHIRO KOMORI, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 143.

Dehydrated model systems consisting of lysine, ribose, phosphate buffer (pH 6.85) and jack mackerel were allowed to react on celite used as supporting medium. Rate of discolouration of systems during storage at 30°C and their reflectance spectra were studied. The data indicated the possibility of sugars participating in the rusting reaction.

J. V. S.

9.149 *Studies on green tuna. V. Spectral properties of green pigment obtained from myoglobin*, CHIAKI KOIZUMI AND FUMIO MATSUURA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (1), 65.

The green pigment formed by heating a MMB, TMAO and tyrosine in a model system was examined for its spectral properties. On reduction with sodium hydrosulfite a weak absorption maximum appeared at 600-605 mμ. The maximum is sharpened and not shifted by treatment with sodium hydrosulfite and carbon monoxide. On adding both hydrosulfite and nicotinamide, two weak maxima appeared at 550 and 520 mμ; the maximum at 600-605 mμ disappeared.

A. A.

9.150 *Nutritional value of crayfish waste meal*, RICHARD T. LOVELL, JAMES R. LAFFEUR AND FRED H. HOSKINS, *J. agric. Fd Chem.*, 1968, **16** (2), 204.

Dried waste comprising of shell muscle and viscera from fresh water crayfish processing plants analysed using an atomic absorption spectrometer and routine analytical technique had the following average values: calcium, 1.1 per cent; phosphorus, 1.2 per cent; manganese, 157 ppm; magnesium, 2656 ppm; potassium, 1400 ppm; iodine, 1313 ppm; iron, 8.8 ppm; chitin-free protein, 32.2 per cent; ether extract, 4.9 per cent; ash, 29.0 per cent and crude fiber, 14.2 per cent. Digestibility co-efficients for chitin free-protein in crayfish waste and soy protein were, 87.54 and 86.61 per cent respectively.

A. A.

9.151 *Utilisation of sardine oil for industrial purposes*, M. N. N. KAIMAL AND P. MADHAVAN, *Res. & Ind.*, 1967, **12** (4), 250.

A commercial grade dark factice for use as a filler in rubber compounding has been developed from sardine oil on treatment with 20 per cent elemental sulphur at 180-200°C.

B. S. N.

9.152 *Studies on volatile fatty acids and volatile bases in Shiokara. II. Some changes during the process or ripening of Ika-Shiokara*, SHIN-ICHI TESHIMA, AKO KANAZAWA, AND KEN-ICHI KASHIWADA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 163.

Shiokara is a product obtained by ripening cuttle fish meat with common salt and hepato pancreas of cuttle fish. Freshly prepared product contained acetic, propionic and isobutyric acid and NH_3 and iso-butylamine. Formic acid, n-butyric acid, n-valeric acid, n-caprioc acid, trimethylamine and dimethylamine formed in the later periods of ripening. The results led to the assumption that ripening started about the 20th day after commencement of processing and completed by the 40th day.

J. V. S.

9.153 *Studies on chemical components of pearl oyster meat. I. Constituents of extracts of adductar muscles*, MASAO HUJITA, SHOU-JEN YEH AND SHIZUNORI IKEDA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 146.

Adductar muscles of *Pinctada fucata* were found to be rich in taurine, glycine, glutamic acid and alanine and other amino acids were found in traces. Betaine was found in abundance.

J. V. S.

9.154 *Studies on chemical components of Japanese pearl oyster meat. II. Amino acid composition and digestibility of adductar muscle*, MASAO HUJITA, SHOU-JEN YEH, KUZUHIKO HAYAMA AND SHIZUNORI IKEDA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 150.

The data reveal the possibility of using adductar muscle protein as fish feed.

9.155 *Studies on accumulation of heavy metals in aquatic organisms. II. On accumulation of copper and zinc in oysters. III. On accumulation of copper and zinc in the parts of oysters*, KUNIOIKUTA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 112, 117.

9.156 *Effect of low level radiation on the proteolytic activity of bacteria in oysters*, J. A. LIUZZO, M. K. FARAG AND A. F. NOVAK, *J. Fd Sci.*, 1967, **32** (6), 678.

Ten species of bacteria which survived a dose level of 0.1 Mrad gamma irradiation were identified. Only 4 species survived a level of 0.8 Mrad. Irradiation at 0.2-0.3 Mrad reduced proteolytic activity of the bacteria considerably. Marked reductions were also noted in proteolysis at the 0.8 Mrad level for the bacteria surviving the level.

K. A. R.

9.157 *Carotenoids in bivalves. I. Carotenoids in short-neck clam*, TOSHI SHIMIZU AND KIMIKO UCHIDA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 154.

Short neck clam (*Veneus japonica*) contained much of β-carotene but lacked lutein. Data on chromatographed fraction are presented.

J. V. S.

9.158 *Carotenoids in bivalves. II. Carotenoids in hard clam*, TOSHI SHIMIZU AND REIKO MONMA, *Bull. J. Soc. sci. Fish.*, 1968, **34** (2), 159.

Carotenoid components of hard clam were far simpler than in short neck-clam. Hard clam consisted of more lutein than other carotenoids but lacked β-carotene in its muscle.

J. V. S.

9.159 *Studies in meat tenderness. 4. Changes in the extractability of myofibrillar proteins during meat ageing*, C. L. DAVEY AND K. V. GILBERT, *J. Fd Sci.*, 1968, **33** (1), 2.

Approximately 52 per cent of the myofibrillar proteins of unaged meat is extracted in 40 min at 2°C whereas from aged meat as much as 78 per cent is extracted. The rate and extent of these changes are determined largely by the ultimate pH value of the meat. Similar increases in protein extraction, displaying the same pH dependence occur during the ageing of well-washed myofibrillar preparations.

A. A.

9.160 *Studies in meat tenderness. 5. The effect on tenderness of carcass cooling and freezing before the completion of rigor mortis*, *J. Fd Sci.*, 1968, **33** (1), 12.

Significant toughness develops in longissimus dorsi muscle of carcasses exposed to low temperature within about 16 hr of slaughter. This 'processing toughness' is due to muscle fiber shortening, earlier demonstrated to be responsible for massive toughening in excised muscles.

K. A. R.

9.161 *Catheptic enzymes in meat tenderisation. 1. Purification of cathepsin D and its action on actomyosin*, C. B. MARTINS AND J. R. WHITAKER, *J. Fd Sci.*, 1968, **33** (1), 59.

The cathepsin from chick leg muscle was purified by ammonium sulphate fraction and by chromatography on carboxymethyl and diethyl—aminoethyl cellulose. It denatured urea, denatured hemoglobin readily at pH 4.40, but had no activity on alpha-N-benzoyl-L-argininamide and alpha-N-acetyl-L-tyrosinamide. The cathepsin had no activity on actomyosin at pH 4.95 and 5.90.

K. A. R.

9.162 *Meat flavour. 2. Procedures for the separation of water soluble beef aroma precursors*, L. L. ZAIKA, A. E. WASSERMAN, C. A. MONK JR AND J. SALAY, *J. Fd Sci.*, 1968, **33** (1), 53.

Separation on the basis of gel filtration, adsorption and anion exchange resulted in a number of fractions responsible for development of roast beef aroma on pyrolysis.

Either sugar phosphates or free sugars are involved in aroma development. Tyrosine, phenylalanine, taurine and glutamic acid, creatine, creatinine and the purine derivatives (inosinic acid, inosine and hypoxanthine) may also be removed without affecting the aroma development. A number of amino acids in trace amounts are present in aroma producing fraction; the requirement for their presence may be questionable.

K. A. R.

9.163 *Determination of meat extracts of beef, mutton, whale meat and sperm whale meat in soup cubes*, W. BALTES, *Z. Lebensmitt. unters. u. Forsch.*, 1968, **136** (2), 69.

Meat extracts are reacted with 2, 4-dinitrofluorobenzol and the neutral and acidic amino acids are extracted. Employing preparative thin layer chromatography it was possible to separate DNP-carnosine and the DNP-derivatives of balenine and anserine from the remaining DNP-amino acids, and to estimate them photometrically. Thereby, one can identify extracts of beef, mutton, whale meat and sperm whale meat which differ in their contents of the aforesaid dipeptides.

K. M. D.

9.164 *A comparison of the light and dark portions of a striated muscle*, G. R. BEECHER, L. L. KASTENSCHMIDT, R. G. CASSENS, W. G. HOEKSTRA AND E. J. BRISKEY, *J. Fd Sci.*, 1968, **33** (1), 84.

Myoglobin level, per cent red fibers and succinic dehydrogenase activity were two fold higher in the semitendinosus dark portion of the striated pig muscle whereas ADP and inorganic phosphate levels were similar in both dark and white portions. Phosphorus levels were higher and sodium levels lower in the semitendinosus light portion than in the semitendinosus dark portion. Zinc and iron contents were greater in the dark portion.

K. A. R.

9.165 *Emulsifying capacities and emulsion stability of dilute meat slurries from various meat trimmings*, R. J. BORTON, N. B. WEBB AND L. J. BRATZLER, *Fd Technol. Champaign*, 1968, **22** (4), 506.

The emulsifying capacities of 13 commercial sausage meat trimmings were evaluated. The leaner products had higher fat emulsifying capacities per unit weight of sample. However, the fatter products indicated a more efficient emulsification by the protein, because these products had higher emulsifying capacities per unit of protein. Chopping 20 lb of beef cheeks and 20 lb of 50.55 per cent of beef trim with salt and water 18-20 hr previous to the laboratory studies greatly enhanced the emulsifying capacity per unit of protein. Some products, notably heart muscle, had higher emulsifying capacities than expected. However, emulsions made from pork hearts, and brains were very unstable, whereas the stability was satisfactory for emulsions made from trimmings derived from striated skeletal muscle.

A. A.

9.166 *Studies on the composition of food. 3. The nutritive value of beef from intensively reared animals*, J. M. HARRIS, A. W. HUBBARD, F. E. ALDER, M. KAY AND D. R. WILLIAMS, *Br. J. Nutr.*, 1968, **22** (1), 21.

Samples of beef from longissimus dorsi and superficial digital flexor portions of animals extensively or intensively reared failed to reveal any significant differences in their moisture, intra-muscular fat, protein, non-protein nitrogen, iron, thiamine or nicotinic acid values. Non-protein nitrogen and nicotinic acid values were higher in longissimus dorsi muscles; iron and riboflavin were lower than in superficial digital flexor muscles. Samples of beef from intensively reared animals were found to contain less of vitamin A and carotene than corresponding samples from extensively reared animals.

B. S. N.

9.167 *Alterations of bovine sarcoplasmic proteins as influenced by high temperature ageing*, G. B. THOMPSON, W. D. DAVIDSON, M. W. MONTGOMERY AND A. F. ANGLEMIER, *J. Fd Sci.*, 1968, **33** (1), 68.

Up to three days storage, extractibility of the water-soluble protein of the longissimus dorsi muscle appeared to be greater in meat held at the elevated temperature (30°C). Thereafter extractibility was greater in muscles held at 3°C. Higher extractable levels of oxymyoglobin were associated with high temperature treatment. Profile alterations appeared with time, but did not appear to be related to anticipated increases in tenderness.

K. A. R.

9.168 *The effects of freezing, frozen storage conditions and degree of doneness on lamb palatability characteristics*, G. C. SMITH, C. W. SPAETH, Z. L. CARPENTER, G. T. KING AND K. E. HOKE, *J. Fd Sci.*, 1968, **33** (1), 19.

Freezing resulted in highly significant increase in shear force values for loin chops and highly significant decrease in flavour, tenderness and overall satisfaction scores for leg roasts. Freezing of rib chops resulted in highly significant decrease in shear force values indicating an increase in tenderness.

K. A. R.

9.169 *5'-adenylic acid deaminase in porcine muscle*, E. D. ABERLE AND R. A. MERKEL, *J. Fd Sci.*, 1968, **33** (1), 27.

There were no significant ($P > 0.5$) differences in adenylic acid deaminase activity within or between the longissimus dorsi, gluteus medius or rectus femoris muscles even though muscle morphology varied from dark, firm and dry to pale, soft and exudative. A positive relationship between adenylic acid deaminase activity and muscle pH at 15 and 45 min post-mortem was found in all muscles studied.

A. A.

9.170 *Degradation of inosinic acid in chicken muscle during aseptic storage and its possible use as an index of quality*, A. W. KHAN, J. DAVIDEK AND C. P. LENTZ, *J. Fd Sci.*, 1968, **33** (1), 25.

Analysis of chicken breast and leg muscle stored under aseptic conditions at 0, 5 and 10°C showed that over 75 per cent loss of inosinic acid content of both breast and leg muscle occurred in 3-5 weeks at 0° in 2-3 weeks at 5° and in about 1 week at 10°C. Beyond this storage period quality deterioration was observed. During the same periods of storage the hypoxanthine content increased gradually to 200-400 μg/g of muscle.

K. A. R.

9.171 *Effects of dietary fat on the amounts and proportions of the individual lipids in turkey muscle*, T. S. NEUDOERFFER AND C. H. LEA, *Brit. J. Nutr.*, 1968, **22** (1), 115.

Partial replacement of carbohydrate in the cereal based diet by beef fat (2.5 per cent) or anchovy oil (2.5 or 5.0

per cent) had no effect on the amount of any of the lipid fractions, except for triglyceride, which varied considerably and was lowest in tissue from groups receiving 2.5 per cent anchovy oil.

A. A.

9.172 *Psychrophilic bacteria of poultry*, ELLA M. BARNES AND C. S. IMPEY, *J. appl. Bact.*, 1968, **31** (1), 97.

The organisms commonly found on poultry carcasses stored at 1°, are pigmented and non-pigmented strains of *Pseudomonas putrefaciens* and strains of Acinetobacter. The growth of these organisms in different portions of meat has been studied and results are discussed.

J. V. S.

9.173 *Chilling fish on board fishing vessels*, J. H. MERRIT, *Refrig. Air Condit. Heat.*, 1967, **21** (11), 23.
18 references.

9.174 *Heat damages of fish proteins*, L. PRAHL, *Nahrung*, 1967, **11** (7/8), 793.

Fried herrings sometimes show strongly browned and dehydrated parts, especially at the thinner tail regions. The protein digestibility of these parts is decreased by 14 per cent as compared to unharmed fish meat samples.

K. A. R.

9.175 *Psychrophilic spoilage bacteria of fish*, B. G. SHAW AND J. M. SHEWAN, *J. appl. Bact.*, 1968, **31** (1), 89.

A high proportion of *Pseudomonas* spp. spoil fish at 0.6°C particularly members of groups, II, III and IV. The proportion of active spoilers of total viable populations on fish does not alter markedly during spoilage and remains below 25 per cent. Growth of and spoilage by single *Pseudomonas* spp. is evident at—3° even after 3 weeks.

A. A.

9.176 *Post mortem degradation of adenine nucleotide in muscle of the lobster*, J. R. DINGLE, J. A. HINES, *J. Fd Sci.*, 1968, **33** (1), 100.

TLC showed that post mortem degradation of adenine nucleotides in the tail muscle of lobster (*Homarus americanus*) followed the route: adenosine 5′—triphosphate (ATP)→adenosine 5′—diphosphate (ADP)→adenosine 5′—monophosphate (AMP)→inosine 5′—monophosphate (IMP)→inosine→hypoxanthine. KCL extracts also degraded ATP by this route.

A. A.

10. Milk and Dairy Products

10.33 *Protein changes associated with extended storage of sterile unheated skim milk*, E. M. MIKOLAJEIK, *J. Fd Sci.*, 1968, **51** (3), 457.

Decrease in the concentration of globulins, blood serum albumin, β-casein, and α-casein occurred during 15 day storage period at 30°C. No changes in the proteins were observed during 15 days storage at 4°C. Storage of skim milk beyond 15 days at 30°C resulted in coagulation and serum separation.

K. A. R.

10.34 *Diacetyl production and utilization by Lactobacillus species*, T. W. KEENAN AND R. C. LINDSAY, *J. Dairy Sci.*, 1968, **51** (2), 188.

Single strain cultures of *Lactobacillus casei* and *Lactobacillus plantarum* accumulated detectable amounts of diacetyl in milk culture at 8 and 30°C, but strains of *L. lactis* and *L. brevis* did not. Significant differences in the production of diacetyl were noted between strains of species. Diacetyl reductase activity was demonstrated in single strain cultures of *L. casei*, *L. lactis* and *L. brevis*. Diacetyl reductase could be induced in *L. plantarum* by growth in the presence of citrate.

K. A. R.

10.35 *Spectrophotometric method for determination of heat activated sulfhydryl groups of skim milk*, M. KOKA, E. M. MIKOLAJEIK AND I. A. GOULD, *J. Dairy Sci.*, 1968, **51** (2), 217.

By suitable modification, adaptation was made of the 5, 5′-dithiobis, (2-nitrobenzoic acid) reagent method for the spectrophotometric determination of activated sulfhydryl (-SH) groups of heated skim milk. The modification consisted of using a nitrogen purged system, controlling pH, adding ammonium sulphate, filtering and determining absorbance of the filtrate at 412 mμ.

K. A. R.

10.36 *Enrichment and fortification of dairy products and margarine*, S. T. COULTER AND E. L. THOMAS, *J. agric. Fd Chem.*, 1968, **16** (2), 158.

Review. 26 references.

10.37 *Decolourisation of annatto in cheddar cheese whey*, F. E. MC DONOUGH, R. E. HARGROVE AND R. P. TITTSLER, *J. Dairy Sci.*, 1968, **51** (3), 471.

Good results can be obtained with 0.002 per cent (w/v) benzoyl peroxide added to whey with holding at 60-63°C for one hour. The strong intensity of the oxidized flavour resulting from this treatment disappeared during the drying procedure.

K. A. R.

10.38 *Detection of cow's milk in human milk by means of gel electrophoresis*, U. FREIMUTH AND W. KRAUSE, *Nahrung*, 1967, **11** (7/8), 729.

The detection is based on the identification of the beta casein or beta-lactoglobulin band of cow's milk. The limit of detection amounts to 1-2 per cent of cow's milk in human milk.

K. A. R.

10.39 *Studies on serological detection of cow milk added to buffalo milk*, SUDARSHAN SINGH MALIK AND P. G. NAIR, *Indian J. vet. Sci. Anim. Husb.*, 1967, **37** (4), 207.

An antiserum specifically reacting with cow's milk was found to be sodium caseinate as such or on its immunization with cow skim milk. The serum could detect cow's milk in buffalo milk in proportions as low as 1/32. The test could be valuable in detecting imported (cow's milk) milk powder from indigenous (buffalo milk) milk powder.

B. S. N.

10.40 *Research on milk proteins in India*, N. C. GANGULI, *Indian J. vet. Sci. Anim. Husb.*, 1968, **38** (1), 1.
Review. 178 references.

10.41 *Studies in stability of protein dispersions in milk. IV. Heat of flocculation of milk*, BALWANT RAI PURI AND K. K. TOTEJA, *Indian J. Dairy Sci.*, 1967, **20** (4), 186.

The thermal effect involved in addition of hydrochloric acid, ethanol, aluminium chloride, zinc sulphate and lithium thiocyanate to milk for heat flocculation is found to have significant correlation with casein constant.

B. S. N.

10.42 *Distribution of radioactivity in milk resulting from oral administration of* ^{14}C*-labelled carbaryl*, R. L. BARON, NANCY J. PALMER, R. ROSS, J. DOHERTY AND W. C. JACOBSON, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 32.

About 1 per cent of the dose of (3.05 mg/kg.) carbonyl-^{14}C-labelled carbaryl administered to lactating cows was recovered in milk; maximum concentration of 2.6 ppm carbaryl equivalents was found in 9 hours. Milk fat showed 4.1 ppm of carbaryl equivalents. Skim milk did not show any carbaryl.

J. V. S.

10.43 *Separation and analysis of component fatty acids of some commercial butters by gas-liquid chromatography*, ANITA GHOSH, AMITAVA GHOSH AND J. DUTTA, *Indian J. Technol.*, 1968, **6** (1), 19.

The fatty acid composition of four commercial samples of butter fat has been determined by gas-liquid chromatography (GLC) using columns of 10 per cent Apiezon L and 10 per cent Lac 728 (diethylene glycol succinate) supported on Diatoport W (60-80 mesh) and pure nitrogen as the carrier gas. By enabling the detection of trace components, such as odd number fatty acids and the resolution of the branched chain acids from straight chain acids, the GLC technique has been found to be superior to other methods of analysis. GLC run of unfractionated methyl esters reveals, with a high degree of accuracy, the fatty acid components of butter fat and distinguishes small differences between samples.

A. A.

10.44 *Role of micro-organisms in the degradation of constituents in Khoa*, M. M. AHMAD AND B. RANGANATHAN, *Indian J. Dairy Sci.*, 1967, **20** (4), 157.

Market samples of *khoa* incubated at 37°C with *B.subtilis* and *Micrococcus* cultures showed visible signs of deterioration in organoleptic quality and breakdown of lactose, fat and protein. *B. subtilis* accounted for proteolytic activity whereas *Micrococcus* species were found to have very little activity in this direction.

B. S. N.

11. Coffee, Tea and Cocoa

11.10 *Humic acid type of substances in roasted coffee extracts. I. Detection, quantitative estimation and isolation of humic acids of coffee*, R. KLOCKING, R. HOFMANN AND D. MUCKE, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135**, (1), 1.

Brown colouring substances in aqueous extracts of roasted coffee seeds were identified as humic acids by various tests. Oxidimetric estimation after gel-filtration on Sephadex G-25 showed that 15 per cent of the water soluble extract consists of humic acids. Only traces of humic acids were detected in raw coffee seeds. The tests for humic acids in coffee substitutes were negative.

K. M. D.

11.11 *Humic acid type of substances in roasted coffee extracts. II. Amino acid content of humic acids of coffee*, H. AURICH, R. HOFMANN, R. KLOCKING AND D. MUCKE, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135**, (2), 59.

Organic bound nitrogen content of humic acid isolated from a commercial coffee extract powder was 3.5-4.2 per cent of which 1/3 to 1/4 was in the form of hydrolysable amino acids. 14 ninhydrin positive bands were found. Out of 18 proteinogenic amino acids that were detected, 17 were estimated quantitatively with the aminomat. Predominant were glutamic acid (213-242μmol/g), glycine (92-103μmol/g), aspartic acid (61-64μmol/g) proline (52-56μmol/g), and leucine (54-57μmol/g).

Because of the predominance of glutamic acid in the humic acid hydrolysate, it is assumed that incorporation of amino acids into the humic acid molecule is not selective. Glutamic acid is also the predominant amino acid in raw coffee hydrolysates, forming about 20 per cent of the total amino acids.

K. M. D.

11.12 *Influence of cocoa on the sweet curdling of cocoa-milk drinks*, F. KIERMEIER AND M. SCHMID, *Z. Lebensmitt. unter. u. Forsch.*, 1967, **134** (5), 281.

The sweet curdling of cocoa-milk beverages is attributed to residues of proteolytic and milk-coagulating enzymes in cocoa powder.

11.13 *Precursors of chocolate aroma: Studies in the degradation of amino acids during the roasting of Accra cocoa beans*, T. A. ROHAN AND T. STEWART, *J. Fd Sci.*, 1967, **32** (6), 625.

Study of amino acid sugar model systems showed that there is a relationship between the temperature of reaction, the extent of amino acid degradation and the production of flavour volatiles during the roasting of cocoa beans.

K. A. R.

11.14 *Thin-layer chromatographic study on the lipid components of cocoa beans and cocoa butter*, YEHUDA LEVANON, STELA M. O. ROSSETINI, MATHILDE RASKIN AND MATILDE T. P. MESQUITA, *J. Fd Sci.*, 1967, **32** (6), 609.

After the fermentation, cocoa bean cotyledon section presented only one chromatographic spot whereas cocoa butter showed five spots. Apparently, the lipids naturally occurring in cocoa beans are not modified during farm fermentation.

A. A.

12. Food Additives

12.26 *Some aspects of the toxicology of food additives*, A. J. RYAN, *Fd Technol. Aust.*, 1967, **19** (15), 736.

12.27 *Sodium stearyl fumarate: effects in cake formulation*, P. F. SCHAMBERGER JR. AND C. P. HETZEL, *Cereal Sci. Today*, 1968, **13** (1), 31.

It was found that in batter systems, such as layer cakes, NaSF stabilises formulations to ingredient variations such as higher levels of sugar and lower levels of emulsified shortening. Cakes made with extreme formula variations but containing NaSF showed substantially improved physical characteristics compared to cakes without this compound

A. A.

12.28 *Sodium stearyl fumarate* (NaSF): *further studies on bread*, B. A. BRACHFELD AND C. P. HETZEL, *Cereal Sci. Today*, 1968, **13**, (1), 13.

Addition of NaSF strengthened the flours by increasing the stability times and decreasing MTI values, as shown in farinograph studies. The specific benefits of the use of NaSF in bread included more desirable crumb characteristics and good loaf volume. NaSF retarded the rate of crumb firming, thereby increasing shelf-life by 1-2 days.

NaSF also permitted a 2 per cent increase in the absorption of the dough while maintaining optimum loaf volume and desirable crumb structure.

A. A.

12.29 *Contribution to the analysis of chemical preservatives for foodstuffs currently permitted in Germany*, O. R. RECHE, *Z. Lebensmittel. unters. u. Forsch.*, 1967, **133** (6), 375.

Experiments on the analysis of currently permitted chemical preservatives and of hexamethylenetetramine are reported. A working procedure for the qualitative detection and quantitative measurement of these substances is proposed.

K. M. D.

12.30 *Isolation of water-soluble food colours*, A. PERDIH AND D. PRIHAVEC, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (4), 239.

After appropriate preparation, protein containing samples are treated with formalin, extracted with chloroform, brought to pH 9, extracted again, treated with quarternary ammonium salt, and the acid dyestuffs extracted with chloroform. The extract is washed with water and purified on alumina with chloroform and methanol. The colours are eluted with dilute ammonia, concentrated in chloroform and chromatographed. Adsorbent must be impregnated on ethanolic solution of alkyl or alkylarylsulphonate at the start. Mixtures of organic solvents with water are suitable as eluents. Addition of formalin and purification on alumina are unnecessary for isolation from foods free from protein. A special method is described for isolation of colours from pudding powder and similar products.

K. M. D.

12.31 *Enzymatic reduction of tartrazine by Proteus vulgaris from rats*, J. J. ROXON, A. J. RYAN AND S. E. WRIGHT, *Fd Cosmet. Toxicol.*, 1967, **5** (5), 645.

The ability of cell-free preparations of *Proteus vulgaris* to reduce the colouring depends on age and nutritional status; old and starved cells are found most efficient. Tartrazine is reduced by a soluble FMN—flavoprotein from crude enzyme.

B. S. N.

12.32 *Short-term toxicity studies of emulsifiers YN in rats*, I. F. GAUNT, P. GRASSO AND S. D. GANGOLLI, *Fd Cosmet. Toxicol.*, 1967, **5** (5), 623.

YN [mixture of ammonium salts of phosphatic acids (about 55 per cent) and of triglycerides from rape seed oil] is used as an emulsifier and viscosity agent in chocolate manufacture. The study reveals that a minimum no-effect level of 6 per cent YN in rat diets for 90 days (at 3 g/kg./day) is observed. Hence the quantities likely to be consumed by human beings may not be toxic since a wide margin of safety is provided.

B. S. N.

12.33 *Metabolic rate of ^{32}P-labelled emulsifier YN in rats*, G. FENER, *Fd Cosmet. Toxicol.*, 1967, **5** (5), 631.

YN as a food additive is found to be non-toxic to rats, as the non-triglyceride components entering body are disposed off along physiological pathways.

B. S. N.

12.34 *Physical factors determining early local tissue reactions produced by food colourings and other compounds injected subcutaneously*, S. D. GANGOLLI, P. GRASSO AND L. GOLBERG, *Fd Cosmet. Toxicol.*, 1967, **5** (5), 601.

Except erythrosine BS, other food colours were absorbed rapidly and uniformly in rats when subcutaneously injected. The physico-chemical characteristics of the compounds determine the nature of local tissue reactions like erythrocyte haemolysis initially and formation of sarcomas later. Surface activities, lipid solubility and protein binding ability of the compounds play a vital role in initiating the onset of toxic symptoms in rats.

B. S. N.

12.35 *Excretion of cyclamate in the rat*, ROBERT C. SONDERS, R. G. WIEGAND AND J. C. NETWAL, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 136.

The recovery of cyclamate fed to rats in their excreta was found to be complete by GC as well as by isotopic recovery of trace dose of ^{14}C-cyclamate.

J. V. S.

12.36 *Alginates-versatile modifying agents*, J. G. KRIGSMAN, *Fd Mf*, 1968, March 15.
Review. Eight references.

12.37 *Up-to-date International food additive legislation*, C. R. A. MARTIN, *Fd Mf*, 1968, March 19.
Review. Four references.

12.38 *The influence of certain metal ions on the visible spectra of food dyes*, A. V. JONES AND J. D. R. THOMAS, *J. Fd Technol.*, 1968, **3** (1), 1.

Addition of calcium, magnesium, aluminium, iron (II), iron (III), copper (II) and cobalt ions at pH 3.0, 6.4, 7.4 and 12.5 to twenty-two food dyes did not in general show any appreciable effect on the spectrum of the dye. The shift in the characteristic frequencies of the free dye absorption maxima was greatest in carmosine in the presence of copper (II) at pH 6.4 and 7.4, and of black PN in the presence of iron (II) at pH 12.5.

K. A. R.

12.39 *Chromatography of food dyes on sephadex*, J. R. PARRISH, *J. Chromatog.*, 1968, **33** (3/4), 542.

Sephadex G-25 (superfine grade) with simple aqueous eluants with an electrolyte and if need be, an ammonium acetate buffer, aids excellent separation of food dye colours by GC and CC.

B. S. N.

12.40 *Moving boundary electrophoresis of food stabilizers*, J. HIDALGO AND P. M. T. HANSEN, *J. Fd Sci.*, 1968, **33** (1), 7.

A high degree of homogeneity was observed for CMC, arabic gum, alginate and λ-carrageenan. In contrast, k-carrageenan contained migrating components, whereas colloidal fractions of guar gum, locust bean gum and corn syrup solids did not migrate in the electrical field. Mixture of CMC with guar gum or gum arabic could be separated at pH 7 and that of CMC with carrageenan could be separated at pH 2.

A. A.

12.41 *Determination of DL TDP and other antioxidants by a modified sublimation technique*, THOMAS FAZIO, JOHN W. HOWARD AND ARMANDO SANDOVAL, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 17.

A method has been developed for the determination of dilaurylthiodipropionate (DLTDP) and other antioxidants by using a simplified and less complex vacuum procedure

than previously reported. Recoveries were: DLTDP, 93-100; BHT, 91-96; Ionox-100, 85-105; PG, 90-100; and BHA, 91 per cent.

13. Food Analysis

13.35 *Determination of alkyl dinitrophenyl carbonates and other ester with particular reference to dinobuton in fruit and vegetables*, H. CROSSLEY AND V. P. LYNCH, *J. Sci. Fd Agric.*, 1968, **19** (2), 57.

The method is based on the extraction of the crop with hexane followed by a clean-up involving acid potassium permanganate solution, and chromatography on neutral alumina. Dinobuton is converted on the alumina column to an aluminium salt of dinoseb, which is eluted with aqueous acetone containing butylamine, and determined spectrophotometrically at 378 mμ. The method is applicable to other dinitrophenyl esters.

A. A.

13.36 *Determination of 4, 6-dinitro-O-sec-butylphenol residues in fruits and almonds by electron-capture gas chromatography*, R. WHITE AND W. W. KILGOPE *J. Fd Sci.*, 1967, **32** (6), 69.

The alkanolamine salts of DNUSBP are converted to DNOSBP with acid prior to extraction with benzene. The extracted DNOSBP is then cleaned-up by column chromatography, methylated with diazomethane, and analysed as the methyl ether. The overall average recovery of DNOSBP residues on almonds, cherries, peaches, and apricot (fortified with 0.01-05 ppm DNUSBP) was 90 per cent.

A. A.

13.37 *Paper chromatographic estimation of flavonoids in fruits*, K. S. SZOTYORI AND E. W. JURICS, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (4), 192.

The most frequently occurring flavonoids were determined in fruits of 17 species. Fruits dried with sodium sulphate were extracted with methanol. The flavonoids were concentrated by repeated chromatography with two different solvent mixtures and developed with uranyl acetate. The quantitative estimation was done with a densitometer.

Rutin, quercetin, and kempferol could be determined with an error of $\pm$ 10 per cent. The possibility of a greater error must be reckoned with in the estimation of quercitrin.

K. M. D.

13.38 *Paper chromatographic estimation of catechin and epicatechin in fruits*, E. W. JURICS, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (5), 269.

The new method enables estimation of as little as 0.5μ g of the two substances. The average of individual measurement is $\pm$ 4 to $\pm$ 8 per cent. The epicatechin and catechin content was estimated in 17 different fruits.

K. M. D.

13.39 *Sulphur containing compounds in meat. IV. Determination of sulphydryl groups in myofibrils with sodium parachloromercurousbenzoate* (PCMB), R. HAMM AND K. HOFMANN, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **136** (1), 7.

The reagent, when allowed to act on myofibrils in a phosphate buffer at pH 7, attacks only the so-called easily accessible SH groups. The extent of the reaction was investigated as a function of reagent concentration and reagent time.

K. M. D.

13.40 *Hydrogen cyanide in the seeds of Prunoidae and some other foods. I. Estimation of glucoside bound hydrocyanic acid in bitter almonds*, E. HANSSEN AND W. STURM, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (2), 69.

At room temperature and pH 5.5-6.5, the β-glucosidase present in bitter almonds hydrolyses amygdaline into glucose and benzaldehydecyanhydrin within 3 hours. At pH 3.5-5.5, the reaction is only partially complete after 3 hours, but it can be considerably accelerated by heating. β-glucosidase is destroyed at temperatures above 75°C. Since the optimal pH range for splitting amygdalin in the first step is the same as for the liberation of HCN by distillation in the second step, it was possible to develop a short working procedure for the estimation of HCN in other amygdaline containing seeds.

K. M. D.

13.41 *Problems of measurement theory in relation to foodstuffs*, H. STREULI, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (2), 68.

Qualities of foodstuffs can be measured by three types of scales; metric, topological (ranking), and binary (yes/no). They differ fundamentally in the calculations that can be made with the numerical values obtained from them. For example, it is questionable whether sums, averages and deviations can be computed with the numerical values of the topological and binary scales. The new concept of the binary scale (1/0, yes/no) appears to be suitable for measuring the marketability of foodstuffs.

Sometimes, the last two kinds of scales are preferable to the stronger metric scale. A new definition of the concept of measurement is proposed.

K. M. D.

13.42 *Comparison of toluene distillation and Karl Fischer methods for determining moisture in dry whole milk*, EDWARD S. DELLA MONICA AND T. F. HOLDEN, *J. Dairy Sci.*, 1968, **51** (1), 40.

From 0 to 7 per cent moisture, the toluene method is more precise having confidence limits of $\pm$0.130 to 0.199. The confidence limits for Karl Fischer titration ranged from $\pm$0.130 to 0.292. The results also indicate the existence of operator differences with both the methods.

K. A. R.

13.43 *A new method for the detection of xanthine dehydrase activity in milk*, F. KIERMEIER AND H. GRAF ZU SOLMSBARUTH, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **133** (6), 365.

An electrochemical method, with automatic recording, for the determination of xanthine dehydrase activity is described; it can be applied for pure enzyme solutions as well as for more complex media e.g. milk. The method is based on the variation of the redox potential, resulting from changes in the concentrations of the reagents, as a function of time.

K. M. D.

13.44 *Determination of small quantities of H_2O_2 in sterile milk*, E. LECHNER AND F. KIERMEIER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **133** (6), 372.

A method for the estimation of H_2O_2 in milk, coffee cream and cocoa beverage (4.5-300 mg H_2O_2/l) is described.

It is based on the photometric measurement of benzidine blue formed from benzidine by H_2O_2 in the presence of lactoperoxidase. Commercial flash pasteurized samples were tested for the presence of H_2O_2.

K. M. D.

13.45 *A new direct colorimetric method for determining aldehydes in alcoholic beverages*, JOSEPH L. OWADES AND JOSEPH M. DONO, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 148.

Free acetaldehyde and acetaldehyde bound to bisulfite and to alcohol (acetal) can be determined on separate aliquots. 3-methyl-2-benzothiazolinone hydrazone hydrochloride reacts with aldehydes to form a highly coloured compound which is measured spectrometrically. The average recovery of acetaldehyde added to wines and distilled liquors was 98 per cent; levels of about 30-175 ppm were detected.

A. A.

13.46 *Colorimetric determination of volatile reducing substances*, L. FARBER AND P. LERKE, *J. Fd Sci.* 1967, **32** (6), 616.

The iodometric method for determining the amount of reaction of an alkaline potassium permanganate solution which is used as a measure of the content of volatile reducing substances (VRS) has been substituted by a colorimetric method. The net absorbance at 610 $m\mu$ is determined for the difference in absorbance between the unreacted and reacted 0.02N $KMNO_4$ in N NaOH solution. The microequivalent of reduction corresponding to the net absorbance value is read off a graph showing the linear relationship between the net absorbance and the amount of VRS.

A. A.

13.47 *Chromatographic methods developed at NPL—a review*, M. R. VERMA, P. K. GUPTA AND J. RAI, *Res. & Ind.*, 1967, **12** (4) 233.

Methods developed for separation and identification of various dyes, both natural and synthetic for colouring food products and writing inks, isomeric phenols and inorganic ions are presented.

B. S. N.

13.48 *Detection and estimation of diphenyl, O-hydroxydiphenyl, and diphenylamine by thin layer chromatography, gas chromatography and spectrofluorimetry*, W. PIDRR AND L. TOTH, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (5), 260.

The three compounds can be detected and semi-quantitatively estimated in one working procedure by using a combination of the spraying agents 2, 4, 7-trinitro-9-fluorenone, 2, 6-dibromoquinonechlorimide, and nitric acid-perhydrol on the thin layer plate. Characteristic colour changes facilitate their specific identification. The values obtained by this method were confirmed by gas chromatography.

K. M. D.

13.49 *Enzymatic estimation of D-gluconic acid in foods*, H. MOELLERING AND H. U. BERGMEYER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (4), 198.

Estimation of gluconate and glucunolactone by means of a gluconate-kinase is described, the indicator enzyme being 6-phosphogluconate-dehydrogenase. This specific method is well suited for quantitative measurement of gluconic acid in foods, animal organs, and in all industrial gluconic acid products. 6-phosphogluconic acid can be estimated simultaneously by this procedure. Optimal test conditions have been determined and the gluconate content measured in various materials.

K. M. D.

13.50 *Spectrophotometric estimation of tocopherol in oils after separation by thin layer chromatography*, J. BLATTNA, J. MANOUSKOVA AND J. DAVIDEK, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (4), 242.

A method using freshly prepared alumina plates has been worked out for the isolation of tocopherols from interfering substances and separation of individual tocopherols (α, $\beta + \gamma$, δ). A method of purification and standardization of indigenous (German) aluminium oxide is described. The tocopherol contents of some fats and oils (maize germ, soyabean, groundnut, sunflower, butter, and pig lard) have been determined.

K. M. D.

13.51 *Tocopherol determination in vegetable oils by means of thin layer chromatography*, M. JACKY, *Nahrung*, 1967, **11** (7/8), 679.

The application of new technique permitted the detection and determination of native tocopherols; also if present in the form of esters. Even after concentration, no tocopherol esters could be detected in raw soybean and sunflower oils.

K. A. R.

13.52 *Gas chromatographic mass spectrometric analysis of isoprenoid hydrocarbons and fatty acids in shark liver oil products*, E. GELPI AND J. ORO, *J. Am. Oil Chem. Soc.*, 1968, **45** (3), 144.

The major components of the non-saponifiable fraction are the pristane and squalene constituting 7.6 and 31.3 per cent of oil. The saponifiable fraction contained normal fatty acids from C_{14} to C_{22}. The commercial pristane contained about 1 per cent phytane and small amounts of octadecane, nonadecane and methyl and ethyl palmitates. Mass spectral data are given for squalene.

J. V. S.

13.53 *Determination of saturated and unsaturated fatty acids: comparison of gas liquid chromatographic, thiocyanogen number and lead salt ether methods*, DENIS E. LA CROIX, A. R. PROSSER AND A. J. SHEPPARD, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 20.

The percentages of total saturated and unsaturated fatty acids obtained by GLC and lead salt ether methods showed poor agreement. The thiocyanogen values for unsaturated fatty acids were higher than GLC values in all but one sample. The poly-unsaturated fatty acid percentages obtained by the thiocyanogen number method were not similar to the GLC values for about half of the fats and oils.

A. A.

13.54 *A chromatographic method for the analysis of propylene glycol fatty acid esters in shortenings containing mono and diglycerides*, MADHU R. SAHASRABUDHE AND J. J. LEGARI, *J. Am. Oil Chem. Soc.*, 1968, **45** (3), 148.

Lipid classes are separated on a silicic acid column, and individual esters are estimated by GC. Recoveries for

individual components, range from 92 to 105 per cent, and total recoveries range from 96 per cent to 100 per cent.

J. V. S.

13.55 *A rapid micro method for the separation, identification, and estimation of the purine bases: caffeine, theobromine and theophyll*, U. M. SENANAYAKE AND R. O. WIJESEKERA, *J. Chromatog.*, 1968, **32** (1), 75.

The method is based on TLC, does not require expensive apparatus and mixtures of the three compounds tested can be assayed. Results are comparable to titrimetric and gravimetric methods.

J. V. S.

13.56 *Preparation of gliadin by urea extraction*, J. W. LEE, *J. Sci. Fd Agric.*, 1968, **19** (3), 153.

Gliadin, extracted by 2 M urea is subjected to gel filtration with Bio Gel P-150 polyacrylamide beads and electrophoresis in starch gel of varying porosity which showed that the molecular weight distribution is relatively narrow. It is suggested that, under some conditions, an unidentified compound of low molecular weight is responsible for the intermolecular cross linkings of gliadin molecules to give high-molecular-weight glutenin.

K. A. R.

13.57 *Quantitative method for anthocyanins. 1. Extraction and determination of total anthocyanin in cranberries*, TIBOR FULEKI AND F. J. FRANCIS, *J. Fd Sci.*, 1968, **33** (1), 72.

The method consists of extracting the anthocyanins with ethanol-1.5 N hydrochloric acid (85:15) and measuring the optical density of the extract at 535 μm. The total anthocyanin content was calculated in absolute quantities with the aid of the extinction co-efficients established for the four major cranberry anthocyanins dissolved in the alcoholic solvent systems.

A. A.

13.58 *Quantitative methods for anthocyanins. 2. Determinations of total anthocyanin and degradation index for cranberry juice*, TIBOR FULEKI AND F. J. FRANCIS, *J. Fd Sci.*, 1968, **33** (1), 78.

The method involves the measurement of the absorbance at 510 μm. on samples diluted with pH 1.0 and 4.5 buffers and calculating the pigment content in absolute quantities. An index on anthocyanin degradation, based on a new concept, could be calculated from the measurements obtained for the total anthocyanin determinations.

K. A. R.

13.59 *Contribution to the detection and semi-quantitative determination of diphenyl and 2-hydroxydiphenyl of citrus fruits*, H. HOPPE AND K. ROMMINGER, *Nahrung*, 1967, **11** (7/8), 797.

In model analyses, the semiquantitative determination by means of visual spot comparison on the chromatogram yielded recoveries with an accuracy within +21 to —14 per cent. The procedure is useful for routine analysis of market samples.

K. A. R.

14. Food Microbiology and Fermentation

14.64 *Activation of spores of Bacillus cereus by γ-radiation*, C. W. GOURD AND Z. J. ORDAL, *J. gen. Microbiol.*, 1968, **50** (1), 77.

Spores of *B. cereus* subjected to 0.02, 0.06, 0.18, 0.54 and 1.08 Mrad of γ-radiation became progressively more activated i.e., they germinated more rapidly in the presence of germinants (L-alanine, inosine n-dodecylamine, calcium dipicolinate) than did irradiated ones. The response to irradiation are compared to those obtained by heat.

J. V. S.

14.65 *Behaviour of indigenous varieties of mushrooms towards the fission product caesium-137*, H. GRUTTER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (3), 173.

Fallout from atomic weapons' tests results in an usually high concentration of 137 Cs and a slight increase in concentration in mushrooms. 137 Cs is absorbed preferentially over potassium which constitutes the greatest part of the mineral components in mushrooms.

Uptake of 137 Cs is greatest from pine needle soils, distinctly less from deciduous forest soils and nil from meadows.

In cooking trials with *Paxillus involutus*, 64 per cent of the 137 Cs activity was found in the cooking water. As only small quantities of mushrooms are consumed by human beings, there is no reason to fear any noteworthy increase in the radiation dose they receive.

K. M. D.

14.66 *Fungal protein for food and feeds. VII. Calorie values of fungus mycelium*, WILLIAM D. GRAY AND IAN A. STAFF, *Econ. Bot.*, 1967, **21** (4), 341.

Fungi (about 100) were cultured in medium containing glucose as the sole source of carbohydrate. The calorie values ranged from 3.658 Kcal/g of mycelium for Acremoniella sp. (1-119) to 5.662 Kcal/g for Geomyces sp. (1-155). The perational hermal efficiencies ranged from 0.09 for No. 291 (an unidentified isolate) to 0.78 for *Rhizoctinia* sp.

K. A. R.

14.67 *Effect of ionizing radiations on resting conidia of Aspergillus flavus*, M. KOPELMAN, P. MARKAKIS AND B. S. SCHWEIGR, *J. Fd Sci.*, 1967, **32** (6), 649.

Conidia were exposed to cobalt-60 gamma radiation and to 1 Mev electrons generated in a resonance transformer accelerator. Irradiation of spores in water indicated a linear relationship between radiation dose and logarithmic survival of the spores with D value equal to 38 krad for both the gamma rays and the electrons. Resistance of spores was higher and dose survival curve was not linear in the absence of water.

K. A. R.

14.68 *Purification of hydrolytic activity of Pestalotiopsis westerdijkii enzyme*, A. CHANDRASEKARAN, *J. Fd Sci. Technol.*, 1967, **4** (4), 159.

The hydrolytic enzyme from the culture solution of *Pestalotiopsis westerdijkii* was precipitated by ammonium sulphate saturation (80 per cent) and purified by passing through Sephadex G-25. This step resulted in 10 per cent loss in activity. Partially purified enzyme exhibited hydrolytic activity on a wide range of carbohydrates including oligo—and polysaccharides and raw vegetables.

A. A.

14.69 *Investigations on the use of proteolytic enzymes for decomposing proteins in wine*, K. WUCHERPFENNING AND I. FRANKE, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (2), 87.

An attempt was made to stabilize the protein in wines by using proteolytic enzymes, instead of bentonite which is commonly used for the purpose. Experiments showed that the proteins in wine are not decomposed by enzymes at temperatures below 30°C, only a few enzymes have any effect at 40°C.

Detailed examination of the results indicate that the proteins in wine are not decomposed by proteolytic enzymes which decompose the proteins in beer, because they are much smaller than beer proteins.

Three different methods of estimating protein in wines were compared. The bentonite test and heat test were found to be inexact. The gel-filtration test gave the most exact results, and could be performed easily and quickly with the appropriate apparatus.

K. M. D.

14.70 *Continuous fermentation of brewer's wort*, A. D. PORTNO, *J. Inst. Brew.*, 1968, **74** (1), 55.

The results suggest that satisfactory systems must allow partial escape of yeast and also maintain some heterogeneity. These requirements can be met by a system which either maintains a concentration gradient in an elongated vessel or comprises a series of homogeneous vessels with a feed—back of cells so that in each instance, yeast in the system is regularly exposed to a high concentration of nutrients.

A. A.

14.71 *Wort composition—a review*, I. C. MACWILLIAM, *J. Inst. Brew.*, 1968, **74** (1), 39.
122 references; 25 tables.

14.72 *Determination of alcohol content of beverages by phase titration*, D. B. WALTERS, I. D. CHAWLA AND D. W. ROGERS, *J. agric. Fd Chem.*, 1968, **16** (2), 259.

Alcohol content of non-carbonated beverages is determined by adding required amount of benzyl alcohol when the appearance of turbidity due to separation of second phase as a function of ethanol content occurs. Volume per cent of alcohol is estimated by comparing the titer with a calibration curve of titer as a function of volume per cent of absolute alcohol in binary solutions with water. Phase titration is simpler and quicker than psychometric method and also allows for estimation of beverages with flavours and colouring agents; this technique may be applied to many analogous problems.

B. S. N.

14.73 *On the aging of wine distillates*, B. R. F. R. LINDEMANN, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **136** (1), 10.

Fundamentals of the evaluation of wine distillates and more exact knowledge of traditional aging are outlined. Artificial ripening is contrasted with accelerated aging. The new findings on catalysed aging are specially discussed and a new method of aging is described.

K. M. D.

14.74 *Tannins in red wine. I. Thin layer chromatography and preparative isolations of tannin components*, W. DIEMAIR AND A. POLSTER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (2), 80.

Wine freed from alcohol and then extracted by shaking with acetic ester yields a mixture of many, mostly monomeric, individual components.

Separation methods on thin layers of silica gel were developed for the detection of these compounds and for testing the purity of the highly condensed main fraction of tannin. The eluents ethyl acetate-chloroform-formic acid (5:4:1) and ethylmethylketone-ethylacetate-formic acid (7:2:1) proved to be specially useful.

Of all the substances in red wine which are absorbed on polyamide, the dyestuffs can be eluted with ethanol, the tannin precursors with methanol, and the tannins with 0.2 per cent sodium hydroxide. The alkali solution is neutralised with the help of a cation exchanger and the tannin is dried at 35°C under vacuum.

K. M. D.

14.75 *Tannins in red wine. II. Properties and isolation*, W. DIEMAIR AND A. POLSTER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (6), 345.

Tannin mixtures obtained from red wine can be separated further on Sephadex G 25, G 50 and G 75 using 0.2 per cent NaOH as eluent. If oxygen is excluded, one obtains a brown main fraction and a blue secondary fraction, as also various yellowish-green to reddish coloured zones. Gel chromatography in alkaline medium is superior to that with acidified dilute alcohol.

All the fractions are strong reducing agents, precipitate gelatine from its solution, and are adsorbed by powdered skin. No fraction reacts with vanillin hydrochloride. The molecular weight of the brown fraction lies between 5,000 and 10,000 that of the blue fraction between 1,000 and 5,000.

K. M. D.

14.76 *Phenolic constituents of beer and brewing materials. III. Simple anthocyanogens from beer*, J. W. GRAMSHAW, *J. Inst. Brew.*, 1968, **74** (1), 20.

By use of chromatography on dextran gel, (+)-catechin and 6 simple anthocyanogens have been isolated from polyamide-beer adsorbates. Three of the anthocyanogens were obtained in homogenous condition while two others appear to be mixtures of at least 2 compounds; the sixth, which is derived by dehydration between 2 others, was obtained contaminated by minute traces of these. Probable chemical structures for these have been indicated.

A. A.

14.77 *The adsorption of hop substances on the yeast cell wall*, I. J. DIXON AND A. A. LEACH, *J. Inst. Brew.*, 1968, **74** (1), 63.

The adsorption of hop substances on to the yeast cell wall, as distinct from the total loss during fermentation, followed the classical pattern of Freundich adsorption isotherm with both top and bottom fermentation yeasts. In order to avoid adventitious contamination of the yeasts by hop compounds during head formation, the fermentations were not fully attenuated. The three yeasts adsorbed very closely similar proportions of hop substances from fermenting worts after same composition, but the actual amount differed from one series of fermentations to another. The losses of bitter compounds during the fermentation were only partly accounted for by adsorption on yeast.

A. A.

14.78 *Hop extraction*, J. E. ANDERSEN AND R. P. HILDEBRAND, *Fd Technol. Aust.*, 1967, **20** (2), 64.

14.79 *A simple technique for increasing yield of straw mushroom Volvariella diplasia (Berk and Br.) Sacc.*, K. RAMAKRISHNAN, D. LALITHA KUMARI, N. SHANMUGAM AND C. S. KRISHNAMURTHY, *Madras agric. J.*, 1968, **55** (4), 194.

Covering the beds with transparent polyethylene (300 gauge) increased the yield of mushroom by 528.7 per cent in the weight of mushroom mainly through regulating the temperature (35.6°C to 37°C) and moisture in the bed. In addition, light also plays an important role.

K. A. R.

14.80 *Action of micro-organisms on the peroxides and carbonyls of rancid fat*, JAMES L. SMITH AND JOHN A. ALFORD, *J. Fd Sci.*, 1968, **33** (1), 93.

All the 26 species of bacteria, molds and yeasts studied could decompose hydroperoxides. The activity of the microorganisms on the monocarbonyl content of the rancid fat was quite varied. Depending on their activity, the microorganisms could be divided into: (1) microorganisms which produced large increases in at least two monocarbonyl classes, (2) microorganisms which removed 2, 4—dienals, (3) microorganisms which removed 2, 4—dienals and 2—enals, and (4) microorganisms which caused decreases in at least two classes of monocarbonyls (without destroying any class completely).

K. A. R.

14.81 *Specific fungi as the causative agents of the sporadic disintegration of sulphited beverages*, J. C. DAKIN AND J. TAMPION, *J. Fd Technol.*, 1968, **3** (1), 39.

Of the ten species used, only *Rhizopus stolonifer*, *R. sexualis* and *Mucor* sp. induced breakdown of the fruit to a puree-like consistency during storage. *Botrytis cinera* and *Sphaerotheca humuli* were responsible for the breakdown of sulphite preserved strawberries. For preventing this defect, the infected fruits should be excluded.

K. A. R.

14.82 *Moniliella acetoabutans: some further characteristics and industrial significance*, J. C. DAKIN AND A. C. STOLK, *J. Fd Technol.*, 1968, **3** (1), 49.

The levels of sulphur dioxide, methyl and *para*- hydroxy benzoate and sorbic acid for inhibiting the growth of *Moniliella acetoabutans* were 100, 300 and 400 ppm respectively at pH 3.3 and in the presence of 1.0 per cent acetic acid. Methyl *para*-benzoate at 1000 ppm did not inhibit the growth.

K. A. R.

14.83 *Structure of B. stearothermophilus: an electron microscopic study*, P. D. WALKER AND ANN BAILLIE, *J. appl. Bact.*, 1968, **31** (1), 108.

The fine structure of *B. stearothermophilus* and related organisms is described using the technique of ultrathin sectioning.

A. A.

14.84 *Occurrence and significance of thermophiles in canned foods*, T. G. GILLESPY AND R. H. THORPE, *J. appl. Bact.*, 1968, **31** (1), 59.
Review. 10 references.

14.85 *Thermophiles in sugar*, M. PAMELA SCARR, *J. appl. Bact.*, 1968, **31** (1), 66.
Review. 21 references.

14.86 *Two improved media for isolating enterococci in certain frozen foods*, R. V. F. LACHICA AND P. A. HARTMAN, *J. appl. Bact.*, 1968, **31** (1), 151.

Two new modified media, i.e., Tween-carbonate agar and thallous acetate-citrate agar were most suitable for isolating enterococci both qualitatively and quantitatively.

J. V. S.

14.87 *False positive coagulase reactions in the characterisation of microorganisms isolated from foods*, CLAUDIA J. LITKENHOUS, EDWARD F. BAER, MILDRED M. GILDON AND MARCIA B. BROMER, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 1.

During the examination of 50 cheese and 50 frozen breaded shrimp samples, 3578 colonies were subjected to coagulase positive test, using citrated plasma. Sixty-six cultures were suspected as false coagulase positive. Results indicate that EDTA or heparin may be satisfactorily used with citrated plasma to avoid false positive reactions. When citrated plasma is used, the culture that clot plasma slowly should be viewed with suspicion.

J. V. S.

14.88 *On the microflora in the process of soy-sauce manufacturing*, HIROSHI ITO, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 22.

The microflora in *koji* made by several *koji* fermentors and soy-mash from the *koji* were investigated.

J. V. S.

14.89 *Microflora in soy sauce-mash made from roll-pressed wheat*, HIROSHI ITO AND HIDEO EBINE, *Rep. Fd Res. Inst., Japan*, 1963, No. 23, 25.

14.90 *Bacteriological quality of soft-serve frozen desserts*, J. H. MARTIN, R. E. ROBERTS AND J. J. SHEURING, *J. Milk Fd Technol.*, 1968, **31** (2), 31.

Soft-serve frozen dessert mixes and the freezer dispensed products made from these mixes were examined for total bacteria, coliform organisms, and heat-resistant spores over a 3 year period.

A. A.

14.91 *Yeast extracts and allied products*, B. J. SMITH, *Fd Mf*, 1968, March 18.
Review. 3 references.

14.92 *Modern malting systems*, A. R. ELKS, *Process Biochem.*, 1968, **3** (4), 25.
Review.

14.93 *Malting, mashing and wort substitutes*, F. K. IMRIE, *Process Biochem.*, 1968, **3** (4), 21.

The partial replacement of worts produced from malt by conventional mashing by substitutes has become economically attractive in recent years. The substitutes are derived from a cereal such as barley or wheat to which bacterial enzymes have been added to supplement the natural enzymes in the cereal. The process involves enzyme digestion of the cereal followed by centrifugal separation of the unconverted portion, and finally evaporating the wort substitute.

A. A.

14.94 *The development of a liquid malt*, O. T. GRIFFIN, J. A. COLLIER AND P. D. SHIELDS, *J. Inst. Brew.*, 1968, **74** (2), 154.

The preservation of green malt by hot air drying is the most usual form of kilning. This not only ensures biological stability but also allows some flavour adjustment both by the evaporation of 'green' flavours and the development of biscuit flavour on curing. A survey is now made of the development of a new process of liquid kilning, in which starch conversion and extraction follow modification and precede evaporative preservation and green flavour removal.

A. A.

14.95 *Brewing advances*, N. S. CURTIS, *Process Biochem.*, 1968, **3** (4), 17.

14.96 *Single-cycle filtration in brewing*, S. A. ATKINSON, *Process Biochem.*, 1968, **3** (4), 38.

14.97 *Reinforced plastics for brewing*, P. C. OLIVER, *Process Biochem.*, 1968, **3** (4), 31.

14.98 *Stainless steel for brewing*, J. H. BRADBURY, *Process Biochem.*, 1968, **3** (4), 32.

14.99 *Non-biological haze in beer*, J. PASFIELD, *Process Biochem.*, 1968, **3** (3), 49.

A polypeptide/tannin complex accounts for the non-biological haze in beer. The preventive methods discussed are: chilling and filtering; oxidation prevention; exclusion of metal ions; tannin adsorption; use of proteolytic enzymes; use of formaldehyde in the mash tun; and stimulation of peroxidase enzymes in malt to oxidise and precipitate tannin.

B. S. N.

14.100 *Volatile fatty acids in some brands of whisky, cognac and rum*, L. NYKANEN, E. PUPUTHI AND H. SUOMALAINEN, *J. Fd Sci.*, 1968, **33** (1), 88.

GC study showed that rum contained the largest amount of volatile acids, 600 mg/litre, while one of the brands of Scotch whisky contained the least, 90 mg/litre. Acetic acid represented 40-95 per cent of the total amount of volatile acids in the whisky; in cognac and brandy, the value was 50-75 per cent, and in rum 75-90 per cent.

K. A. R.

14.101 *Studies on the suitability of synthetic mustard oil producing substances for food preservation. II. Cider preservation tests*, F. BAUM, *Nahrung*, 1967, **11** (7/8), 819.

By using mustard oil producing substances K 68 and D 4720 together with ethyl p-hydroxybenzoate or propyl p-hydroxybenzoate, the aerobic bacteria in cider have been reduced considerably. But efficient dosages still led to the off-flavours detectable even after pasteurisation and storage upto 4 months. The development of moulds was completely inhibited in treated ciders.

A. A.

15. Toxicology

15.31 *Hydrogen cyanide in the seeds of Prunoidae and some other foods. II. Hydrocyanic acid content in raw and processed bitter almonds. Toxicological and food-law considerations*, W. STUIM AND E. HANSSEN, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (5), 249.

HCN content in raw, bitter almonds of different origins was found to be 0.29-0.31 per cent, corresponding to 4.9-5.3 per cent amygdaline. These values exceed those reported in the literature by about 20 per cent. Brief cooking and roasting do not alter the HCN content.

K. M. D.

15.32 *Isolation of new toxin from cultures of Aspergillus flavus*, J. V. RODRICKS, KENNETH R. HENERY-LOGAN, *Nature, Lond.*, 1967, **217** (5129), 668.

A new toxic metabolite 'aspertoxin' having a Rf of 0.55-0.60 on silica gel TLC with chloroform/pyridine (9/1, v/v), or chloroform/acetic acid (9/1, v/v) as developing solvent has been isolated. Injection of 2.0 μg/egg into the yolk or air cell killed 100 per cent of the embryos; a concentration of 0.7 μg/egg killed 50 per cent of the embryos. Microscopic examination of non-viable embryos revealed beak malformation, generalised oedema, loss of muscle tone and haemorrhage from the umbilical vessels.

K. A. R.

15.33 *Effect of B-group vitamins and ethyl alcohol on aflatoxin production by A. flavus*, S. C. BASAPPA, J. JAYARAMAN, V. SREENIVASAMURTHY AND H. A. B. PARPIA, *Indian J. exp. Biol.*, 1967, **5** (4), 262.

Thiamine (100 μg/100 ml. medium) alone, of all the B-group vitamins, stimulated toxin production (22.0 mg/l). Ethyl alcohol at 2 per cent level increased toxin production by nearly 5 times (123.0 mg./l) as compared to control.

K. A. R.

15.34 *Aflatoxin—a summary of recent work*, F. G. PEERS, *Trop. Sci.*, 1967, **9** (4), 186.

165 references.

15.35 *Growth and aflatoxin production by Aspergillus parasiticus from various carbon sources*, NORMAN D. DAVIS AND URBAN L. DIENER, *Appl. Microbiol.*, 1968, **16** (1), 158.

Glucose, ribose, xylose and glycerol acted as very good sources of growth and aflatoxin production in *A. parasiticus* Speare var. *globosum* Muriakami (*A. flavus* ATCC 15517) cultured in 2 per cent yeast extract solution containing 15 per cent carbohydrate. The carbon compounds involved appear to be metabolised both by the hexose monophosphate and the classical glycolytic pathway.

B. S. N.

15.36 *Use of immunofluorescence and animal tests to detect growth and toxin production by Clostridium botulinum type E in food*, T. MIDURA, C. TACLINDO, JR, G. S. NYGAARD, H. L. BODILY AND R. M. WOOD, *Appl. Microbiol.*, 1968, **16** (1), 102.

The appearance of *Clostridium botulinum* type E organisms and of toxin in experimentally inoculated packages of turkey roll was followed to study the time relationship between the presence of vegetative cells and the demonstration of toxin. Maximum amount of toxin were present during the period when fluorescing organisms were also more numerous.

A. A.

15.37 *On the chronic-toxic action of dichloromethane*, G. BOPNMANN AND A. LOESER, *Z. Lebensuitt. unters. u. Forsch.*, 1967, **136** (1), 14.

No harmful effects were observed on rats when dichloromethane was added to drinking water (2.25 g./18.1), although, each individual experimental animal is expected to have taken in 250 mg of dichloromethane in the 91-day experiment.

K. M. D.

15.38 *Effect of calcium and phosphate ions on the formation of soluble iron—gossypol complex*, T. R. SHIEH, E. MATHEWS, R. J. WODZINSKI AND J. H. WARE, *J. agric. Fd Chem.*, 1968, **16** (2), 208.

Ferric iron with gossypol solution of more than 3 moles of phosphate per mole iron formed a soluble dark-brown complex having characteristic spectrum of iron gossypol.

On Ca^{2+} being added, removal of soluble ferrous-gossypol complex from solution was observed.

B. S. N.

15.39 *Low temperature growth Characteristics of Clostridia*, T. A. ROBERTS AND G. HOBBS, *J. appl. Bact.*, 1968, **31** (1), 75.

Growth of *Cl. botulinum* type E is rapid in temperature range 3-5°C; non proteolytic strains of types B and F, can grow and produce toxin at similar temperatures. Clostridial spores have been observed at 5° below the minimum temperatures. A medium containing sodium carbonate supported germination best.

J. V. S.

15.40 *Adaptation of biphasic culture technique to the sporulation of Clostridium botulinum type E*, MARY K. BRUCH, C. W. BOHRER AND C. B. DENNY, *J. Fd Sci.*, 1968, **33** (1), 108.

An improved method for producing high yield spore crops of two strains of *Clostridium botulinum* type E was developed. Biphasic culture employing agar-water or agar-broth systems are described for two different types of culture vessels.

A. A.

15.41 *Growth and toxin production of Clostridium botulinum type E*, M. AJMAL, *J. appl. Bact.*, 1968, **31** (1), 120.

Effect of temperature and period of incubation on the growth and toxin production of *Cl. botulinum*.

J. V. S.

15.42 *Clostridium botulinum type E. Growth and toxin production in food*, M. AJMAL, *J. appl. Bact.*, 1968, 31 (1), 124.

Growth and toxin production by *Cl. botulinum* type E in experimentally inoculated irradiated and non-irradiated horse-meat and fish (herring and cod), and cured meats was investigated. No, OS or TP variant was observed during growth. Toxin was produced under both aerobic and non-aerobic conditions of incubation. Irradiated fish was found to be made susceptible to toxin production than unirradiated fish similarly treated. Toxic out-growth occurred in two products of ham and one of cured ox tongue with concentrations of NaCl, 3.7 per cent and nitrite 3 ppm. Corned beef containing 4.6 per cent of NaCl and 60 ppm of nitrogen did not allow the growth of type E with an inoculum as large as 1×10^5 spores/g.

A. A.

15.43 *Heat and radiation resistance and activation of spores of Clostridium welchii*, T. A. ROBERTS, *J. appl. Bact.*, 1968, **31** (1), 133.

Only 0.13-3.6 per cent of food poisoning strains grew without heating, the heat activation being generally detected at 75-80°, and on one occasion at 75-100°. Spores of 'food poisoning' strains were more resistant to gamma radiation than spores of classical strains.

A. A.

15.44 *Diffusion of aflatoxins in foodstuffs*, H. K. FRANK, *J. Fd Sci.*, 1968, **33** (1), 98.

Apple juice, sliced and pre-packed bread, soft cheese and a model substrate with high water content were inoculated with a toxic strain of *Aspergillus flavus* isolated from Brazil nuts. After 14 days, apple juice showed the highest content of free aflatoxin B_1, which decreased remarkably in the next 12 days. In bread, aflatoxin could be detected only in parts with visible mycelium; outside these parts, toxins could not be estimated.

K. A. R.

15.45 *TLC spotting solvent for aflatoxins*, L. STOLOFF, A. C. BECKWITH AND MARY E. CUSHMAC, *J. Ass. off. anal. Chem.*, 1968, **57** (1), 65.

Benzene has been recommended as a spotting solvent for aflatoxin on silica gel thin layer plates in preference to chloroform.

J. V. S.

15.46 *Collaborative study of a versatile procedure for assay of aflatoxins in peanut products including preparatory separation and confirmation of identity*, R. M. TEPPLEY, L. STOLOFF AND A. D. CAMPBELL, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 67.

The CB procedure (This journal, 1966, 49, 1218) for aflatoxin in peanut products was tested by 13 collaborators and found to be precise and accurate as the first action procedure (This journal, 1966, 49, 229). The CB procedure showed better recoveries and was time saving.

J. V. S.

15.47 *Hepatorenal lesions in rats fed a low lipotrope diet and exposed to aflatoxin*, P. M. NEW BERNE, A. E. ROGERS AND G. N. WOGAN, *J. Nutr.*, 1968, **94** (3), 331.

The study shows that aflatoxin did not exert significant effect on development of renal lesions in rats subsisting on a low lipotrope diet. A severe liver response was, however, observed.

B. S. N.

15.48 *Screening method for Zearalenone, aflatoxin and ochratoxin*, R. M. EPPLEY, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 74.

The method consists of extraction of material with water-chloroform mixture and sequential elution of the toxins on a silica gel column. Different commodities were tested but cotton seed, green coffee and capsicum pepper showed interferences for all toxins.

J. V. S.

15.49 *Researches on the micro-organisms which deteriorate the stored cereals and grains. 34. Detection of injurious strains and properties of toxic substance of scab Fusarium blight grown on the wheat*, HIROSHI TSUNODA, NORITSUNA TOYAZAKI, NOBIUCHI MOROKA, NAOKO NAKANO, HIDEO YOSHIYAMA, KAORU OKUBO AND MASAE ISODA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 115.

Fusarium nivale is a toxic strain and has the maximum toxic effect when grown on rice. The morphological features of the strain grown on domestic wheat of Japan are described. A toxic fraction has been isolated from this strain. Details of its effects on mouse are discussed. The toxin described here appears to be new and the authors have proposed the name 'fusarenon'.

J. V. S.

16. Infestation, Pesticides and Fungicides

16.52 *Climate and potential range of distribution of stored product mites in Japan*, R. N. SINHA, *J. econ. Ent.*, 1968, **61** (1), 70.

16.53 *Respiration of confused flour beetle in five atmospheres of varying CO_2 : O_2 ratios*, STANLEY D. CARLSON, *J. econ. Ent.*, 1968, **61** (1), 94.

Respiratory gas exchange was determined in *Tr. confusum* at 37°C in 5 different CO_2: O_2 ratios ranging from 1:0.74 to the normal atmosphere ratio of 1:717. The RQ was less than 1.0 in all CO_2: O_2 ratios except 1.717. RQ was lowest in the lowest O_2 concentration.

J. V. S.

16.54 *Respiration of confused flour beetle adults in CO_2 or N_2 and after sublethal fumigation*, STANLEY D. CARLSON, *J. econ. Ent.*, 1968, **61** (1), 125.

Exposure of adult test insects for 30 min to CO_2 or N_2 reduced their O_2 consumption to the minimum, which remained so during the 2 hour exposure period. During recovery from CO_2 or N_2 anoxia respiration increased. During N_2 exposure O_2 consumption as well as CO_2 production declined; in CO_2 exposure, production of CO_2 (by insect) increased. Fumigation of insects with CCl_2 ;CS_2 (80:20 by vol.) at the peak of O_2 consumption after CO_4 or N_2 anoxia caused continued depression in respiration.

J. V. S.

16.55 *Demonstration and extraction of a sex attractant from female Angoumois grain moths*, RONALD E. KEYS AND ROBERT B. MILLS, *J. econ. Ent.*, 1968, **61** (1), 46.

Using a 'Y choice' olfactometer, females of *Sitotroga cerealella* were demonstrated as secreting a substance attractive to males. Benzene and ethyl ether extracts of females were most attractive while methyl chloride and acetone extracts were less attractive. Samples of 0.1 female equivalent were as attractive as a single female virgin in bio-assays.

J. V. S.

16.56 *Effect of soil systemic insecticides on flavour and residues in coffee*, J. G. PODRIGUEZ, J. E. FAHEY AND C. E. FERNANDEZ, *J. agric. Fd Chem.*, 1968, **16** (2), 276.

Coffee beans treated with systemic insecticides, phorate disulfoton and Bidrin did not show any foreign odour or flavour and any detectable residues of disulfoton or its metabolites.

B. S. N.

16.57 *Colorimetric method for the determination of dichlorovos (DDVP)*, S. B. KADKOL, *J. Fd Sci. Technol.*, 1967, **4** (37), 123.

16.58 *Gas chromatographic determination of malathion and its oxygen analog malaoxons.*, CALVIN CORLEY AND MORTON BERZOA, *J. agric. Fd Chem.*, 1968, **16** (2), 361.

The rapid GC method with a single injection needs minimum cleanup with recoveries of 90-100 per cent in spinach, range grass, tomatoes, milk and fat at 0.05-2 ppm level. Detection of compounds was accomplished by flame photometry after chromatography on a column lightly packed with diethylene glycol succinate.

B. S. N.

16.59 *Behaviour of DDT in potatoes during commercial and home preparation*, F. C. LAMB, R. P. FARROW, E. R. ELKINS, R. W. COOK AND J. R. KIMBALL, *J. agric. Fd Chem.*, 1968, **16** (2), 272.

Potatoes grown in soil treated over a 5 year period with DDT were harvested and prepared for serving by commercial canning home preparative procedures. Low concentrations of o, p'-DDT and pp'-DDT and p,p-DDE were present at harvest. Commercial washing operations removed about 20 per cent of the total DDT residue from potatoes and lye peeling plus washing removed about 94 per cent. Commercial processing further reduced the residue to insignificant levels. During home preparative procedures, peeling removed more than 91 per cent of the residue. There was no significant decrease from the original residue when potatoes with skins were boiled or pressure cooked. Potatoes stored at 45°F for a period of 6 weeks showed no significant loss of residue.

A. A.

16.60 *Bromide residues from methyl bromide fumigation of food commodities*, M. E. GETZENDANER, A. E. DOBY, E. L. MC LAUGHLIN AND D. L. LINDGREN, *J. agric. Fd Chem.*, 1968, **16** (2), 265.

X-ray fluorescence method for estimating bromide residues in cereal products, fats, herbs, spices, beverages and other foods fumigated with methyl bromide. From almost no residue to 115 ppm/lb for 1000 c.ft. for powdered eggs, the range of residue amounts varied with samples tested.

B. S. N.

16.61 *Researches on the behaviour of ethylene oxide during fumigation of foodstuffs. I. Quantitative estimation of ethylene oxide and its residue formation in wheat in a silo experiment*, K. PFEILSTICKER AND H. RASMUSSEN, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **136** (1), 1.

The chlorohydrin method of estimation of ethylene oxide and its method of application are discussed. The residues of ethylene oxide remaining in wheat after fumigation of silo have been determined. On an average, a residue of 7 mg/kg was measured in aerated wheat after silo fumigation, by using the xylol method.

K. M. D.

16.62 *Anti microbial action of diphenyl and its derivatives. I. Anti microbial and metabolic-physiological action*, S. W. SOUCI, H. J. REHM, S. LAUFER-HEYDENREICH AND G. HERBIG, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (4), 209.

Diphenyl inhibits carotene synthesis. SOPP exerts a weak inhibitory effect on catalase, peroxidase and succinate dehydrogenase and strong one on NAD-oxidase. Terminal oxidation is also inhibited. There are indications that various hydroxyderivatives of diphenyl bring about decomposition of nucleic acids, phospholipids, and other phosphate containing substances. Strains resistant to diphenyl are also resistant to SOPP and vice versa. The same is true for diphenyl and other compounds e.g. chlorinated nitrobenzene and diphenyl derivatives containing substituted NH_2 and OH groups. In the animal body, diphenyl is hydroxylated in the 4- and 4' position while SOPP is hydroxlated in the 5-position and is precipitated as 2, 5-dihydroxydiphenyl. In the animal organism, glucoronic acid and sulphuric acid conjugates are formed from diphenyl and SOPP.

K. M. D.

16.63 *Anti microbial action of diphenyl and its derivatives. II. Physical and chemical bases*, H. J. REHM, S. LAUFER-HEYDENREICH AND P. WALLNOFER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (3), 117.

Partial vapour pressure of biphenyl was calculated at different temperatures between 0 and 40°C. Diphenyl

evaporates inside at gaseous space of 2 lit. in 5-8 min at 30°C. With the help of Tween 80 and acetone it can be mixed with water within certain limits. Souci and Maier-Haarlanders' method for the estimation of diphenyl has been simplified for microbiological purposes. Sodium orthophenylphenate (SOPP) shows a distinct increase in antimicrobial effect at alkaline pH.

K. M. D.

16.64 *Metabolism of some 4 nitroaniline derivatives in the rat*, COLLEEN MATE, A. T. RYAN AND S. E. WRIGHT, *Fd Cosmet. Toxicol.*, 1967, **5** (5), 657.

2, 6-Dichloro-4-nitroaniline (Botran, Allisan) is used as an effective fungicide for fruit and vegetables.

4-nitroaniline is partly excreted unchanged in rats and also as 4-phenylenediamine and 2-amino-5-nitro phenol. 4-aminophenols are formed by replacement of nitro group by hydroxyl in both halogenated derivatives. Metabolites from methylated derivative for unidentified, white chloro-compound gave some corresponding phenylenediamine. Using isotopically labelled compounds, results have been quantified to explain the metabolic replacement of nitro by hydroxyl group.

B. S. N.

16.65 *Toxic effect of insecticide telodrin in poultry*, M. P. VERMA, H. S. BAHGA AND B. K. SONI, *Indian J. exp. Biol.*, 1967, **5** (4), 245.

Acute toxicity of chlorinated insecticide, telodrin (Octa-chloro-hexahydro-methanoisobenzo-furan), has been studied in white leg horn cockerels. The LD 50 for cockerels has been determined as 3.85 mg/kg body weight. The liver and kidney showed varying degrees of degenerative and haemorrhagic changes.

K. A. R.

16.66 *Inter-relationships among copper, zinc and cadmium on the diet of the confused flour beetle*, JOHN C. MEDICI AND M. WIGHT TAYLOR, *J. Nutr.*, 1967, **93** (3), 307.

Addition of copper to diet slightly reduced the toxic effects of high doses of zinc and cadmium in *Tribolium confusum* (Duval). Cadmium in the diet raises zinc requirement significantly, whereas for copper there may be very slight increase.

B. S. N.

16.67 *A study of the compound fumigant containing ethylene dichloride*, TOYOAKI HARADA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 37.

A new fumigant was formulated by combining CCl_4 at 19 per cent level and 2, 2-dichlorovinyl dimethyl phosphate at 1 per cent level. For practical use, a dosage of 50g./m³ for 72 hr was optimal. It spreads easily and does very little damage to the fumigated grain, particularly to viability.

J. V. S.

16.68 *A study of fungicidal and insecticidal effect of a ethylene oxide fumigant 'Dycide H'*, TOYOAKI HARADA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 46.

Dycide H consisting of 10 per cent ethylene oxide and 90 per cent CO_2 was tested. A dosage of 250-300 g./1.5 m³ for more than 48 hr was suggested.

J. V. S.

16.69 *The comparative experiment on food preservation between 'high chlor' method and fumigation with phostoxin*, TOYOAKI HARADA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 71.

The high chlor procedure (2.1:10 mixture of chlorine and hydrogen) used in a warehouse (126 m³) was compared with fumigation. The former was less effective than the latter, but there were no differences in their fungicidal effects and effects on the viability of grain.

J. V. S.

16.70 *Application of 'phostoxin' for fumigation. 5. Insecticidal test on pupae of rice weevil. 6. Ignition and explosion test of fumigant phostoxin. 7. Effect of phostoxin for preventing mushroom for export from insect damage. 8. Application of phostoxin in the covering with waterproof sheet*, TOYOAKI HARADA, *Rep. Fd Res. Inst., Japan*, 1968, No. 23, 51.

5. The results obtained with 1 tablet of phostoxin per cu.m. at 10°C for 120 hr, at 15°C for 96 hr, and at 25°C for 72 hr were similar to the earlier results of the author.

6. There was no danger of ignition or explosion even at high doses of the fumigant or where water was sprinkled on the fumigant to accelerate gas production. The fumigant did not affect the metal containers.

7. Treatment of mushrooms packed in cardboard boxes (dosage, 0.6 g of fumigant for 50 litre space) destroyed all insects and prevented further infestation.

8. Satisfactory insecticidal effects were obtained when phostoxin was used for fumigation by covering with waterproof sheet.

J. V. S.

16.71 *Researches on micro-organisms which deteriorate the stored cereals and grains. 33. Effects of phostoxin as fungicide against Eumycetes grown in grains during storage of practical scale in the comparison of chloropicrin*, OSAMU TSURUTA, *Rep. Fd Res. Inst., Japan*, 1967, No. 23, 79.

The doses of fumigants were adjusted to compare their effects on an identical economical basis (16 g of chloropicrin/m³ for 3 days; and 0.5 tablet of phostoxin/m³ for 5 days). The experiment was conducted in June-September when the growth of injurious Eumycetes was most vigorous. The results show that the fungicidal effects of phostoxin were inferior to those of chloropicrin in the dosages employed in this experiment. Better fungicidal effects were indicated by using higher dosages.

J. V. S.

16.72 *Estimated chlorinated pesticide residues in animal and vegetable oils*, J. SINGH AND J. D. LANTHIER, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 45.

The oils (cottonseed oil, hydrogenated marine oil, seal oil, butter and processed beef tallow) are spread on a thin layer of celite 545; the pesticides are extracted from oil coated celite with acetonitriles partitioned in skellysolve F and cleaned-up on a basic alumina column. GC with an electron capture detector is used for qualitative and quantitative estimations. Recoveries at levels of 0.1 and 0.225 ppm ranged from 82-106 per cent.

J. V. S.

16.73 *Pesticide detection and determination*, L. MARTIN, *Fd Technol. Aust.*, 1968, **20** (4), 154.

16.74 *Organochlorine pesticide residues in foodstuffs*, J. O. G. TATTON *Process Biochem.*, 1968, **3** (3), 21.

Describes GC technique consisting of extraction of pesticides, clean up, GC treatment and confirmatory procedure for estimating organochlorine residues in foods.

B. S. N.

16.75 *Determination of sec-butylamine residues in fruit*, E. W. DAY, JR, F. J. HOLZER, J. L. TEPE, J. W. ECKERT, *J. Ass. off. anal. Chem.*, 1968, **51** (1), 39.

For determining sec-butylamine from certain fruits, the amine is distilled from the tissue, reacted with 1-fluoro-2, 4-dinitrobenzene and determined by GC with an electron affinity detector. Dimethylamine which interferes, can be removed by TLC before final measurement. Sec-butylamine is a post-harvest fungicide for fruits.

J. V. S.

17. Nutrition and Biochemistry

17.77 *Attitudes and approaches to supplementation of foods with nutrients*, ROBERT S. HARRIS, *J. agric. Fd Chem.*, 1968, **16** (2), 149.

Review. Eight references.

17.78 *U. S. diets and enrichment*, CORINNE LEBOVIT, *J. agric. Fd Chem.*, 1968, **16** (2), 153.

Review. Nine references.

17.79 *Protein problems and world malnutrition*, A. M. ALTSCHUL, *J. Fd Sci. Technol.*, 1967, **4** (3), 107.

17.80 *Availability of essential amino acids from proteins. I. Beef serum albumin*, Z. DVORAK, *J. Sci. Fd Agric.*, 1967, **19** (2), 71.

Available essential amino acids were determined microbiologically after enzymic hydrolysis of the protein. Amount of lysine determined by Carpenter's method with fluorodinitrobenzene did not correspond to the values found by microbiological analysis with *S. facalis*. Values obtained by chemical method was higher than the actual amount of available lysine. The availability of lysine as well as that of amino acids in general depended on the enzymic digestibility.

K. A. R.

17.81 *Availability of essential amino acids from proteins. II Food proteins*, Z. DVORAK, *J. Sci. Fd Agric.*, 1968, **19** (2), 77.

17.82 *Intestinal synthesis of B-complex vitamins in rats as influenced by feeding of curds*, B. R. BALIGA AND R. RAJAGOPALAN, *J. Fd Sci. Technol.*, 1967, **4** (3), 120.

17.83 *Catabolic rate of body protein in rat during the earlier stages of protein depletion*, MICHIO YAMAGUCHI AND MAKOTO KANDATSU, *Nature, Lond.*, 1967, **217** (5129), 668.

Feeding protein-free diet to rats after preliminary feeding of 20 per cent casein diet showed an exponential decrease in body protein and a sigmoidal decrease in body weight. The total percentage change in body, liver and muscle nitrogen during protein depletion have been plotted logarithmically. By general kinetic analysis the catabolic rate per day and the count of the less labile component were estimated to be 0.79 per cent and 97.2 per cent respectively. The more labile components were estimated to be 83.3 and 2.8 per cent respectively; and in the liver and muscle it was estimated to be 30.6 per cent and 6.6 per cent respectively. It is suggested that a total of 581 mg of protein should be supplied in a diet for each 100 g of body weight; corresponding to 830 mg if the value of NPU of the dietary protein is 70.

K. A. R.

17.84 *Determination of the relative nutritive value of protein and validity*, D. M. HEGSTED, RAYMOND NEFF AND JANE WORCESTER, *J. agric. Fd Chem.*, 1968, **16** (2), 190.

Method for the estimation of the relative nutritive value of (RNV) of protein using the slope-ratio technique with young rats provides data regarding weight gain, body water and body nitrogen similar to data from conventional method. Satisfactory results are obtained even with nine animals for each protein item assayed.

B. S. N.

17.85 *Enrichment of special dietary food products*, L. J. FILER JR, *J. agric. Fd Chem.*, 1968, **16** (2), 184.

Review. 28 references.

17.86 *Effect of concentrate of rice polishings on faecal excretion of bile acid and cholesterol degrading intestinal microflora of albino rats*, C. H. CHAKRABARTHI, S. G. SHIRSAT AND C. P. SUKUMARAN, *Indian J. exp. Biol.*, 1967, **5** (4), 222.

Concentrate of rice polishings increases the faecal excretion of bile acid, and decreases the cholesterol content of liver and blood of rats fed high cholesterol diet. But this increase in liver cholesterol was not found when sulphasuxidine (1 per cent) and streptomycin (0.05 per cent) are incorporated in the above diet.

K. A. R.

17.87 *New quantitative approach to the study of non-enzymatic browning*, EUGENE A. TALLEY AND WILLIAM L. PORTER, *J. agric. Fd Chem.*, 1968, **16** (2), 262.

Simple mixtures of amino acids and sugars are adsorbed on filter paper discs and fried in deep fat to simulate potato chip frying. The course of the reaction is monitored by an amino acid analyser by placing the filter paper discs directly on the resin columns. The browning reaction intermediates and the residual amino acids are separated and measured. The amino acids involved decrease in the concentration (at different rates), while the ninhydrin active intermediates increase to a maximum and then decrease.

K. A. R.

17.88 *Studies on the Maillard reaction. II. Conversion of pentoses under the action of amino acetates*, T. H. SEVERIN AND W. SEILMEIER, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (4), 230.

When D-ribose, D-xylose, and L-arabinose are heated with acetates of primary amines, one obtains a compound whose structure is probably 4-hydroxy-5-methyl-2, 3-dihydrofuranone.

K. M. D.

17.89 *Symposium on hematologic effects of vitamin E*, *Am. J. clin. Nutr.*, 1968, **21** (1), 1.

Papers presented are:

1. Tocopherol in infants fed diets rich in polyunsaturated fatty acids.
2. Vitamin E and linoleic acid in the feeding of premature infants.
3. Vitamin E response in infants fed a low-fat formula.
4. Haemolytic anemia in vitamin E deficiency.
5. The red blood cell in vitamin E deficient monkey.

17.90 *Colloquim on protein deficiencies and calorie deficiencies*, ROBERT B. BRADFIELD, *Am. J. clin. Nutr.*, 1968, **21** (1), 130.

17.91 *Food habits and nutritional status of minority groups in the United Kingdom, Proc. Nutr. Soc.*, 1967, **26** (2), 191.

The following papers were presented at the Symposia: The nature and extent of minority groups in Britain (J. H. Westergaard). Social and economic implications of minority food habits (J. C. McKenzie). The nutritional status of vegans and vegetarians (F. R. Ellis and Pamela Mumford). Nutritional status of Asian infants (M. A. Hussain and G. R. Wadsworth). The nutritional status of West Indian Immigrants (Bruno Gans). Response of the food industry to minority demands (Harold Ford).

17.92 *The new proteins, Br. Fd J.*, 1968, **70** (823), 47.

Deals with trends of research and development of new proteins including plant and fibrillated proteins.

17.93 *Adaptations to the patterns of food intake; some mechanisms and consequences*, P. Fabry and T. Braun, *Proc. Nutr. Soc.*, 1967, **26** (2), 144.
Review. 45 references.

17.94 *Fructose metabolism:* II. *Regulatory control to the triose level*, David Zakim and Robert H. Herman, *Am. J. clin. Nutr.*, 1968, **21** (4), 315.
Review. 56 references.

17.95 *Measurement of available lysine in heated and unheated foodstuffs by chemical and biological methods*, Amal M. Boctor and A. E. Harper, *J. Nutr.*, 1968, **94** (3), 289.

Rat growth assay and fluoronitrobenzene (FDNB) methods were used to estimate availability of lysine in meat and egg albumin before and after treatment in presence of glucose. With a basal diet of 25 per cent gluten diet and on addition of graded levels of lysine for a period of two weeks, a close correlation between weight gain and lysine intake was observed. Rat growth assay gave a lower value than FDNB assay for lysine in autoclaved egg albumin. This is not due to formation of toxic compounds or loss of methionine. For estimation of lysine in heated products, FDNB method is not suitable, although in case of heated foods lysine availability noticed may partly be due to fecal excretion as a part of undigestible residue.

B. S. N.

17.96 *The influence of protein-calorie deficiency on the central nervous system*, R. J. C. Stewart and B. S. Platt, *Proc. Nutr. Soc.*, 1968, **27** (1), 95.
Review. 33 references.

17.97 *Effect of dietary protein on serum amino acids*, Sheila M. Pereira, Almos Begum, Regina Sundararaj and Mary E. Dumm, *Am. J. clin. Nutr.*, 1968, **21** (2), 167.

Preschool children fed with a low protein diet of 1.4 g vegetable protein/kg for 5 days showed a significant and gradual increase in the ratio of non-essential to essential amino acids estimated by rapid one dimensional paper chromatographic technique. After 5 days upto the end of 8 days, however, these values did not show significant increases. The ratio decreased markedly when subjects were fed milk or meat protein for 5 days.

B. S. N.

17.98 *The protein quality of meat meals as assayed with the rat and Streptococcus zymogenes*, R. Ferrando, Nicole Henry and P. Larvor, *Brit. J. Nutr.*, 1968, **22** (1), 129.

Seven samples of meat meal have been assayed with rats by the PER test and with *Streptococcus zymogenes* by Ford's relative nutritive value (RNV) test. A correlation coefficient of 0.895 was obtained for the results from the two series of tests.

A. A.

17.99 *The influence of protein deficiency on absorption of amino acids in the gastro-intestinal tract of rats*, Z. Ziemalanski D. Cieslak, B. Plisza and A. Szczygiel, *Nahrung*, 1967, **11** (7/8), 559.

Feeding protein free diet to rats for 2-3 weeks resulted in more efficient absorption of amino acids in small intestine than did the normal diet, as determined from increase in the alpha-amino nitrogen and from changes in the individual free amino acids in the vena porta blood serum. The changes were more intense in young rats (6 weeks) than in elder ones (9 weeks).

K. A. R.

17.100 *Long term rat feeding trials with used frying fats*, Granville A. Nolen, J. Craig Alexander, *J. Nutr.*, 1967, **93** (3), 337.

Rats fed with fried, partially hydrogenated soybean oil, cotton seed oil and lard did not show any perceptible toxic effects; the degree of toxicity developed is very low and not of any dietary significance.

B. S. N.

17.101 *Protein quality of a soyabean protein textured food in experimental animals and children*, Ricardo Bressani, Fernando Viteri, Luiz G. Elias, Silvia De Zaghi, Jorge Alvarado and A. D. Odell, *J. Nutr.*, 1967, **93** (3), 349.

Textured food simulating beef and prepared as a blend of soya bean protein, egg albumin and wheat gluten on being fed to children was found readily acceptable and showed maximum growth rates at 16.7 per cent level. PER and digestibility coefficients of the food were respectively 2.30 and 92.3; biological value being 65.3 per cent; protein quality was about 80 per cent of that from milk.

B. S. N.

18. Food Processing, Packaging and Engineering

18.68 *Pilot plant studies in the application of turbulent thinfilm evaporator to the low temperature concentration of pure apple juice*, R. E. Leverington and R. C. Morgan, *Fd Technol. Aust.*, 1968, **20** (2), 58.

Pineapple juice (Brix about 13°) which had been preheated and clarified to a pulp content of less than 1 per cent, was evaporated to over 70°Brix at saturated vapour temperatures of 32, 46, and 60°C with rotor speeds of 1500 and 2000 rpm and temperature difference upto 70°C. The apparent overall heat transfer coefficient was calculated and plotted against the variable factors.

18.69 *Air filtration for the spray drying of dairy products*, D. R. Heldman, C. W. Hall and J. I. Hedrick, *J. Fd Sci.*, 1968, **51** (3), 466.

A considerable portion of the air-borne contamination can be eliminated by direct air filtration. Ultra-high efficiency air filters will remove essentially all micro-organisms from an air supply.

K. A. R.

18.70 *Preparative trials on roller dried weaning food*, M. R. CHANDRASEKHARA, M. MADHAVA KRISHNAIAH, H. N. CHANDRASEKHARA AND S. R. SHURPALEKAR, *J. Fd Sci. Technol.*, 1967, **4** (3), 115.

18.71 *EVOP: tool for in-plant research*, MORTON FOX, *Fd Technol., Champaign*, 1968, **22** (3), 293.

Practical guide to use in the food plant of the evolutionary operation procedures for optimising product and/or process. Complete example illustrates application of EVOP to on-line study of process time and temperature in canning of golden kernel corn.

A. A.

18.72 *Investigations and considerations on the use of plastics for foods. X. Cleaning of plastics as a pre-condition for their use*, F. KIERMEIER, E. RENNER, AND J. HOFFMANN, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **134** (4), 221.

Damage caused to the inner surface of milking machine tubes (plastic and rubber) by inexpert mechanical cleaning, low elasticity in the cold season, and natural wear and tear, leads to collection of milk residues in the scratches and cracks and growth of micro-organisms in them. A deposit of fat and protein, favouring microbial growth is formed in spite of careful cleaning. Bacterial flora observed under the UV-microscope were almost all living germs.

Milk quality deteriorates as the tubes become older. This was demonstrated by a number of live organisms in milk, its rate of reduction, organoleptic properties and suitability for cheese-making.

K. M. D.

18.73 *Rates of moisture sorption and desorption in porous dried foodstuffs*, C. JUDSON KING, *Fd Technol. Champaign*, 1968, **22** (4), 509.

This paper presents an analysis of the ways in which heat and mass transfer process interact to govern rates of sorption and desorption of water from dried foodstuffs.

A. A.

18.74 *Literature values of thermal conductivities of foods*, EDWARD E. WOODAMS AND JOSEPH E. NOWREY, *Fd Technol. Champaign*, 1968, **22** (4), 494.

Results of a literature survey presented in tables. 38 references.

18.75 *How golden wonder make effluent treatment pay-high quality starch from potato waste*, *Fd Mf*, 1968, **43** (4), 33.

Describes a sophisticated effluent treatment plant which recovers 20 tons a week of high grade potato starch.

18.76 *Food cannery wastes the treatment*, C. D. PARKER, *Fd Technol. Aust.*, 1968, **20** (37), 114.

18.77 *Treatment of effluents from food processes*, JAMES J. PRIESTLY, *Fd Mf*, 1968, **43** (4), 30.

18.78 *Dehumidification in the field of preservation by drying*, F. W. ARRIGONI *Ashrae J.*, 1968, March, 62.
Review.

18.79 *Contribution to the testing of plastic commodities on the effect of lubricants on the migrating tendency of organotin compounds from rigid PVC*, H. WOGGON, U. KOHLER AND W. J. UHDE, *Nahrung*, 1967, **11** (7/8), 809.

A special photometric procedure for the quantitative estimation of migrating tendency of the organotin compounds. A marked trailing effect of the lubricant on stabilizer migration appears only if the lubricant content is higher than 3 per cent. From toxicological point, use of 2.5 per cent of lubricant together with 2 per cent of di-n-octyltin compounds in manufacturing rigid PVC for packaging food materials is advocated.

K. A. R.

18.80 *Testing of plastic vessels. Detection of anti-oxidants and UV-absorbers in plastics*, H. WOGGON AND D. JEHLE, *Z. Lebensmitt. unters. u. Forsch.*, 1968, **136** (2), 77.

Thin-layer chromatography has been applied to detect 28 such compounds (15 of which are permissible in packaging materials and vessels used for foodstuffs) in polyolefins and polystyrols (including impact-drawn types of polystyrol). The proposed eluents and spray reagents enable unambiguous identification even of critical pairs.

K. M. D.

18.81 *Reactions in food systems: negative temperature coefficients and other abnormal temperature effects*, D. J. MCWEENY, *J. Fd Technol.*, 1968, 3 (1), 15.
Review. 49 references.

18.82 *Development of modern malting equipment*, H. J. ROCKLEY, *Process Biochem.*, 1968, **3** (4), 36.

The compact plant for continuous malting in static vessel described here may be used for either conventional malting or for carrying out resteep process with increased output and economy in power consumption.

B. S. N.

18.83 *Use of computor-derived tables to calculate sterilising process for packaged goods*, D. H. HERNDON, R. C. GRIFFIN JR AND C. O. BALL, *Fd Technol. Champaign*, 1968, **22** (4), 473.

18.84 *RF aids concentration of food liquids*, H. E. O. HEINEMAN AND J. O. MAVIS, *Fd Technol. Champaign*, 1968, **22** (4), 377.

18.85 *Calculating the calculated risk*, DAVID STUHLBARG, *Chem. Engng.* 1968, **75** (2), 152.

Optimum economy in operation is achieved through choosing the best of several plans involving risk. For this purpose, quantitative evaluation is carried out in terms of per cent risk, weight per cent risk, capital equivalent of operating profit and capital equivalent of operating loss for which the necessary equations in terms of the normally available cost factors have been indicated.

M. C. B.

18.86 *When is the pilot plant necessary?* R. KATZEN, *Chem. Engng*, 1968, **75** (7), 95.

In the early days, the development of a new process involved a series of steps starting from lab scale and eventually reaching full scale commercial plant. Nowadays with lab data alone, it is possible to calculate the size of commercial unit with a reasonable degree of accuracy through use of some fundamental principles and properties. The modern concepts of step analysis, evaluation factor, risk engineering, has resulted in cutting short the time and effort needed to arrive at a full fledged plant from basic laboratory data.

M. C. B.

18.87 *Resolving problem with OR*, J. R. MURPHY, *Chem. Engng*, 1968, **75** (3), 114.

The beginning and the end of problem solving consist of identification and final action. Operations Research (OR)

lies between these factors. OR is the reduction of related operations to mathematical terms as an aid to problem solving. The role of the following types of models—inventory, waiting time, allocation of resources, competition replacement search and net work, during marketing production research and engineering are indicated.

M. C. B.

19. Food Texture and Flavour

19.44 *An objective evaluation of changes in firmness of ripening bananas using a sonic technique*, E. E. FINNEY JR, I. BEN-GERA AND D. R. MASSIE, *J. Fd Sci.*, 1967, **32** (6), 642.

Studies on the resonant frequencies of cylindrical specimens of flesh from valery bananas showed that softening of the banana during ripening was associated with a decrease in Young's modulus of elasticity. Modulus of elasticity was significantly and directly correlated with starch content, but inversely correlated with luminous reflectance and the logarithm of per cent reducing sugar.

K. A. R.

19.45 *Rose' wine colour preference and preference stability by an experienced and an inexperienced panel*, C. S. OUGH AND M. A. AMERINE, *J. Fd Sci.*, 1967, **32** (6), 706.

The inexperienced subjects were less consistent to colour preferences at the first testing but were more consistent at the second testing. Experienced panel had stable preferences. Both groups showed similar preference patterns.

K. A. R.

19.46 *Influence of storage period on rancidification of soup powders*, J. POKORNY, H. ZWAIN AND G. JANICEK, *Z. Lebensmitt. unters. u. Forsch.*, 1967, **135** (3), 132.

Composition of the fat in soup powders has some significance only at the beginning of oxidation; other factors predominate thereafter. The peroxide number increases noticeably only at the beginning of the storage period, and remains almost constant after that. The best criteria for degree of rancidity after several months of storage are the acid number and the thiobarbiturate number; and after very long periods also the benzidine number. During storage the ratio of peroxides in the oxidation products diminishes while that of the decomposition products of peroxides, viz. free fatty acids and aldehydes, increases.

K. M. D.

19.47 *Towards objective evaluation of food flavour*, J. J. POWERS, *Fd Technol. Champaign*, 1968, **22** (4), 383.

Correlation of GC and sensory judgements by computor programmes is discussed. Limitations of this technique and of computor programmes for the 'discriminant analysis' procedure are pointed out.

J. V. S.

19.48 *Effects of odorous and flavouring substances in the diet on salivary secretion. Studies on the duration of action and the amount of secretion*, W. BLUMBERGER AND H. GLATZEL, *Nahrung*, 1967, **11** (7/8), 767.

Basal rice diet without the addition of spices causes a trebling of the fasting secretion. Addition of spices to this basal diet stimulated the salivary output: mustard nearly four; curry nearly six; lemon nearly eight; and chillies nearly ten times. The increased secretion resulting from wormwood was varying. The amylase activity of saliva is intensified over the whole meal. Basal rice diet and without addition of curry or wormwood increases the initial values by nearly one and a half to two; and addition of mustard or chilles, nearly three and lemon nearly five times. On an average the saliva secreted in the chewed food during eating amounts to 2.4-9.1 ml within one min.

K. A. R.

19.49 *The influence of sugar concentrations on the vapour pressure of food odour volatiles in aqueous solutions*, A. G. WIENTJES, *J. Fd Sci.*, 1968, **33** (1), 1.

The addition of fructose or invert sugar in very high concentrations to aqueous solutions containing strawberry volatiles or synthetic compounds respectively results, for some components, in a decrease of peak heights in gas chromatograms of the vapours over the solutions; the phenomenon is thought to be of interest for studying flavour retention in juice concentration.

A. A.

19.50 *Blending and compatibility of flavours*, J. N. KINSEY, *Fd Mf*, 1968, March 20.

19.51 *Some aspects of the statistics of small members of triangular taste tests*, V. D. LONG, *J. Fd Technol.*, 1968, **3** (1), 69.

The binomial distribution of random selections of added samples in small numbers of triangular taste tests has been applied to estimate (*a*) scores establishing a difference between samples, (*b*) the extent of true discrimination shown by any significant score, (*c*) the fixed panel size needed to establish difference or similarity, and (*d*) decisive scores in a sequential test scheme. It is shown that conclusion may be reached with fewer tests than the published literature suggests, thereby affording a saving of testing effort.

A. A.

19.52 *Survey of polycyclic aromatic hydrocarbons in smoked foods*, A. J. MALANOSKI, E. L. GREENFIELD, C. J. BARNES AND J. M. WORTHINGTON, JR, *J. Ass. off. anal. Chem.*, 1968, **57** (1), 114.

Fifty six-samples of smoked meat foods were tested by FDA and the level of benzo (a) pyrenes and other polycyclic aromatic hydrocarbons were found in concentrations ranging from 0.5 to 7 ppb.

J. V. S.

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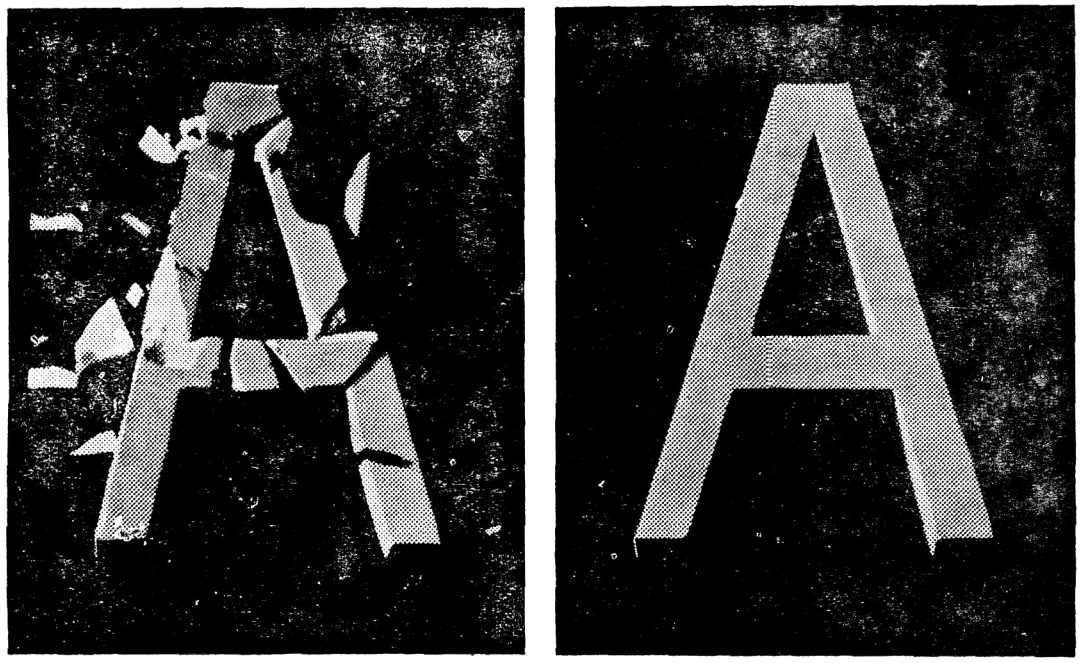

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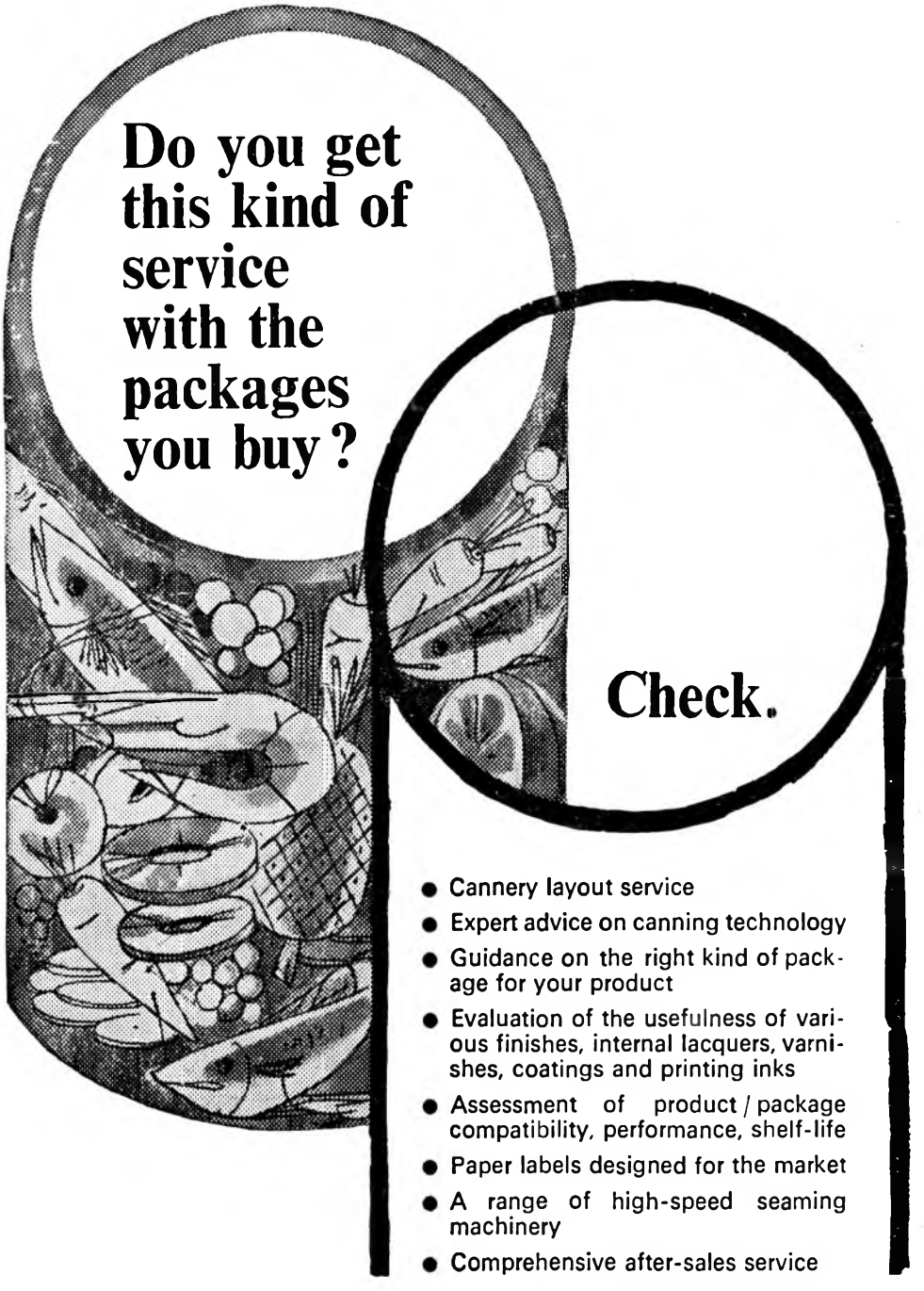

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