

Journal of Food Science & Technology



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No. 4

ASSOCIATION OF FOOD TECHNOLOGISTS, INDIA



One third of the world's children have no milk today

And they won't have milk for a long time to come. Yet the child needs food of a higher nutritional value. A six month old infant needs twice as many calories; five times as much animal protein per kilogram of body weight as the average adult. A four year old needs 50 per cent more calories and 100 per cent more animal protein. Milk meets nutritional deficiencies. But it's just not enough—not for all the world's 500 million children under 15 years of age.

UNICEF aims at meeting their basic needs. One way is by setting up dairies all over the world. In India, we have a string of UNICEF aided projects. The First Amul Dairy at Anand, and the dairies at Worli, Hyderabad, Madurai, Vijayawada

are a few... These dairies range in capacity from 50,000 to 5,00,000 litres of milk a day. UNICEF assistance for plant and equipment will be repaid by distribution of milk at subsidised rates to children, expectant and nursing mothers for a given period of years.

For the First Amul Dairy and the dairies at Worli, Hyderabad and Madurai, L&T carried out the entire mechanical and electrical installation including piping, testing and commissioning.

For Vijayawada Milk Products Factory, L&T will be installing a Niro Atomizer spray drying plant—the second milk powder plant in India to be put up with UNICEF aid.



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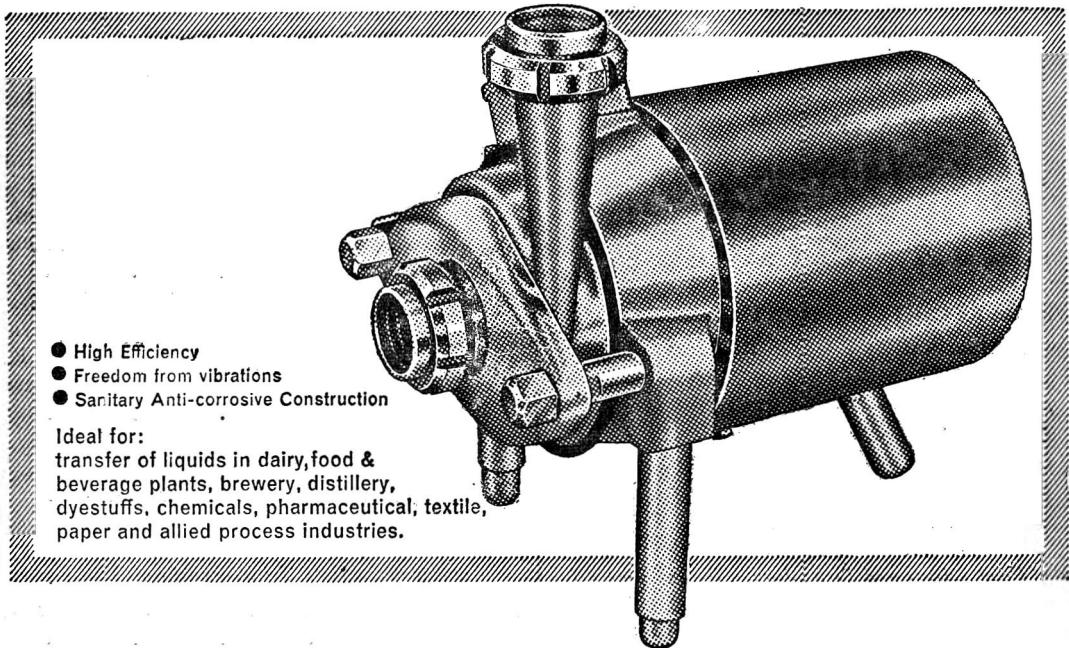
Cover Picture

Lac-Tone is milk toned with ground nut protein isolate. With UNICEF Aid, it is proposed to set up large scale unit for the production of Lac-Tone in the country. The photograph shows school children drinking Lac-Tone with relish.

29 10 1967

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EDITOR'S NOTE

The Journal completes four years with this issue and is entering the fifth year of publication. Despite earlier doubts, it has come to stay; and with a fairly high standard as a scientific journal. Many scientific institutions in India as well as abroad dealing in food science and allied fields subscribe to this Journal. The abstracts of scientific papers in this journal are regularly included in the International abstracting media. The repute of a scientific journal, however, stems from the merit of its matter, especially original or research papers; and for this, the editor depends largely on the referee who has to assess the value of paper for publication. The role of a referee is vital in publishing scientific material; it is for him to be unstinting in scientific criticism and ungrudging in appreciation of scientific value. A major function of the editor is to refer the paper to very competent persons in the field to assess its suitability for publication; later, the text has to be carefully edited according to the pattern set for publication in the Journal.

Under the piquant title '*Is the literature meant for reading*', Nature published an editorial sometime back (1966). 'It is hard, for example, to know how much of the literature is redundant, precisely how much of it is obscure even to the readership for which it is intended, and how much of it would never have appeared in the first place if it were not for the extraneous pressure such as the tendency of appointment boards to be influenced by the volume of a person's published work.' No doubt the research worker is compelled to publish his findings; but material without scientific merit adds little, except to the volume. The accumulation of needless bulk can be largely prevented if proper attention is given to a critical assessment and proper editing of the matter by the authors themselves before rushing it to the editor. In many cases, important data are buried under ambiguous, descriptive phraseology. Editing of such matter to suit the publication standards, becomes an uphill task and after processing, the author may feel hurt at the reduced size of the article. In this respect, it may be useful if each Institute or research centre did 'internal refereeing' before sending a paper for publication.

Our abstract section has been welcomed by the

members. Abstracts are made after careful screening of references in selected journals and efforts are being made to include literature of importance to food scientists and industries. This section is compiled from the Food Technology Abstracts compiled by C.F.T.R.I., to whom we are grateful.

The new sections on 'Food Industries in India' and 'Our Laboratories' are intended to give an overall picture of the 'food business' in the country; more of such contributions are welcome. We also include information about new food equipment whenever the manufacturers provide us with the technical data.

The year 1967 was marked by some important events for the food industry. The International Symposium on *Protein Foods and Concentrates* held at C.F.T.R.I., Mysore attracted many scientists of eminence, and provided a forum for exchange of thoughts on some very important developments in the field. The 'Protein Workshop' which followed this conference, will, we hope, catalyse the establishment of protein industry in the country.

A development of far-reaching significance was initiated when the Food Corporation of India set up 30 mechanical paddy drying units in Thanjavur District, Madras State. Improper drying has been one of the drawbacks in rice processing in India. The introduction of high yielding varieties which germinate quickly if left moist, during the rainy season, necessitated the immediate setting up of drying units. It is to the credit of the Food Corporation of India that these mechanical driers with a capacity of 160 tonnes of paddy per day were set up in a very short time of 4-5 months and worked successfully during the last *Kuruvai* harvest season.

The Government-operated modern bread factories have also been put into operation in Bombay and Madras during the year. Two large scale poultry dressing plants at Poona and Chandigarh have been established and one fishmeal manufacturing plant in Private Sector has been opened at Malpi.

We look forward to 1968 with the hope that there will be many more developments in food industries and the food technologists and agriculturists will strive to make the food prospects of the country less dependent on the vagaries of nature.

Studies on Some Comparative Milling Properties of Raw and Parboiled Rice

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Manuscript Received: 10 August 1967

Parboiled rice required greater abrasive force and/or longer period of milling than raw rice for milling to the same degree of polish in a laboratory McGill polisher. Breakage increased slowly during milling of both raw or parboiled rice up to 7-8 per cent polish; at higher percentages of polish, breakage increased rapidly. Breakage was lower in parboiled rice than in raw rice both during shelling and milling. The sticking of bran to rice while polishing of parboiled rice is caused by the 'oiliness' of the surface. It can be overcome by using a moderate abrasive force and increasing the milling time. The use of a sieving-cum-brushing device helps in eliminating the bran. Bran from parboiled rice contains a certain proportion of large particles and this contributes to the clogging of sieves while polishing. Bran from parboiled rice can be removed with little loss of endosperm. Colour extraction studies using a red variety of rice showed that for equal weight of bran removed during polishing, a greater amount of surface bran can be removed from parboiled rice than from raw rice.

In the course of a recent study on the suitability of some conventional and modern rice mills for milling parboiled rice it was observed that certain types of polishers used in modern mills offer difficulties. These difficulties were: failure to give adequate polish to parboiled rice and adherence of bran to rice thus imparting a dirty appearance to the milled product. Similar difficulties were experienced when brown rice from parboiled paddy was milled in Engelberg type horizontal polishers. Clogging of wiremesh screens during polishing has also been reported by rice millers. These observations indicated that besides the well known differences in breakage and head rice yields, there may be other differences in the milling properties of raw and parboiled paddy which would determine the choice of milling machine.

The present study was undertaken to investigate specifically the effect of milling time and abrasion pressure on the degree of polish and per cent breakage at different stages of milling raw and parboiled rice. Conditions for milling with minimum breakage were also investigated. Methods for overcoming the difficulty due to the adherence of bran to milled parboiled rice were studied. The amount of residual bran sticking to rice at different stages of polishing of raw and parboiled rice was also determined.

Materials and Methods

Two varieties of paddy (*Ratnachudi* and *Bangara sanna*) obtained from a local paddy breeding farm and also from a single agricultural plot were used for the studies. Representative samples from each lot were parboiled in the laboratory by the hot soaking method.¹ The parboiled paddy was sun-dried till the moisture content was reduced to about 20 per cent and then spread in shade to effect slow and even drying.

Paddy (1 kg.) was shelled in a McGill sheller, and the resulting brown rice, after removing the brokens, was milled in a McGill miller (No. 3) for varying periods (5-100 sec.) and with different loads* (1-13 lb). The bran removed during polishing, as also the milled rice, were sieved through 16-BSS mesh and the fraction passing through was weighed. The weight of such polish expressed as percentage of brown rice milled is referred to as 'degree of polish' in this study. All brokens in the milled rice up to three-fourth sized grains were determined in a rice sizing device. It was ensured that raw and parboiled paddy contained nearly the same amount of moisture in order to eliminate the effect of different moisture contents on milling.

The bran adhering to parboiled rice milled under different conditions (Table 1) was determined by sieving through 16-BSS mesh sieve. Parboiled rice

* Extra weight added to the lever end of the mill.

TABLE 1: AMOUNT OF BRAN STICKING TO PARBOILED RICE AFTER POLISHING
(Variety—*Bangara sanna*, Batch size—700g. rice)

Treatment No.	Load lb.	Time sec.	Moisture—19.0%		Moisture—9.1%	
			Degree polish %	Weight of sticking bran g.	Degree polish %	Weight of sticking bran g.
1	0	60	4.0	0.9	3.6	0.5
2	1	20	3.7	4.0	4.0	4.0
3	1	20	4.3	1.1	...	...
	0	20				
4	2	5	2.3	9.5	1.7	5.9
5	2	10	3.3	9.5	3.4	7.0
6	2	15	3.7	6.5	3.9	5.0
7	2	20	4.1	4.0	4.0	2.9
8	2	10	4.0	1.0	4.1	1.1
	0	20				
9	2	15	4.1	0.5	4.3	0.4
	0	20				
10	10	5	4.3	9.5	3.8	12.5
11	10	10	3.9	17.0	4.4	5.0
12	10	5	4.1	0.9	4.7	1.1
	0	20				
13	10	10	4.6	0.5	4.8	0.5
	0	20				

at two moisture levels was used for the study. Fineness of bran from raw and parboiled rice in four

varieties was determined by sieve analysis using standard sieves.

A commercial pure variety of *Kar* paddy which gave brown rice with coloured (reddish) skin was used for studying the effect of different degrees of polish on the percentage of bran removal. Colour was extracted from 2 g. samples of the rice polished to different degrees by an alkaline methanol solvent². Loosely adhering bran was first removed by washing and decantation with 10 ml. water. The colour was then extracted by boiling the rice for 10 minutes with two successive 25 ml. lots of 5 per cent sodium carbonate solution. 20 ml. of methanol were added to the combined extracts to prevent turbidity. The extracts were then made up to volume and filtered. The colour of the filtrate was measured in a photo-electric colorimeter at 420 m μ . (No. 42 filter). The amount of bran colour extracted from brown rice was taken as 100 and the amount of bran colour removed at any degree of polish was determined by measuring the residual colour in rice.

Results and Discussion

The results of studies on the effect of time of milling (polisher hold up time) on the degree of polish and per cent breakage in rice are presented in Fig. 1. It will be seen that at constant abrasive load, both these

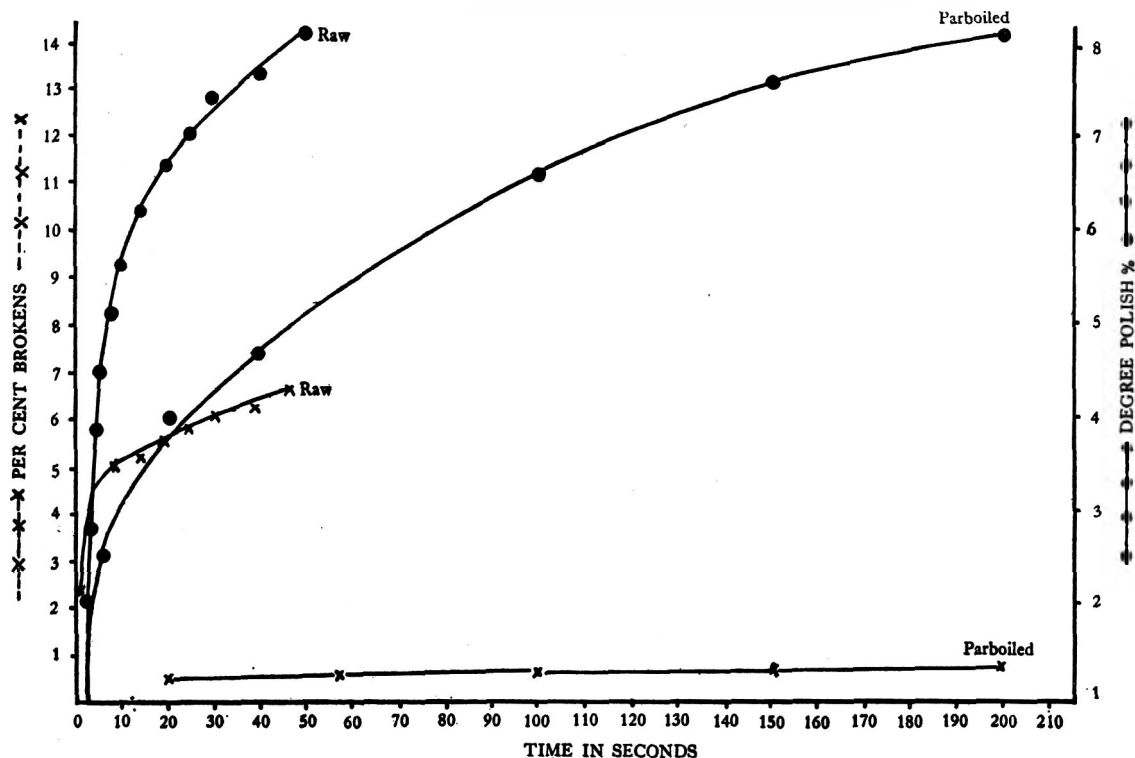


Fig. 1. Effect of duration of milling on breakage and degree of polish of rice (Load 2 lb)

factors increased with milling time, but parboiled rice required longer milling than raw rice for effecting the same degree of polish. For 5 per cent degree of polish, for instance, raw rice needed milling for 8 sec., while parboiled rice required 40 sec. Both raw and parboiled rice could be polished up to 4-5 per cent degree of polish in a relatively short time, while for achieving higher ranges of polish, prolonged polishing was necessary. This indicates that the outer bran layers are easier to abrade than the inner aleurone and endosperm layers². Breakage during polishing was lower in parboiled rice than in raw rice. Even at the high degree of polish of 8 per cent, breakage was below 1 per cent in parboiled rice, while it was above 7 per cent in raw rice.

The results of studies on milling for a definite period (5 sec.) using different abrasive loads are presented in Fig. 2. The results follow the same pattern as those in the previous

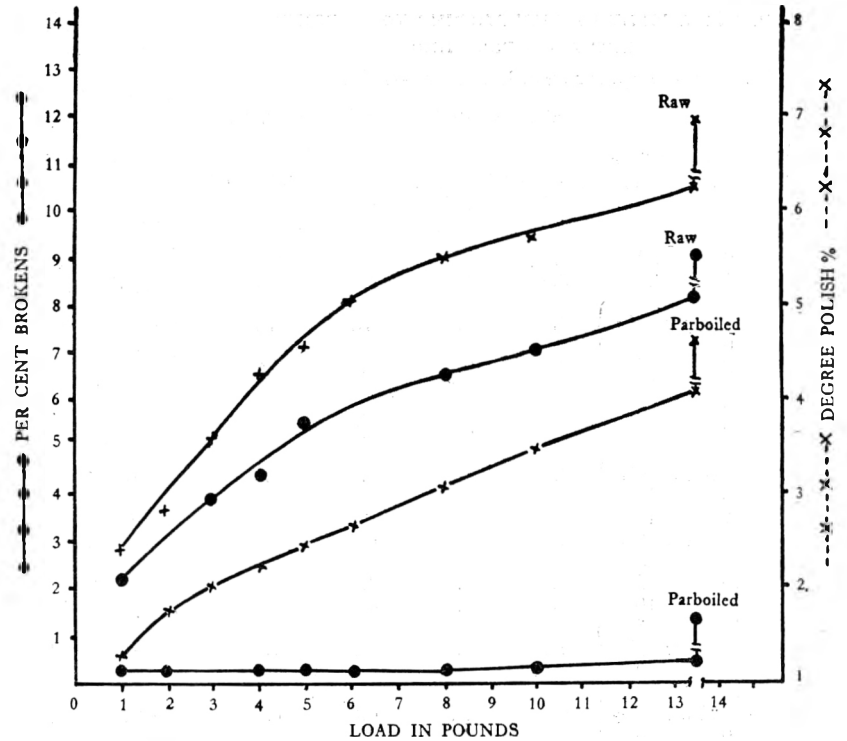


Fig. 2. Effect of load applied during milling on breakage and degree of polish in rice. (Time of Milling 5 sec.)
(The break—|— indicates that higher polish than was obtained at maximum load of 13.5 lb possible with the mill was possible if the period of milling is higher than 5 sec.)

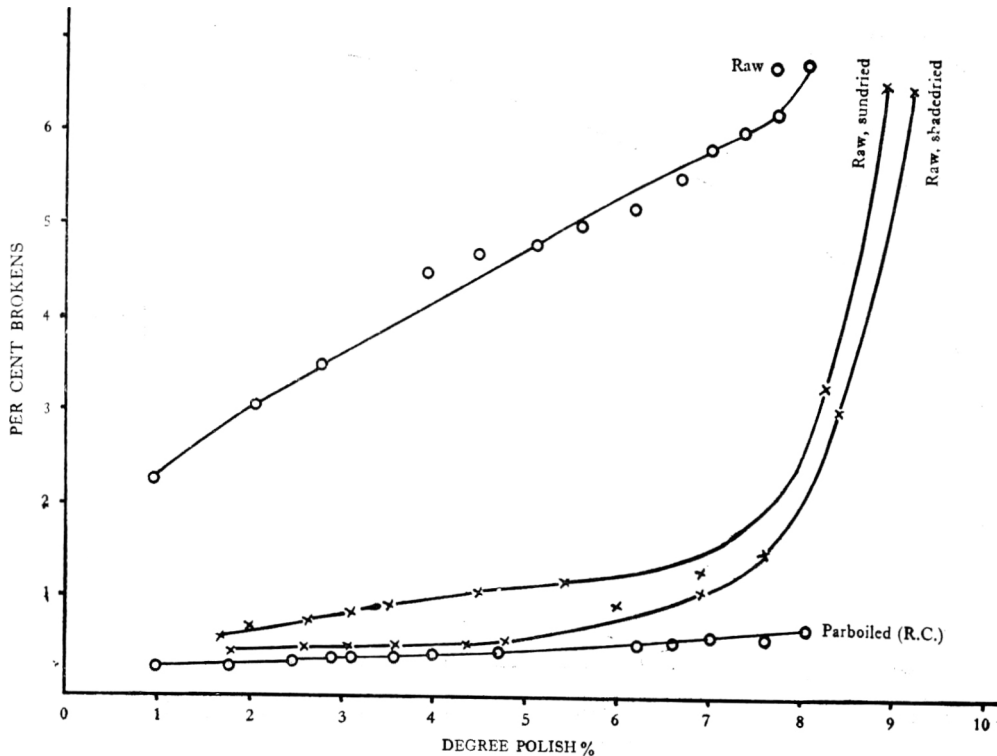


Fig. 3. Breakage at different degrees of polishings of rice. (Load 2 lb; Time of milling; 2-150 sec.)
○—○ Ratnachudi; ×—× Bangara sanna

study. Parboiled rice required 3-4 times as much abrasive milling load as raw rice for attaining the same degree of polish. Polishers meant for parboiled rice should, therefore, be designed to resist a higher abrasion pressure than those used for raw paddy.

The effect of increasing the degree of polish on breakage of raw and parboiled rice (*Ratnachudi* variety) as also the influence of the method of drying paddy—sun-drying and shade drying (*Bangara sanna*

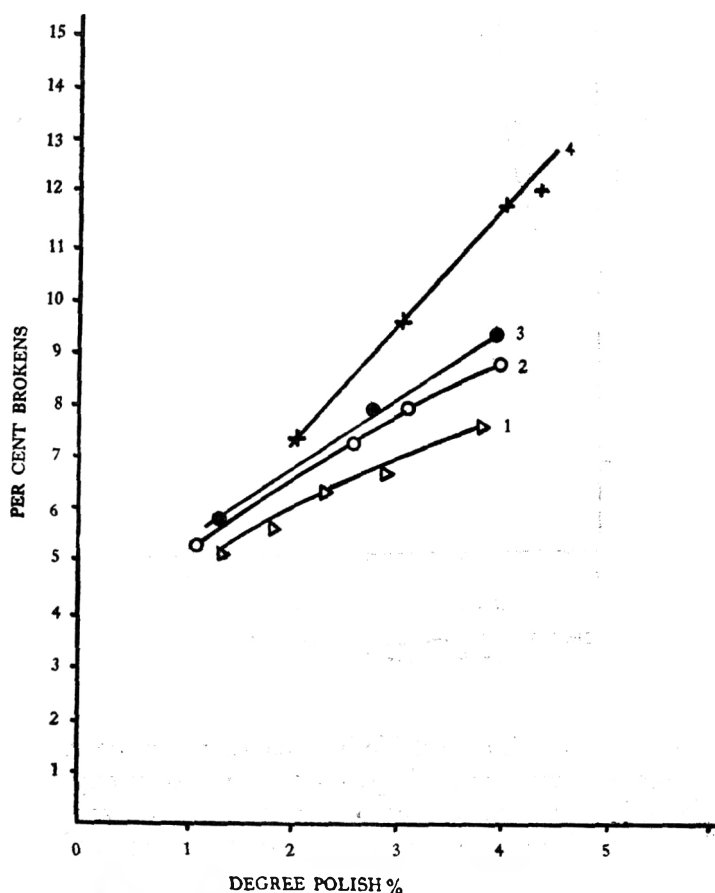
variety) on breakage during polishing is presented in Fig. 3. Breakage during shelling alone was 17.3 per cent and 0.2 per cent respectively in raw and parboiled paddy (*Ratnachudi* variety); breakage figures for sundried and shadedried raw *Bangara sanna* paddy were respectively 7.8 per cent and 5.0 per cent. Breakage during polishing increased steadily in the case of both raw and parboiled rice although the increase was more rapid in raw rice. At 8 per cent degree of polish, breakage was below 1 per cent in parboiled rice while it was above 6 per cent in raw rice. At this stage of polishing the temperature of rice increased to 55-60°C. In commercial practice, polishing does not extend beyond 4 per cent, and the breakage rate is not high.

Autrey *et al.*² have reported that breakage during milling of raw paddy varied from 2 per cent to 5 per cent at the shelling stage and 7.5 per cent to 8 per cent in the polishing stage including brushing. Breakage in paddy as received in mills varied from 4.07 per cent to 15.0 per cent. In the present study, breakage during shelling varied from 5 per cent to 17

per cent for raw paddy. It was only 0.2 per cent for parboiled paddy. Breakage figures during polishing was under 7 per cent for raw paddy and 1 per cent for parboiled paddy. The relatively high breakage during shelling observed by us is due to the presence of preformed cracks in paddy fed to the mill. Low breakage during polishing could be due to the low degree of polish and also the use of a different type of milling machine. Autrey *et al.* used a pilot plant mill which simulated the commercial milling system.

Breakage in rice at different degrees of polish (up to 4 per cent) obtained by using different load-time combinations for milling is represented in Fig. 4. It will be seen that high abrasion pressure and short time milling give more breakage than milling for long periods at low abrasion pressures. The use of minimum abrasion pressure for polishing is, therefore, indicated although this would increase the mill hold-up-time. In a continuous polishing operation, as in a commercial rice mill, this would require more polishing units in a series, each polisher being used for removing a small amount of bran with moderate milling pressure.

Elimination of bran from parboiled rice: The results of quantitative studies on bran adhering to milled parboiled rice are given in Table 1. The amount of bran sticking to the rice is determined by the abrasive or scouring force used and the time of milling. The former controls the amount of bran scoured, while the latter determines the amount of bran sieved out through the perforations of the screen. The use of high abrasion force with short milling time (treatments 2, 4, 5, 6, 7, 10 and 11) helps to remove more bran from the rice, but it does not allow sufficient sieving time. If the milling is prolonged further after removing the milling pressure (treatments 3, 8, 9, 12 and 13) the sticking bran gets brushed and sieved out through the screen. In a commercial rice mill, the difficulty due to the sticking bran can be overcome by using a large number of polishing units so that sufficient brushing and sieving time is permitted. Even an Engelberg type huller with wide clearance to minimise polishing can be used as a brushing cum sieving device to overcome the difficulty of sticking bran. In a trial experiment, in which milled parboiled rice with a dirty appearance containing 0.6 per cent sticking bran was passed through an Engelberg type huller, the resulting rice had improved appearance and the bran content was reduced to 0.2 per cent. High moisture content also enhances the tendency of bran to stick to rice but even there by running the machine longer with no extra load and increasing the sieving time by running the machine, the difficulty can be eliminated.



1. No extra load (10-35 sec.) 3. 3 lb load (2-8 sec.)
2. 2 lb load (4-15 sec.) 4. 10 lb load (2-5 sec.)

Fig. 4. Load-time combinations for minimum breakage during milling of raw rice.

It is pertinent to point out here that the problem of bran stickiness is serious only in the milling of parboiled rice, and not in the milling of raw rice. Histological studies have shown the presence, in parboiled rice, of oil globules that are damaged and burst, while in the case of raw rice, the oil appears as roundish globules (Mahadevappa, M. and Desikachar, H. S. R., Unpublished). Smearing of oil at 0.5 per cent level on the surface of rice enhances bran stickiness in both raw and parboiled rice. The amount of sticking bran was 0.15 per cent in the case of un-smear control rice, while it was 0.9 per cent in the case of rice smeared with 0.5 per cent oil. The basic cause of bran stickiness is the 'oiliness' of the surface of parboiled rice.

Sieve analysis of raw and parboiled rice bran: It was observed during milling trials that bran from parboiled rice was more flaky and bigger in size than bran from raw rice. Data on sieve analysis of raw and parboiled bran from four varieties of paddy are given in Table 2. It will be seen that parboiled rice

TABLE 2: SIEVE ANALYSIS OF BRAN SAMPLES

	Mesh size	Bangara sanna %	Sonakathi %	Gurmatia %	Safri %
Raw	-22	93.5	93.0	87.5	86.3
	-18	5.7	6.5	12.0	12.7
	-16	0.0	0.0	0.0	0.0
	+16	0.0	0.0	0.0	0.0
Parboiled	-22	76.6	82.5	60.0	38.3
	-18	10.6	15.0	32.5	49.3
	-16	5.3	2.5	3.7	5.5
	+16	6.8	0.0	3.1	6.2

bran generally contains less proportion of fine particles (passing through 22 mesh and 18 mesh) than raw bran. It also contains a small proportion of particle of +16 size which is totally absent in raw rice bran. The higher proportion of bran particles of large size may be responsible for the clogging troubles in polishers observed during the polishing of parboiled rice. The use of screens of bigger mesh for polishing parboiled rice is, therefore, rational in this context.

Degree of polish vis-à-vis bran removed: It was noticed that parboiled rice needed to be milled to

slightly less polishing than raw rice to have the same minimum consumer acceptability. The residual bran streaks on red rice grains normally admixed with commercial rice varieties were less in parboiled rice than in raw rice when milled to the same degree. The degree of bran removed at different degrees of polish was determined to verify this visual observation. Data presented in Fig. 5 show that at equal degrees of

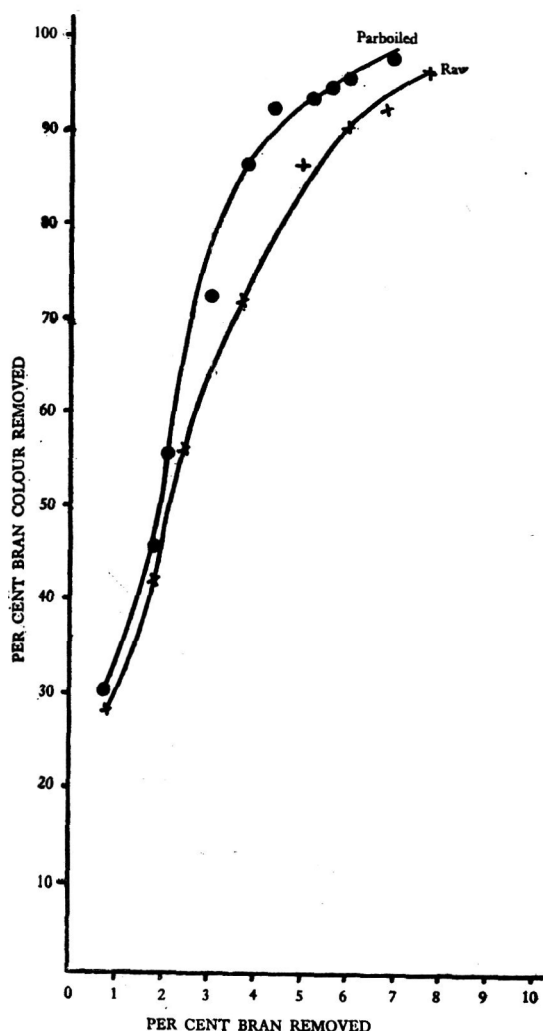


Fig. 5. Bran colour removed at different degrees of polish in Red (Kor) rice

polish above 2.5, extractable bran colour was more in the case of raw rice than in parboiled rice. Conversely, for effecting equal degree of surface bran removal, parboiled rice had to be subjected to a lesser degree of polish than raw rice. For instance, at 80 per cent bran removal, at which level the rice attains a minimum consumer acceptability, parboiled rice had to be polished to about 3 per cent while raw rice had to be milled to 4 per cent, indicating that on this score a

1 per cent increase in mill rice yield is possible during parboiling. This possibility, indicated in our studies with red rice, will have to be tested on white varieties of rice normally marketed.

Bran from parboiled rice can be peeled out as flakes and more easily than from raw rice. Also, bran from parboiled rice contains less starch and more oil than raw rice bran⁴. These results, indicate that parboiling, not only facilitates dehusking but also helps the separation of surface bran without loss of endosperm

although a higher abrasive pressure and or longer milling time have to be used for polishing.

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Relative Yield of Total and Head Rice From Raw and Parboiled Paddy

H. S. R. DESIKACHAR, M. K. BHASHYAM AND H. A. B. PARPIA

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Total and head rice yields were measured from raw and parboiled paddy in twelve varieties using laboratory test milling equipment. The increase in total rice yield through parboiling varied from -0.4 to +3.2 per cent while the increase in marketable rice was about 2.5 per cent on the average. Average increase in head rice was 22.5 per cent, the increases being particularly high with varieties which normally suffer high breakage in the raw state during conventional processing. Paddy samples with defective milling quality—no matter how defective—were upgraded by the parboiling treatment to yield 95-98 per cent of the rice in the form of whole grain. For the same degree of polish, bran colour was removed faster in parboiled rice than in raw rice. Parboiled rice needs, therefore, to be polished to a lower degree than raw rice for producing marketable rice. If yields are corrected for moisture content, the profits accruing from increased yields of rice through parboiling are almost neutralised by the processing costs. Parboiling would fetch profits only for those varieties which suffer high breakage in the raw state and cannot therefore be milled economically.

While there is general agreement with regard to the increase in yield of rice as a result of parboiling, opinions vary as to the extent of this increase. Claims of increase in yield are often attributable to high moisture content in parboiled rice. Results of a study to determine quantitative differences in yield of rice from raw and parboiled paddy under controlled experimental conditions are presented in this paper. This study also gives data that would facilitate an economic evaluation of the parboiling process.

Materials and Methods

Twelve commercial varieties of paddy obtained from five states of India were used for the study. Five kg. lots from each variety of paddy were parboiled by the hot soaking method described earlier¹, sun dried to about 20 per cent moisture and later shade-dried until the moisture content was reduced to 10-12 per cent, weighed and stored in closed containers. Lots of 1 kg. of the raw and parboiled paddy were then shelled in a McGill sheller and the amount of brokens in the brown rice was determined with a sizing machine. The brokens and head rice were recombined and polished to 3-4 per cent in McGill sheller No. 3. The bran and the milled rice were sieved through standard 16 mesh sieve. The broken rice was added back to the milled rice, and the total bran removed, was weighed to determine the degree of polish. Brokens of various grades in the milled rice were separated through a

sizing device and yields of total rice, marketable rice (total rice minus brokens of less than $\frac{1}{4}$ size) and head rice were calculated. Moisture in the rice was determined by the standard oven drying method. Yield data for each variety and treatment presented in Tables 1-3 were averages of three replicates, except in some cases where only two replicate determinations could be made. Adjustments were made in yield data for differences in moisture content and/or degree of polish between raw and parboiled samples in each variety. All data have been adjusted to 3 per cent degree of polish on paddy and to 12 per cent moisture content on wet basis.

The amount of surface bran removed at different degrees of polishing was also determined for two typical varieties of paddy—*Coimbatore Sanna* and *Bangara Sanna*—which contained 13 per cent and 40 per cent respectively of grains with a reddish coloured pericarp. Five gramme samples of brown rice as well as rice polished to different degrees from raw and parboiled paddy of *Bangara Sanna* variety were extracted with 5 per cent sodium bicarbonate solution as described earlier^{2,3}. The residual bran colour at any stage of polishing was expressed as per cent of colour from brown rice. In the case of *Coimbatore Sanna*, coloured grains from 10 g. samples were hand-picked and used for colour extraction. Representative rice samples were prepared using Boerner Sample Divider in all cases.

TABLE 1: MEAN % YIELD OF TOTAL RICE, MARKETABLE RICE AND HEAD RICE DURING MILLING OF RAW AND PARBOILED PADDY

Variety	Total Rice				Marketable Rice				Head Rice			
	Parboiled	Raw	Difference	C.D. at 5%/1% level	Parboiled	Raw	difference	C.D. at 5%/1% level	Parboiled	Raw	Difference	C.D. at 5%/1% level
<i>A.K.K.</i>	76.4	75.7	0.7†	0.32	76.3	74.7	1.6†	0.51	75.8	52.2	23.6†	0.80
<i>Basangi</i>	76.3	73.1	3.2†		76.2	71.6	4.6†		74.8	29.9	44.9†	
<i>Kichidi</i>	75.9	76.0	-0.1	0.43	75.7	75.4	0.3	0.68	74.4	63.5	10.9†	1.06
<i>S.K.K.</i>	75.3	75.5	-0.3		75.2	74.6	0.6*		73.3	51.5	21.8†	
<i>Bangara Sanna</i> (Comm)	73.7	74.1	-0.4*	0.51	73.6	73.0	0.6*	0.80	72.2	56.0	16.2†	1.25
<i>Sonakati</i>	73.4	72.9	0.5*		72.6	70.3	2.3†		66.5	48.7	17.8†	
<i>Dubraj</i>	74.6	74.1	0.5*	0.68	74.5	73.4	1.1†	1.06	72.8	59.6	13.2†	1.67
<i>Gurmatia</i>	74.3	73.3	1.0†		74.1	72.7	1.4†		72.3	45.2	27.1†	
<i>Safri</i>	74.1	72.6	1.5†	0.38	74.0	71.5	2.5†	0.63	73.0	48.3	24.7†	1.00
<i>Bangara Sanna</i> (Shade dried)	71.9	72.1	-0.2		71.8	71.5	0.3		70.4	67.2	3.2†	
<i>Coimbatore Sanna</i>	74.8	74.9	-0.1	0.51	74.5	74.5	0.0	0.83	69.5	69.7	-0.2	1.31
<i>Nallaralu</i>	77.7	76.1	1.6†		77.6	53.9	13.7†		75.1	8.1	67.0†	
Average	...	...	0.65	...	...	...	2.5	...	...	22.5	...	

* Significant at 5% level

† Significant at 1% level

Results and Discussion

Rice yields: Data relating to rice yields of raw and parboiled paddy are presented in Table 1. It will be seen that with regard to total rice, the increase in yield as a result of parboiling is quite small, when yields are expressed on equal moisture and equal polish basis. The increase varied from -0.4 to +3.2 per cent among different varieties with an average of 0.65 per cent. The positive increases are statistically significant in all cases while the negative increases are quite small and mostly insignificant. The net increase in the availability of total rice as a result of parboiling is quite small and far lower than what has been usually claimed.

Increase in yields of marketable rice due to parboiling varies from 0 to 13.7 per cent with an average of 2.5 per cent. The most beneficial effect of parboiling, however, is in increasing head rice yields by an average of 22.5 per cent. With respect to the hard varieties of paddy (*Bangara Sanna*, *Coimbatore Sanna*, *Kichidi*, etc.) which normally give high head rice yields even in the raw state, the increase in head rice yield as a result of parboiling is low. If the initial milling quality of paddy is bad in the raw state either due to varietal differences (*Nallarlu*, *Safri*, *Basangi*, etc.) or due to bad post-harvest processing treatment, parboiling is beneficial since breakage during milling is reduced to a minimum.

The data on the extent of reduction in breakage due to parboiling are presented in Table 2. Much of the breakage during milling of rice occurred in the shelling stage itself (with laboratory sheller consisting of a ribbed metal cylinder and a rubber roller). The breakage varied from 4 to 40 per cent for raw paddy while for parboiled paddy it varied only from 0.3

TABLE 2: BREAKAGE DURING SHELLING AND POLISHING OF RAW AND PARBOILED PADDY

(All data expressed as per cent of paddy used for milling)

Variety	During shelling		During shelling and polishing together			
	Raw	Par-boiled	Total		Less than $\frac{1}{4}$ size	
			Raw	Par-boiled	Raw	Par-boiled
<i>A.K.K.</i>	19.6	0.8	22.5	1.2	1.0	0.1
<i>Basangi</i>	40.0	0.6	43.0	1.0	1.5	0.1
<i>Kichidi</i>	10.0	1.3	11.3	1.6	0.6	0.2
<i>S.K.K.</i>	21.6	1.3	23.5	1.7	1.0	0.2
<i>Bangara sanna</i> (Comm)	15.2	0.3	17.7	1.4	1.1	0.2
<i>Sonakati</i>	21.9	5.9	24.3	6.8	2.9	0.8
<i>Dubraj</i>	12.1	1.1	14.5	0.5	0.8	0.1
<i>Gurmatia</i>	25.1	1.1	27.5	1.6	0.6	0.2
<i>Safri</i>	20.6	0.3	23.3	0.6	1.1	0.1
<i>Bangara sanna</i> (Shade dried)	4.0	0.2	4.7	0.5	0.6	0.1
<i>Coimbatore sanna</i>	3.4	3.6	5.2	5.3	0.4	0.3
<i>Nallarlu</i>	Very high	2.0	68.0	2.6	12.0	0.1

to 6 per cent showing that defective milling quality in raw paddy was corrected by parboiling. The same trend was observed when the total breakage during shelling and polishing was considered together. Broken rice of less than $\frac{1}{4}$ sized grain is not permitted in marketed rice, and it is generally disposed off as mill brokens. Even this fraction was far higher (0.6—12 per cent) in raw rice than in parboiled rice (0.1—0.8 per cent).

Bran removal during milling: The data on bran colour removal at different degrees of polish in the two varieties of paddy (Fig. 1), show that colour was removed faster during polishing in parboiled rice than in raw rice; this corroborates our earlier observations².

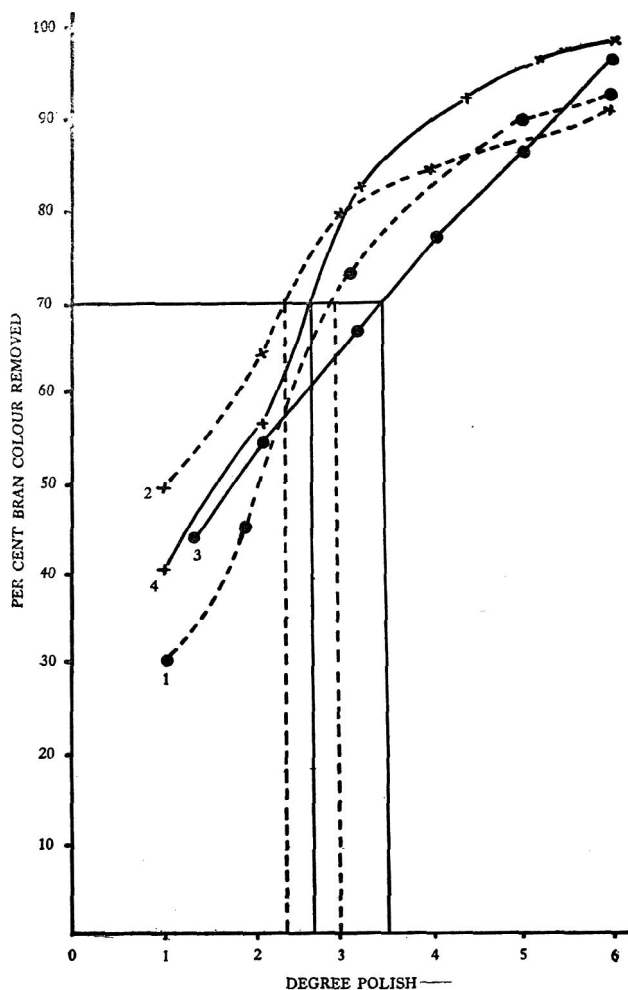


Fig. 1. Degree of polish for minimum consumer acceptability in raw and parboiled rice.
 1. Bangarsanna Raw 3. Coimbatore Sanna Raw
 2. Bangarsanna Parboiled 4. Coimbatore Sanna Parboiled

At 3 per cent degree of polish for *Bangara Sanna* paddy, parboiled rice had lost 79 per cent of its surface bran colour as compared with 70 per cent only for raw rice. For removal of about 70 per cent bran colour parboiled rice needs to be polished to about 2.4 per cent, while raw rice needs to be polished to 3 per cent. In the case of *Coimbatore Sanna*, the corresponding degree of polish for 70 per cent bran colour removal was 3.5 per cent and 2.7 per cent for raw and parboiled rice. If the degree of milling is restricted to the level required for minimum consumer acceptability, parboiling can give about 0.5–0.8 per cent higher yield of rice than raw rice.

Economics

If the economics of parboiling process based on increased rice yields is to be worked out, actual milling trials in large rice mills are required. However, certain general conclusions based on extrapola-

tion of laboratory data can be drawn. If the degree of polish is restricted to the level required for minimum consumer acceptability, the increase in total rice yield as a result of parboiling is about 1.5 per cent and in marketable rice about 3.5 per cent. The increase is due partly to decreased bran removal (about 0.8 per cent) and partly to reduction of broken during shelling and polishing (which are not normally recovered but are lost in sheller and polisher bran). A costing of products of milling as shown in Table 3 gives a net profit of about Rs 1.75/quintal of paddy.

TABLE 3: COST ESTIMATE OF PRODUCTS DURING MILLING OF RAW PARBOILED PADDY*

(All data relate to 100 kg. of paddy milled)

	Rate Re/kg.	Raw		Parboiled	
		Yield kg.	Value Rs	Yield kg.	Value Rs
Mill Rice	1.00	68.5	68.50	71.5	71.50
Broken	0.60	2.0	1.20	0.5	0.30
Bran	0.35	4.5	1.40	3.0	1.05
Total	...	75.0	71.10	75.0	72.85

* Data based on laboratory studies using McGill sheller.

The cost of parboiling, involving the operations of soaking, steaming and drying, varies from place to place depending on labour charges, drying method used, fuel for raising steam, etc., but varies from Re 1.50–1.75/quintal of paddy. Therefore, for paddy varieties which can normally be milled in the raw state without incurring breakage higher than 20–25 per cent (which is the limit prescribed for raw marketed rice in India), the economic gain due to parboiling is small and is only in the range of Re 0.25/quintal of paddy. For varieties which have poor milling quality, either due to genetic factors or due to bad handling or drying after harvest, parboiling can give high economic returns in addition to the well-known improvement in nutritional quality. The extent of economic benefit depends on the prevailing differences in the market price of whole rice, marketable rice and broken rice. It is proposed to carry out detailed economic study of the parboiling process in commercial units based on the indication of laboratory investigations.

Acknowledgement

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Purification and Hydrolytic Activity of *Pestalotiopsis westerdijkii* Enzyme

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The hydrolytic enzyme active against various carbohydrates, present in the culture solution of *Pestalotiopsis westerdijkii*, was precipitated by ammonium sulphate saturation (80%) and purified by passing through Sephadex G-25. This step resulted in about 10 per cent loss in activity. However, the activity pattern before and after gel filtration remained the same. Partially purified enzyme exhibited hydrolytic activity on a wide range of substrates, including oligo and polysaccharides and raw vegetables, thus indicating the presence of multiple components in the preparation.

Though the problem of degrading structural polysaccharides by the use of extra-cellular enzyme preparations has been tackled successfully by many authors, this knowledge has found only limited application in the industrial processing of vegetable foods. Japan has taken the lead in manufacturing infant and instant foods based on enzymic processing. Many micro-organisms are known to elaborate extra-cellular enzymes, particularly cellulase and hemi-cellulase, but so far, only a few fungi have been thoroughly investigated¹⁻⁵. Since cellulase and hemi-cellulase are regarded as adaptive enzymes, an enrichment technique is usually adopted for the preparation of these enzymes. This paper deals with the partial purification of the enzyme from *Pestalotiopsis westerdijkii* and the study of its hydrolytic activity on various carbohydrates.

Materials and Methods

Partial purification: The crude enzyme obtained by culturing the fungus on coconut-solka flocc[†] base for 10 days was fractionated with ammonium sulphate as follows⁶. Enzyme grade solid ammonium sulphate was added to the crude enzyme up to 30 per cent saturation, allowed to stand at room temperature for 6 hr and spun in a refrigerated centrifuge at 2500×G for 30 min. The supernatant was collected, ammonium sulphate added up to 80 per cent saturation, allowed to stand in the cold room at 4°C for 12 to 16 hr and centrifuged. The dark brown precipitate was separat-

ed, dissolved in one tenth of the original volume of distilled water. One ml of this preparation was passed through a Sephadex G-25 column (1.5×15.0 cm) and eluted with distilled water. One ml fractions were collected and the presence of enzyme activity was tested by the procedure of Hash and King⁷. The appearance of a yellow colour on treatment with the p-nitrophenol indicated enzyme activity. This procedure was repeated with a larger column with a view to collect the active enzyme in adequate quantity.

Protein extraction from coconut flour: Two g. of coconut flour and the specified volume of enzyme solution were placed in a 100 ml beaker and the volume made up to 40 ml. A few drops of toluene were added and the contents incubated at 40°C for 72 hr after which the milk was extracted and analyzed for its crude protein content (N×6.25).

Studies on hydrolytic activity: Following the procedure of Li and King⁸, various carbohydrates, including oligo- and polysaccharides, were tested for their susceptibility to enzymic hydrolysis. Paper chromatograms of initial and final reaction mixtures were developed according to Jermyn and Isherwood⁹ and Cifonelli and Smith¹⁰.

The susceptibility of plant materials for hydrolytic degradation was tested by incubating thin slices of onion, apple and radish with 6 ml of partially purified enzyme (Sp. activity 0.14 unit of C₁ per mg. of protein) at pH 6.0 and 40°C for 12 and 48 hr.

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† Wood cellulose product of M/s Brown & Co., Berlin N.H. (U.S.A.).

Results and Discussion

The crude enzyme precipitated from culture filtrate by 80 per cent saturation with ammonium sulphate was very dark in colour. When this preparation was passed through a Sephadex column, two different bands, a fast moving, dark brown band and a slow moving yellow band, separated. The material eluted from the former was highly active, while that obtained from the yellow band was only slightly active; almost all the nitrogen present in the crude enzyme precipitate was concentrated in the latter. The specific activity increased from 0.019 to 0.14 units of C_1 per mg. of protein in the purified enzyme.

Table 1 shows the efficiency of the enzyme in releasing protein from coconut flour before and after

TABLE 1: ACTIVITY OF *p. westerdijkii* ENZYME BEFORE AND AFTER GEL FILTRATION

Volume of enzyme ml.	Protein extraction (%)*	
	Before	After
0.0	61.5	...
0.5	66.9	61.5
1.0	69.4	62.5
2.0	74.2	65.2
4.0	76.9	67.7
8.0	81.2	74.5
12.0	80.6	76.9
16.0	85.8	76.3

* Corrected for enzyme nitrogen.

gel filtration. It is evident from the table that there is a loss of about 10 per cent in total enzyme activity after gel filtration, but the activity pattern remained unchanged. This indicates that the slow moving yellow band contains only the metabolic wastes of the fungus and other inactive substances.

Studies on hydrolytic activity: It is clear from Table 2 that most di-, tri-, oligo- and polysaccharides are hydrolyzed by the partially purified enzyme preparation. The enzyme does not attack Sephadex and this eliminates the possibility of an enzyme-gel interaction.

Fig. 1 shows complete solubilization of thin sections of plant material. Noticeable degradation of the tissue occurred within 12 hr. The enzyme preparation also degraded filter paper and some

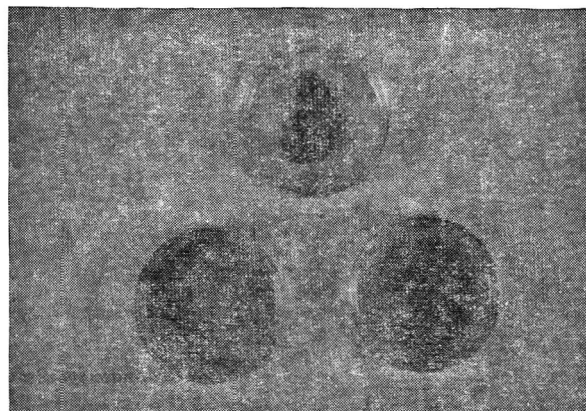


Fig. 1: Action of Enzyme on Vegetable Tissue

other vegetable food-stuffs. Shredded coconut was solubilized within a matter of hours¹¹.

The ability of the enzyme to degrade not only various carbohydrates but also plant materials indicates the multi-component nature of the enzyme.

TABLE 2: HYDROLYTIC ACTIVITY OF PARTIALLY PURIFIED ENZYME ON VARIOUS CARBOHYDRATES

Substrate	Susceptibility to hydrolysis	Substrate	Susceptibility to hydrolysis
β -1-4-Glucans:		Other carbohydrates:	
Hydrocellulose	+	β -D-glucose	
Cellulose	+	pentaacetate	±
Cellotriose	+	Gum arabic	+
Cellotetraose	+	Inulin	+
Cellopentaose	+	Maltose	+
Cellohexaose	+	Melibiose	+
		Melezitose	-
		Trehalose	±
		Turanose	+
Substituted		Gum ghatti	+
β -1-4-Glucans:		Lactose	+
Carboxy methyl cellulose-70-Low	+	Raffinose	+
Carboxy methyl cellulose-70-Medium	+	Sucrose	+
Cellulose octaacetate	-	Sephadex G-25	-
		Sephadex G-75	-
		Sephadex G-100	-
		Biogel p-10 (polyacrylamide)	-
Other β -glucosides:		Amylopectin	+
Esculin	+	Amylose	+
P-Nitrophenyl- β -D-glucopyranoside	+	Dextran	-
Salicin	+	Xylan (P)	+
Amygdalin	+	Pectin	-
Gentiobiose	+	Pectic acid	±

+ Clearcut evidence of hydrolysis.

- No detectable hydrolysis.

± Hydrolytic products, if present, were in such small amounts as to render detection questionable.

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Effect of Pre-harvest Application of Growth Regulators on the Control of Berry Drop in Bangalore Blue Grapes (*Vitis labrusca* L.)

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A study was undertaken to investigate the relative efficacy of six growth regulating chemicals, namely, α -naphthalene acetic acid (NAA); parachlorophenophenoxy acetic acid (PCPA); gibberellic acid (GA); 2, 4, 5-trichlorophenoxy acetic acid; maleic hydrazide-40 (MH) and Planofix, with two carriers namely, Waxol-0 and water, sprayed 7 days prior to harvest, on the control of post-harvest berry drop in Bangalore blue grapes. α -NAA proved superior to others in checking berry drop during transit and also during storage at ordinary room as well as cold storage conditions. A concentration of 100 p.p.m. was found to be optimum, although a concentration as high as 250 p.p.m. did not have any deleterious effects on the vines or bunches.

Post-harvest berry drop (or shatter) in certain varieties of table grapes is a serious problem, because it leads to material loss of fruit during handling and transport and renders bunches unattractive. Different types of post-harvest drop are recognised, such as, drop due to brittle or weak stem, 'wet drop' in which the berry is pulled out due to strain and stress in handling, and 'dry drop' as a result the formation of an abscission layer and drop due to infection by decay organisms¹⁻³.

Growth regulating chemicals have been employed to check fruit drop in apples, pears, citrus and several other fruits. Pentzer⁴ observed that pre- as well as post-harvest application of naphthaleneacetic acid (NAA) failed to check berry drop in grapes. Lavee⁵, however, reported reduction of drop in Muscat of Hamburg grapes by spraying bunches with 10-20 p.p.m. of NAA or PCPA, 4 days before picking. Weaver⁶ reported that in the case of Thompson Seedless grapes sprayed with 15 p.p.m. of 4-chlorophenoxyacetic acid (CPA) the pedicels became two to three times as thick as those of the controls and adherence of berries was much better. Spraying with gibberellic acid (GA) in low concentrations also thickened the pedicels, but did not improve berry adherence⁷.

Most of the trials with growth regulators on grapes have been carried out at pre-bloom to fruit-set stage. There are, however, a few conflicting reports on the control of berry drop by their application at the harvest stage^{4,5}.

The present study was undertaken to find out the relative efficacy of various growth regulators in controlling berry drop and also their concentration, especially when applied 2-5 days prior to harvest.

Materials and Methods

The trials were carried out in February and August 1965 in the vineyard of the Ramakrishna Ashram at Bangalore. A row with practically uniform vines was selected for each treatment. Different rows were demarcated by stone pillars.

For each treatment, 50 bunches of uniform size and maturity were selected and tagged. These were sprayed with the growth regulator formulations. In all, six formulations were tried, 3 of them, namely, —NAA, PCPA and GA in February and the other 3, namely, 2, 4, 5-Trichlorophenoxyacetic acid (2, 4, 5-T), maleic hydrazide (MH-40), Planofix (a proprietary compound based on α -NAA) in August; the effect of α -NAA treatment also on the August crop was studied. Three concentrations, namely, 25, 50 and 100 p.p.m., and two carriers, namely, 4 per cent waxol-0 and water, were employed (4 per cent waxol-0 was prepared by diluting the stock emulsion of 12 per cent solids with water⁸).

A week after spraying, the treated bunches were harvested, packed in conical bamboo baskets and brought by train to Mysore. In the laboratory, healthy and intact bunches, dropped berries which

were sound and decayed berries were separated and weighed. About 2 kg. of intact bunches were placed in a wooden crate in duplicate, and these crates were kept in a cold room at 0°C and also at ordinary room temperature. Periodically, observations were made regarding the weights of intact bunches, separated berries which were sound and also decayed berries and cumulative percentage wastage worked out. The data are presented in Tables 1-4.

Results

Transportation: During transport by rail, there was less wastage in treated lots than in untreated ones. Wax emulsion alone without any growth regulator reduced wastage. α -NAA was the most effective growth regulator in controlling berry drop.

Storage at room temperature (21-35°C): The data in Table 2 show that at the end of 9 days storage at room temperature, there was generally higher wastage in bunches treated with PCPA and GA as compared to the control and that wastage was the least in bunches treated with α -NAA. With regard to the use of the carriers for spraying wastage due to berry drop was less with waxol-0 than with water. In the case of α -NAA in water, berry drop decreased with increasing concentration of the growth regulator, upto 100 p.p.m. With waxol-0, as the carrier, there was better control in berry drop (4.7 per cent to 8.5 per cent) as compared to (23.6 per cent) the control.

Storage at 0°C and 85-95 per cent R.H.: The data in Table 3 show that at the end of 5 weeks of cold storage, berry drop was 16.4 per cent and 18.3 per cent in untreated and waxol treated lots respectively and much less in the case of lots treated with growth regulators. As in the case of storage at room temperature, wastage was the least in bunches treated with α -NAA. Wastage was less when waxol-0 was used as carrier for the spray. At the end of 9 weeks of storage, cumulative percentage drop in bunches treated with α -NAA in waxol-0 was only 6.2-7.8 per cent, as against 10.0-27.9 per cent in the case of bunches treated with α -NAA in water. It was 40.5 per cent and 44.6 per cent respectively in control bunches with or without waxol-0.

The data on berry drop in the monsoon season trials (August 1965); employing 2, 4, 5-T, MH-40, α -NAA and Planofix are shown in Table 4. At the end of 8 weeks, berry drop was high in control as well as in waxol-0 treatment, closely followed by 2, 4, 5-T and MH-40 treatments. α -NAA at both 100 p.p.m., as well as 250 p.p.m., concentration significantly reduced berry drop. It was not, however, quite effective at 50 p.p.m., concentration. With Planofix

TABLE 1: BERRY DROP AND WASTAGE DURING TRANSIT IN BANGALORE BLUE GRAPES

Treatment	Wastage % due to		
	Dropped berries	Diseased or crushed berries	Total wastage
PCPA, 25 ppm in water	2.2	1.2	3.4
" 50 "	1.8	0.4	2.2
" 100 "	4.0	0.1	4.1
PCPA, 25 ppm in 4% Waxol-0	2.0	0.5	2.5
" 50 "	3.4	0.4	3.8
" 100 "	4.4	0.5	4.9
Alpha-NAA, 25 ppm in water	0.9	0.2	1.1
" 50 "	2.0	0.2	2.2
" 100 "	0.5	0.2	0.7
Alpha-NAA, 25 ppm in 4% Waxol-0	0.9	0.2	1.1
" 50 "	1.2	Nil	1.2
" 100 "	0.9	0.2	1.1
GA, 25 ppm in water	3.4	0.2	3.6
" 50 "	2.7	0.2	2.9
" 100 "	2.8	0.3	3.1
GA, 25 ppm in 4% Waxol-0	2.1	Nil	2.1
" 50 "	4.5	0.3	4.8
" 100 "	3.2	0.1	3.3
4% Waxol-0	4.5	0.4	4.9
Control	9.1	0.5	9.6

TABLE 2: CUMULATIVE PERCENTAGE BERRY DROP IN BANGALORE BLUE GRAPES STORED AT ROOM TEMPERATURE (21-35°C)

Treatment	Berry drop (%) after storage for days			
	4	6	7	9
PCPA, 25 ppm in water	5.4	13.2	18.3	32.0
" 50 "	1.1	9.9	21.5	42.7
" 100 "	12.0	37.3	69.3	89.0
PCPA, 25 ppm in 4% Waxol-0	3.9	11.4	26.4	36.8
" 50 "	3.7	18.3	27.4	37.6
" 100 "	2.2	5.5	9.9	18.7
Alpha-NAA, 25 ppm in water	3.4	13.5	24.6	36.8
" 50 "	0.8	2.8	7.0	10.6
" 100 "	0	0.7	1.5	2.3
Alpha-NAA, 25 ppm in 4% Waxol-0	0	0.4	2.3	4.7
" 50 "	0.4	1.6	3.5	8.5
" 100 "	0.2	0.6	2.3	5.2
GA, 25 ppm in water	4.2	10.3	15.5	24.5
" 50 "	4.0	7.0	15.4	24.8
" 100 "	1.8	4.6	9.1	14.4
GA, 25 ppm in 4% Waxol-0	0.8	6.7	9.3	11.4
" 50 "	5.9	9.1	24.1	38.1
" 100 "	0.9	7.9	14.7	26.6
4% Waxol-0	0.3	6.0	12.2	20.7
Control	3.2	10.3	16.0	23.6

TABLE 3: CUMULATIVE PERCENTAGE BERRY DROP IN BANGALORE BLUE GRAPES TREATED AND STORED AT 0°C (February 1967 Trials)

Treatment	% berry drop after storage for (weeks)								
	1	2	3	4	5	6	7	8	9
PCPA, 25 ppm in water	0.9	3.1	5.1	7.5	10.3	—	—	—	—
„ 50 ppm in water	0.6	3.6	6.6	8.7	14.2	—	—	—	—
„ 100 ppm in water	1.2	4.3	8.6	12.1	17.6	—	—	—	—
„ 25 ppm in 4% Waxol-0	0.6	2.0	4.3	6.6	9.9	—	—	—	—
„ 50 ppm in 4% Waxol-0	0.6	2.0	4.1	7.4	10.9	—	—	—	—
„ 100 ppm in 4% Waxol-0	1.1	2.9	6.7	9.8	13.3	—	—	—	—
Alpha-NAA, 25 ppm in water	0.4	0.5	1.8	3.7	5.3	6.8	9.0	14.6	19.9
„ 50 ppm in water	0.4	1.1	2.6	5.2	6.9	9.4	13.1	20.5	27.9
„ 100 ppm in water	0.2	0.3	0.7	1.3	2.1	2.8	3.8	6.4	10.0
„ 25 ppm in 4% Waxol-0	0.3	0.3	0.8	1.3	1.9	2.5	3.1	4.7	6.2
Alpha-NNA, 50 ppm in 4% Waxol-0	0.1	0.3	0.7	1.0	1.8	2.9	3.8	5.0	6.9
Alpha-NNA, 100 ppm in 4% Waxol-0	0.5	0.6	1.4	1.8	2.4	3.2	4.3	5.9	8.7
GA, 25 ppm in water	2.1	4.5	8.0	12.8	17.7	—	—	—	—
„ 50 ppm in water	1.5	5.4	8.3	12.1	15.1	—	—	—	—
„ 100 ppm in water	0.9	2.5	5.3	8.2	9.8	—	—	—	—
„ 25 ppm in 4% Waxol-0	0.8	2.9	4.4	6.7	8.9	12.0	—	—	—
„ 50 ppm in 4% Waxol-0	1.1	2.4	5.3	7.8	10.0	13.4	—	—	—
„ 100 ppm in 4% Waxol-0	0.2	1.8	2.7	4.7	6.4	8.2	—	—	—
4% Waxol-0	2.4	6.8	10.8	14.6	18.3	20.6	25.2	31.4	40.5
Control	1.8	6.2	10.6	13.7	16.4	22.6	28.8	34.9	44.6

— Observations discontinued when total wastage exceeded 15%.

TABLE 4: CUMULATIVE PERCENTAGE BERRY DROP IN BANGALORE BLUE GRAPES TREATED AND STORED AT 0°C (August, 1967 trials)

Treatment	% berry drop after storage for (weeks)				
	3	4	6	7	8
2, 4, 5,-T, 50 ppm in 4% Waxol-0	3.0	8.3	11.8	16.7	—
2, 4, 5,-T, 100 ppm in 4% Waxol-0	3.2	8.6	13.7	—	—
MH-40, 50 ppm in 4% Waxol-0	2.3	5.6	6.6	16.4	—
MH-40, 100 ppm in 4% Waxol-0	4.8	11.1	16.3	—	—
Alpha-NAA, 50 ppm in 4% Waxol-0	3.5	7.9	12.8	18.7	—
Alpha-NAA, 100 ppm in 4% Waxol-0	1.7	3.2	5.3	5.5	7.2
Alpha-NAA, 250 ppm in 4% Waxol-0	1.3	1.9	3.2	7.3	7.5
Planofix, 1 ml. in one gallon of 4% Waxol-0	1.2	1.4	4.2	7.5	7.8
4% Waxol-0	4.5	12.3	18.9	24.5	32.0
Control	4.8	10.7	15.5	19.6	22.0

— Observations discontinued when total wastage exceeded 15 %.

(1 ml/gallon of 4 per cent waxol-0), the results were similar (7.2-7.8 per cent) to those in the case of α -NNA at (100 p.p.m.). At the end of 8 weeks, the berry drop was high in the control and the lot treated with waxol-0 (22.0 and 32.0 per cent respectively).

Berry drop is a serious problem in Bangalore Blue grapes. Among the 6 growth regulators tried, α -NAA was the most effective in checking berry drop during transit and also during storage at room temperature as well as at 0°C. The effect of α -NAA was more pronounced when applied with waxol-0 as carrier. A concentration of 100 p.p.m., of α -NAA was the optimum; higher concentrations, up to 250 p.p.m., did not lead to further reduction in berry drop. The high concentration of α -NAA did not affect adversely the vines or the bunches.

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Studies on The Storage of Mandarin Oranges (*Citrus reticulata* Blanco) Treated with Wax or Wrapped in Diphenyl Treated paper

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The effect of prepacking Coorg oranges before storing at room temperature and at optimum cold store conditions has been studied. The results indicate that under ambient conditions (26-30°C and 30 to 60 per cent RH) without any packaging, unwaxed, waxed and wiped oranges could be stored for 7, 9 and 12 days, as against 16, 18 and 20 days in ventilated polyethylene bags of 200 gauge, and 22 days when wrapped in diphenyl treated paper. In optimum cold storage (4-5°C and 85-95 per cent RH), unwaxed fruits had a shelf-life of 2½ months and waxed fruits, 3 months. In ventilated polyethylene bags with fruits wrapped in diphenyl treated paper, the shelf-life was 4½ months.

The loose-skinned mandarin orange is widely grown in many tropical and sub-tropical regions of the world. In India, it is cultivated in Assam, Madhya Pradesh, Punjab and Coorg (Mysore State). The Coorg mandarin orange, although slightly small in size, is highly appreciated for its taste and flavour. However, it is susceptible to infection by *Penicillium* spp. which impairs its storage life. It has been reported that under cold storage (5-7°C; 85-90 per cent RH)¹, oranges have a shelf-life of about 2½ months. The cold stored fruit, however, has a desiccated appearance. The practice of retailing oranges in consumer-size polyethylene bags is widely practised in some Western countries with benefit to the grower, retailer and consumer²⁻⁴. Earlier studies have shown that pre-packaging of fresh produce in plastic film bags helps in extending the shelf-life both at room temperature and under cold storage⁵⁻⁷.

The present paper deals with studies on the effect of waxing and use of diphenyl wraps on the storage behaviour of Coorg oranges, pre-packaged in perforated and unperforated consumer-size polyethylene bags and stored at room temperature (26-30°C and 30-60 per cent RH) and at low temperature (4-5°C and 85-90 per cent RH).

Materials and Methods

Materials: Fresh, ripe fruits with well-developed colour, and free from visible defects were harvested

from an orchard in Coorg and transported to Mysore within 24 hours.

Packaging material: Consumer-size bags (25 cm × 30 cm) made of low density polyethylene of 100 and 200 gauge and cellulose film (MST 300), with and without vents, were used for packaging the oranges. Bags with varying numbers and sizes of vents were included. To determine the progressive build-up of carbon dioxide, a 30 cm long rubber tube was introduced into each non-ventilated bag and the loose end of the tube was closed tightly with a pinch-cock, as described in the earlier studies⁸.

Treatment of fruits: The oranges were divided into four lots. The first lot (*a*) was dipped for 1 minute in 4 per cent sugarcane wax emulsion in water containing 1 per cent SOPP⁹ and then dried. The second lot (*b*) was given the same treatment, but after wiping each fruit with cloth to remove surface dirt. The third lot (*c*) was wrapped in diphenyl-treated tissue paper which was prepared by dipping paper in an alcoholic solution of diphenyl and subsequent drying. The amount of diphenyl per sheet of paper (25 cm × 25 cm) was 30 mg. The fourth lot (*d*) was kept as control in packaged condition. Fifty fruits from each of the four lots were stored in bamboo baskets to serve as controls.

Eight fruits (approximately 1 kg.) were placed in each bag and the mouth of the bag closed by means

* Research Fellow under a project sponsored by M/s Union Carbide India, Ltd.

of a twine thread. Twelve bags were used in each case as replicates.

Storage conditions: The packages were kept under (i) room temperature (26-30°C and 30-60 per cent RH) and (ii) optimum cold storage (4-5°C and 85-90 per cent RH). Periodical observations were made to study the extent of decay and physiological loss in weight (PLW). In non-ventilated bags, the carbon dioxide build-up was measured at regular intervals with the help of a Hartmann and Brann portable gas analyser.

The shelf-life of fruits was determined on the basis of general appearance, fungal or microbial spoilage, physiological loss in weight and marketability. Physiological loss in weight of 10 per cent or spoilage of 10 per cent, or PLW and storage loss of 15 per cent was taken as the index of the shelf-life of the fruit.

Methods of analysis: At the end of the storage period, the juice of stored oranges was analysed for vitamin C content by dye reduction titration method⁹, acidity by titration¹⁰ and brix by a hand refractometer. In the case of oranges kept at optimum cold storage conditions, peel, pomace and juice percentages were determined. Organoleptic quality of fruits was assessed with the help of a panel of judges. The data are presented in Tables 1-4.

Results and Discussion

Storage under room conditions: Data in Table 1 for control samples (unpacked) under treatments a, b, and c had a shelf-life of 7, 9 and 12 days with PLW of 11.1, 10.3 and 10.5 per cent respectively; whereas fruits from (a), (b) and (c) lots packed in 200 gauge polyethylene bags with 40 vents (30 mm diam) had a shelf life of 16, 18 and 20 days respectively with a corresponding PLW of 5.4, 4.0 and 3.6 per cent in the case of bags with 40 vents and 8.4, 5.4 and 4.7 per cent in the bags with 16 vents. The increased shelf-life was due to waxing as well as packaging in ventilated bags. In the case of diphenyl wrapped fruits, (treatment d), placed in ventilated polyethylene bags, the fruits had a slightly higher shelf-life (22 days). In unventilated bags, although the PLW was less, spoilage was high ranging from 11 to 16 per cent, and the juice had an unsatisfactory flavour. The build-up of carbon dioxide in 100 and 200 gauge polyethylene bags without vents ranged from 4 to 20 per cent on the eighth day and from 8.0 to 20 per cent by twelfth day. Both 100 and 200 gauge bags were unsuitable for pre-packaging because of high build up of carbon dioxide and humidity. Data for cellulose film bags without

TABLE 1: PHYSIOLOGICAL LOSS IN WEIGHT, SPOILAGE AND SHELF-LIFE OF PREPACKAGED ORANGES AT 26-30°C AND 30-60% RH.

Package	Treat-ment*	Aera-tion %	P.L.W. %	Spoilage %	Shelf-life in days
1. Control	a	100	11.1	6.5	7
	b	100	10.3	6.8	9
	c	100	10.5	6.2	12
2. Polyethylene bag, 100 gauge, no vents	a	...	0.9	15.6	11
	b	...	0.4	16.2	11
	c	...	0.2	15.3	15
3. Polyethylene bag, 200 gauge, no vents	a	...	0.7	12.8	7
	b	...	0.2	11.0	8
	c	...	0.2	12.0	8
4. M.S.T. (300) Cellulose film, no vents	a	...	3.0	15.2	9
	b	...	3.0	12.3	10
	c	...	3.4	12.0	12
5. Polyethylene bag, 200 gauge, 10 vents (60 mm.)	a	0.20	8.0	7.3	16
	b	...	4.5	12.5	18
	c	...	3.7	11.1	20
	d	...	4.8	11.4	20
6. Polyethylene bag, 200 gauge, 40 vents (30 mm.)	a	0.20	5.4	10.7	16
	b	...	4.0	11.7	18
	c	...	3.6	11.1	20
	d	...	5.2	9.1	22
7. Polyethylene bag, 200 gauge, 16 vents (60 mm.)	a	0.32	8.4	7.3	16
	b	...	5.4	10.2	18
	c	...	4.7	10.5	20
	d	...	6.3	9.2	22

* (a) No treatment

(b) Dipped for 1 minute in fungicidal wax emulsion

(c) Wiped and dipped for 1 minute in wax emulsion

(d) Wrapped in diphenyl paper

vents were practically similar to those obtained with 200 gauge polyethylene bags without vents.

There was no significant change in brix, acidity and brix-acid ratio, and there was no definite trend in the decrease of ascorbic acid content (11.7-18.0 mg./100 g. in stored fruit; 24.1 mg./100 g. in fresh juice).

Storage under cold storage condition: The data presented in Tables 2 and 4 show that oranges prepackaged in 100 gauge unventilated polyethylene bags, treated or otherwise, showed a high percentage of fungal decay at the end of 2½ months. There was a high build-up of carbon dioxide in unventilated bags. Spoilage was less in waxed or wiped-and-waxed fruits than in untreated ones. In bags having different degrees of ventilation, treated fruits showed a high percentage of spoilage at the end of 3½ months. Generally increasing the number of vents while maintaining the area constant, decreased the percentage of spoilage in both treated and untreated fruits. Cellulose film (MST 300) bags were not suitable for packaging because they gave way while handling and further they did not show any advantage over ventilated polyethylene bags.

TABLE 2: CUMULATIVE % WASTAGE OF PREPACKAGED ORANGES STORED AT 4-5°C WITH 85-90% RH.

Package	Treatment	Details of package			Cumulative wastage (%) after storage period (in months)							Shelf-life (months)
		No. of vents	Size of vents (diam. in mm.)	Per cent aeration	1.0	1.5	2.5	3.0	3.5	4.0	4.5	
100 gauge polyethylene bag, no vents	a	...	0.0	...	2.5	5.0	42.5	s	s	s	s	1.5
200 gauge polyethylene bag, ventilated	a	10	60	0.20	0.0	0.0	0.0	10.0	17.5	s	s	3.5
"	a	16	60	0.32	0.0	0.0	0.0	2.5	2.5	12.5	37.5	3.5
"	a	40	30	0.20	2.5	12.5	17.5	s	s	s	s	2.5
"	a	80	30	0.40	2.5	2.5	2.5	2.5	5.0	5.0	32.5	4.0
M.S.T. (300) cellulose film, ventilated	a	20	60	0.40	0.0	3.1	6.2	12.5	12.5	90.6	s	2.5
100 gauge polyethylene bag, no vents	b	0	0	...	...	0	3.8	81.3	s	s	s	2.5
" ventilated	b	10	60	0.20	0	0	0	40.0	s	s	s	2.5
"	b	16	60	0.32	0	0	20.5	25.0	s	s	s	2.5
"	b	40	30	0.20	0	0	0	10.0	22.5	s	s	3.0
"	b	80	30	0.40	0	0	0	12.5	32.5	s	s	2.5
M.S.T. (300) cellulose film, ventilated	b	20	60	0.40	0	0	6.1	15.1	33.0	s	s	2.5
100 gauge polyethylene bag, no vents	c	0	0	0	0	1.3	23.8	s	s	s	s	1.5
" ventilated	c	10	60	0.20	0	0	6.3	31.1	s	s	s	2.5
"	c	16	60	0.32	0	0	2.5	7.5	20.0	s	s	3.0
"	c	40	30	0.20	0	0	2.5	7.5	25.0	s	s	3.0
"	c	80	30	0.40	0	0	0	5.0	32.5	s	s	3.0
M.S.T. (300) cellulose film, ventilated	c	20	60	0.40	0	0	2.5	10.0	27.5	0.8	s	3.0
Polyethylene bag, ventilated	d	10	60	0.20	0	0	0	2.5	2.5	2.5	10.0	4.5
"	d	80	30	0.40	0	2.5	2.5	2.5	5.0	5.0	10.0	4.5
Control (in bamboo baskets)	a	...	...	100.00	0	2.3	2.3	s	s	s	s	2.5
"	b	...	...	100.00	0	0	4.4	4.4	11.5	53.8	82.0	3.0
"	c	...	...	100.00	2.0	2.0	4.9	4.9	12.0	34.5	s	3.0
"	d	...	...	100.00	10.0	10.0	10.0	12.2	12.2	12.2	21.3	3.0

(a) No treatment; (b) Waxed; (c) Wiped and waxed; (d) Wrapped in diphenyl paper;
 (s) Shrivelled—observation discontinued

TABLE 3: CUMULATIVE % PHYSIOLOGICAL LOSS IN WEIGHT OF PREPACKAGED ORANGES STORED AT 4-5°C AND 85-90% RH.

Package	Treatment	Details of package			Cumulative physiological loss in weight (%) Storage period in months							Shelf-life (month)
		No. of vents	Size of vents (in mm.)	Per cent of aeration	1.0	1.5	2.5	3.0	3.5	4.0	4.5	
Polyethylene bag, 100 gauge, no vents	a	0	...	0	0.2	0.9	1.0	...	...	...	...	1.5
" ventilated	a	10	60	0.20	0.7	1.8	2.6	3.5	4.4	...	...	3.5
"	a	16	60	0.32	0.7	1.9	3.4	4.5	5.2	6.5	7.8	3.5
"	a	40	30	0.20	1.2	2.1	3.7	...	...	...	...	2.5
"	a	80	30	0.40	1.6	2.7	4.3	5.5	6.5	7.7	8.6	4.0
M.S.T. (300) cellulose film, ventilated	a	20	60	0.40	1.2	3.2	6.0	8.7	11.2	15.5	...	2.5
Polyethylene bag, 100 gauge, no vents	b	0	0	0	0	0	0.9	1.0	...	...	...	2.5
" ventilated	b	10	60	0.20	1.1	2.0	2.8	3.8	...	...	...	2.5
"	b	16	60	0.32	1.5	2.0	4.4	5.6	...	...	...	2.5
"	b	40	30	0.20	1.6	2.8	4.0	5.2	6.0	...	...	3.0
"	b	80	30	0.40	2.0	3.3	5.4	7.1	8.0	...	...	2.5
M.S.T. (300) cellulose film, ventilated	b	20	60	0.40	2.0	4.3	8.0	11.6	13.3	...	...	2.5
Polyethylene bag, 100 gauge, no vents	c	0	0	0	0	0.9	0.9	...	...	...	...	1.5
"	c	10	60	0.20	1.2	2.0	3.4	4.9	...	...	...	2.5
"	c	16	60	0.32	1.8	3.2	5.3	6.9	8.0	...	...	3.0
"	c	40	30	0.20	1.4	2.7	4.2	6.1	7.0	...	...	3.0
"	c	80	30	0.40	1.8	3.4	5.4	7.5	9.6	...	...	3.0
M.S.T. (300) cellulose film, ventilated	c	20	60	0.40	2.3	4.5	7.5	10.6	12.6	...	...	3.0
Polyethylene bag	d	10	60	0.20	0.8	1.4	2.0	2.6	3.1	3.7	4.4	4.5
" ventilated	d	80	30	0.40	1.9	3.2	4.9	6.4	7.3	8.5	9.9	4.5
Control (in bamboo baskets)	a	...	...	100.00	7.4	9.3	13.9	...	...	...	...	2.5
"	b	...	...	100.00	3.9	9.0	9.4	13.7	16.3	21.0	25.1	3.0
"	c	...	...	100.00	2.3	4.8	8.3	12.7	13.4	14.7	...	3.0
"	d	...	...	100.00	2.2	5.5	7.5	12.4	13.8	15.4	17.7	3.0

(a) No treatment; (b) Waxed; (c) Wiped and waxed; (d) Wrapped in diphenyl paper

TABLE 4: YIELD AND COMPOSITION OF JUICE OF PREPACKAGED ORANGES STORED AT 4-5°C AND 85-90% RH.

Package	Details of package				Period of storage (months)	Yield of juice w/w (%)	Composition of juice			
	Treatment	No. of vents	Size of vents (in mm.)	Per cent of aeration			Brix	Acidity (% citric)	Brix/acid ratio	Ascorbic acid (mg/100 ml.)
100 gauge Polyethylene bag, no vents	a	0	0	0	2.5	46.32	12.0	0.67	17.9	30.29
„ ventilated	a	10	60	0.20	3.5	43.41	12.5	0.74	16.8	31.34
„	a	16	60	0.32	4.5	41.86	12.0	0.47	25.5	24.60
„	a	40	30	0.20	2.5	47.03	12.0	0.68	17.6	29.82
„	a	80	30	0.40	4.5	41.18	12.5	0.58	21.5	26.90
M.S.T. (300) cellulose film, ventilated	a	20	60	0.40	4.0	44.57	13.0	0.63	20.6	33.70
100 gauge Polyethylene bag, no vents	b	0	...	0.00	3.0	41.15	12.5	0.77	16.2	31.30
„ ventilated	b	10	60	0.2	3.0	45.64	12.5	0.67	18.6	25.40
„	b	16	60	0.32	3.5	46.67	13.0	0.77	16.9	31.43
„	b	40	30	0.20	3.5	45.46	12.0	0.73	16.4	26.68
„	b	80	30	0.40	3.5	42.15	12.0	0.69	17.4	29.73
M.S.T. (300) cellulose film, ventilated	b	20	60	0.40	3.5	40.15	12.5	0.68	18.3	30.16
100 gauge polyethylene bag, no vents	c	0	...	...	2.5	46.23	12.5	0.66	19.0	31.72
„ ventilated	c	10	60	0.20	3.0	42.68	12.5	0.72	17.3	27.98
„	c	16	60	0.32	3.5	40.69	13.0	0.62	20.9	25.03
„	c	40	60	0.20	3.5	37.17	13.0	0.65	20.0	29.20
„	c	80	30	0.40	3.5	40.17	13.0	0.64	20.3	28.62
M.S.T. (300) cellulose film, ventilated	c	20	60	0.40	...	na	na	na	na	na
Polyethylene bag, ventilated	d	10	60	0.20	4.5	40.80	12.0	0.46	26.1	23.17
„	d	80	30	0.40	4.5	43.22	13.0	0.54	24.1	25.36
Control (in bamboo baskets)	a	...	...	100.00	2.5	38.08	14.0	0.74	18.9	38.10
„	b	...	...	100.00	4.5	32.44	13.5	0.54	25.0	18.50
„	c	...	...	100.00	...	na	na	na	na	na
„	d	...	...	100.00	4.5	29.92	14.5	0.51	na	22.52
Fresh oranges	Initial	...	...	...	Fresh	45.60	9.5	0.30	31.50	24.10

(a) No treatment;

(b) Waxed;

(c) Wiped and waxed;

(d) Wrapped in diphenyl paper

(na) Observation not record

In the case of fruits wrapped with diphenyl paper and kept in polyethylene bags of 10 and 80 vents, the wastage was 2.5 and 5 per cent respectively at the end of 4 months' storage; it increased to about 10 per cent in both cases by the end of 4½ months. In all other treatments spoilage exceeded 10 per cent within a much shorter period. Unpackaged control fruits dipped in wax or wrapped in diphenyl-treated paper, and in bamboo baskets showed a spoilage of 82.0 per cent and 21.3 per cent respectively at the end of 4½ months. Untreated fruits without any packaging could not be kept for more than 2½ months, as they showed shrivelling and became unmarketable. Treated fruits had a shelf-life of 3 months. The physiological loss was the least in polyethylene bags with no vents, irrespective of treatment (Table 3). Both treated and untreated fruits in ventilated bags suffered less

PLW than controls. At the end of 4 months' storage, diphenyl wrapped fruits in ventilated bags showed a PLW of 3.7 to 8.5 per cent as against 15.4 per cent in control.

There was no significant variation in the juice yield of treated fruits stored in ventilated bags (Table 4).

In the case of fruits wrapped with diphenyl paper and packaged in ventilated polyethylene bags of 10 and 80 vents, the yield of juice was as high as 40.8 and 43.2 per cent respectively at the end of 4½ months, while in the control lot with diphenyl wrap but without packaging it was 29.9 per cent only. The yield of juice from fresh fruit was 45.6 per cent.

There was a general increase in the brix as well as in the acidity of juice in all treatments, due to the desiccation of fruits. There was no appreciable change in the ascorbic acid content.

Unpackaged control fruits had a shrivelled appearance. Fruits kept in 100 gauge polyethylene bags had the best appearance, followed closely by fruits wrapped with diphenyl treated paper and kept in ventilated bags.

Fruits wrapped in diphenyl paper and stored in ventilated bags were adjudged to be the best in taste and flavour. Fruits kept in 100 gauge polyethylene bags were inferior in taste and flavour.

Acknowledgement

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Chemical Composition of Cardamom

Systematic data on the chemical composition of cardamom grown in different regions in the country are presented in this note.

Samples of cardamom were obtained on a randomised basis from various estates in Mudigere, Coorg, Yercaud, Nelliampathys, Palanis, Kerala and Tirunelveli. They were analysed for moisture, volatile oil, ash, alkalinity of ash, water-soluble ash, acid-insoluble ash, non-volatile ether extract, crude fibre, crude protein and starch. Analyses of seeds and husk were carried out separately, using samples passing through 30-mesh sieve. Volatile oil and moisture estimations were done immediately after powdering. The methods of the American Spice Trade Association¹ were adopted for the analysis. The data are given in Table 1.

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Reference

1. Methods of Analysis, 1960. American Spice Trade Association, New York.

TABLE 1: CHEMICAL ANALYSIS OF CARDAMOM

Region of growth	Material	Moisture %	Weight 100 g. cardamom	Volatile oil % v/w	Total ash %	Alkalinity K ₂ O/100 g.	Water-soluble ash %	Acid-insoluble ash %	Non-volatile ether extract %	Crude fibre %	Crude protein % N × 6.25	Starch (by acid hydrolysis) %
Mudigere (3 samples)	Seeds	8.0-10.0	72.0-74.5	8.0	4.7-6.2	0.8-2.1	2.6-3.7	1.0-1.4	2.0-3.6	6.9-9.8	8.8-11.3	47.0-48.0
	Husk	6.9-9.5	25.5-28.0	...	16.2-16.7	5.6-6.9	12.6-13.6	nil	1.5-2.3	29.0-31.2	3.3-4.2	...
Coorg (2 samples)	Seeds	8.5-9.0	72.5-73.5	7.5-8.8	4.6-5.8	0.68-0.8	2.3-2.5	1.1-1.9	2.2-3.1	6.7-8.7	10.5	47.7-48.0
	Husk	9.8-9.8	26.5-27.5	...	15.9-17.1	4.9-6.1	11.0-12.3	0.0-0.14	1.7-2.4	27.0-28.3	4.7-4.75	...
Wynad (2 samples)	Seeds	8.0	71.0-74.0	9.0	4.1-4.6	0.7-0.8	2.1-2.4	0.4-1.0	2.5-3.7	9.9-10.1	10.25	48.0-50.0
	Husk	7.5-8.2	26.0-29.0	...	13.4	3.8-4.0	8.6-11.0	0.0-0.14	3.0-3.5	25.8-29.9	3.3-3.8	...
Nelliampathys (3 samples)	Seeds	7.0-9.0	69.0-74.0	8.5-10.5	4.5-5.4	0.7-1.3	2.3-3.7	0.4-1.2	2.5-3.5	9.5-12.8	10.7-11.5	43.0-46.0
	Husk	7.5-12.2	26.0-31.0	...	12.8-19.5	4.4-6.1	8.3-16.5	0.0-0.1	1.9-2.9	28.7-31.5	3.4-4.8	...
Palanis (2 samples)	Seeds	7.0-9.5	76.0	5.5-7.0	3.8-4.5	0.4-0.7	1.3-1.7	1.3-1.6	2.8-2.9	8.3-9.0	7.0-9.1	41.8-43.5
	Husk	8.9-10.2	24.0	...	16.1-17.4	6.0-6.8	11.0-13.4	nil	2.2-2.5	28.0-38.2	3.5-4.5	...
Kerala (2 samples)	Seeds	8.0-9.0	62.0-72.0	7.5-10.0	4.9-6.0	0.6-2.4	1.7-4.9	0.4-1.7	2.2-2.4	8.4-9.3	9.7-14.0	39.1-43.7
	Husk	8.8-8.9	28.0-38.0	...	13.5-15.1	5.0-5.2	9.9-10.8	nil	2.1-2.4	29.1-30.9	4.1-5.3	...
Yercaud (1 sample)	Seeds	7.0	73.0	9.0	4.3	0.7	2.1	0.9	2.4	7.0	9.8	45.5
	Husk	8.9	27.0	...	14.8	4.6	11.0	0.04	2.4	29.5	4.3	...
Tirunelveli (1 sample)	Seeds	8.5	67.0	10.0	5.4	1.2	3.9	0.4	4.5	11.7	10.5	44.1
	Husk	9.4	33.0	...	12.5	4.2	8.6	nil	2.6	28.0	5.3	...
	Max.	10.0	76.0	10.5	6.9	4.4	5.0	1.9	4.5	12.8	14.0	49.9
	Min.	7.0	62.0	5.5	3.8	0.4	1.3	0.4	2.0	6.7	7.0	39.0
	Average	8.3	71.9	8.3	5.0	1.1	2.7	1.1	2.9	9.2	10.3	45.4
	Max.	12.2	38.0	...	19.5	6.9	13.6	0.1	3.5	31.5	5.3	...
	Min.	7.0	24.0	...	12.5	3.8	8.3	nil	1.5	25.8	3.3	...
	Average	8.9	28.1	...	15.3	5.1	11.4	0.05	2.4	29.0	4.2	...

Science and India's Food Problem

The 3-day symposium on 'Science and India's Food Problem', organised jointly by the National Institute of Sciences and the Indian Council of Agricultural Research was inaugurated on 6th October 1967 by Dr D. R. Gadgil, Deputy Chairman, Planning Commission. Over 100 scientists from different parts of the country participated in the symposium. Eighty-one papers were presented.

Dr Gadgil called for closer relation between scientific research and development plans. He felt that at present Indian scientists 'have not been involved deeply enough in the problems of their environment' and added that in each of the steps of plan formulation and implementation, the contribution of the scientific community was of crucial importance. Dr Gadgil said that a solution of the problem of continuously increasing the agricultural production depended fundamentally on the work of scientists.

The first session of the symposium was devoted to the discussion of the various aspects of the protein, land and water resources, population growth, increase in livestock population, food needs in relation to quantity and quality of foods, and so on. 'Meeting the challenge with the aid of science' was the theme of the second session. Papers on fuller utilization of land resources, including extension of cultivated areas, reclamation of saline, alkaline and other waste lands, utilisation of irrigation potential, measures to fight droughts, introduction of multiple cropping and intensified use of science and technology for improving crop production and crop protection were considered at this session. Conservation and processing of food-stuffs and development and manufacture of high protein foods were also discussed.

The third and the last session of the symposium discussed planning in relation to food production and laid down guide lines for future research. Papers on the place of co-operative research in achieving greater agricultural productivity, personnel and organisation for agricultural research, education and extension, resource planning and utilization, crop and animal sciences research, and role of agricultural education in increasing agricultural production were discussed at this session.

Scientists, who participated in the discussion, felt that the challenge to achieve self-sufficiency in food

through increased production can be met. The country had the basic natural resources, soil, water, climate and labour for meeting the challenge and production can at least be doubled, if full use is made of the resources. Among the measures suggested for increasing production were multiple cropping with suitable cropping patterns, reclamation of saline and inundated waste land, utilization of non-conventional foods for human consumption and better utilization of irrigation potentials.

Nutrition experts observed, that inadequacies in Indian dietaries were not only quantitative but also qualitative leading to a high incidence of both under-nutrition and malnutrition. It was stated that though vegetable foods in suitable combination could provide proteins of satisfactory nutritive value, a good diet should include at least some quantity of animal protein. Exploitation of the country's vast marine resources, greater emphasis on the production and utilisation of fruits, leafy vegetables and tuber crops, and improvement of milk production were suggested.

In this connection, it was mentioned that a wheat variety with as much as 5 per cent lysine, had been evolved. It was reported that high yield and high quality were being combined in the new varieties of cereals and millets that have been evolved in various research stations.

It was suggested that use could be made of atomic energy for desalination of brackish water for irrigation purposes. The country had limited water resources and could well follow the example of Israel in solving this problem.

The need for the creation of extension agencies to take the fruits of scientific research to farmers was stressed at the symposium. The ICAR proposes to carry out 'co-ordinated projects' on a national basis for crop improvement.

Dr T. R. Seshadri, president of the National Institute of Sciences of India, in his concluding remarks regretted that although Indian scientists had done valuable research work, the results of their efforts had not been fully exploited for the benefit of the country because of complex political, social and administrative pressures.

K. K. IYA

Eleventh Indian Standards Convention, Chandigarh

DRIVE FOR IMPLEMENTATION OF STANDARDS—CONSUMER PROTECTION—QUALITY CONTROL

The Eleventh Indian Standards Convention (Chandigarh, 25-30 Sept. 1967) organised by the Indian Standards Institution brought into sharp focus the role of standardization in accelerating the pace of industrialization in the country and in promoting export trade. The Convention highlighted the need for implementing the Indian standards in the interests of economic development and for fighting the current recession in industry.

About 600 delegates from scientific, technical and research organizations, public and private undertakings, Government departments and local bodies attended the Convention.

The Convention was presided over by Shri K. V. Raghunatha Reddy, Union Minister of State for Industrial Development and Company Affairs, and was inaugurated by Dr M. S. Randhawa, Chief Commissioner of Union Territory of Chandigarh.

Shri K. V. Raghunatha Reddy observed that standardization was the starting point both for interchangeability and mass production which, in turn, formed the basis of automation. A developing country like India could forge ahead only through increased productivity which was dependent on standardization of materials used, processes adopted and goods produced. India was today faced with the urgent

need for a substantial increase in agricultural production. In this, standardization could make significant contributions. The quality of products mattered both in internal and overseas markets. Owing, however, to short supply of goods, there was a sellers' market obtaining in the country, as a result of which manufacturers had a tendency to by-pass the codes of conduct in regard to quality. Shri Reddy stressed the need for protecting consumers' interest.

Dr M. S. Randhawa pointed out that the preparation of standards was not the be-all and end-all of standardization; the implementation of standards was equally important for achieving the national objectives of improving both industrial productivity and the quality of products. The Certification Marks Scheme of ISI, which provided a third-party guarantee to purchasers, could create confidence in consumers and go a long way in furthering standardization and quality control.

ISI fellowships were awarded on the occasion to 66 scientists, engineers and others in recognition of their contributions to the development and promotion of standardization in different spheres of trade and industry. The K. L. Moudgill Prize for the year was awarded to Dr A. N. Ghosh, Director General of ISI for his services to the cause of standardization in the country.

Deleterious Natural Products in Foods and Feeds

Speaker: F. M. STRONG

Professor of Biochemistry, University of Wisconsin, Madison, Wisconsin, U.S.A.

Many plant and animal materials commonly used as food, contain substances harmful to people or animals that consume them^{1,2}. These substances may be natural components of foods or they may be introduced as a result of microbial contamination. Accidental contamination resulting from the use of agricultural pesticides, and chemicals added intentionally as preservatives or for other purposes, will not be considered in this talk. Acutely toxic materials will also not be considered, since they are less important from the public health standpoint than those which produce their effects in a slower, less obvious manner. Well known examples of the latter type include cholesterol and saturated fats in relation to atherosclerosis, aflatoxin as an insidious carcinogen, and *Lathyrus sativus* (Khesari dal) as the causative agent of human neurolathyrism.

Amino Nitrites and Amino Acids

Lathyrus odoratus (*flowering sweet pea*) seed meal, when fed to weanling rats or two day-old chicks or turkey poultry produces gross skeletal abnormalities and in many of the animals, death may occur due to aortic rupture. The causative agent, β -amino propionitrile (BAPN), occurs in the seeds as the γ -N-glutamyl derivative, which is hydrolysed *in vivo* to free BAPN. It is detoxified *in vivo* by conversion to cyanoacetic acid through the action of monoamine oxidase (MAO). Simultaneous feeding of BAPN and an MAO inhibitor, such as *Marsilid* (isonicotinyl isopropyl-hydrazine phosphate) greatly enhances the toxic effects because of interference with the detoxification mechanism.

BAPN acts by preventing the formation of normal cross linkages in collagen and elastin, thus weakening the connective tissues of the animal body. Cross linkages in elastin require the formation of demosine and isodesmosine from lysine, and BAPN has been shown to inhibit this process³.

Another toxic nitrile is β -cyanoalanine which occurs in the common vetch, *Vicia sativa*, and

accounts for the deleterious effects in poultry and other livestock following consumption of this plant. *Lathyrus latifolius* and several other *Lathyrus* species contain α, γ -diamino butyric acid, a neurotoxin. Human lathyrism is probably caused by oxalyldiaminopropionic acid present in *Lathyrus sativus*⁴. A related toxic amino acid, β -methylamino-alanine, occurs in the cycad nut, a source of starchy food for people in the Pacific Islands area⁵.

The most recently discovered natural product of this type is present in linseed meal, a high-protein animal feed which has been reported to induce symptoms of vitamin B₆ deficiency. This toxin is 1-(γ -N-glutamyl) amino-D-proline (linatine⁶). The corresponding free 1-amino-D-proline presumably formed by hydrolysis *in vivo*, readily complexes pyridoxal phosphate. Its effects are nullified by the simultaneous administration of vitamin B₆.

Sympathomimetic Amines

Tyramine, histamine, serotonin, norepinephrine, dopamine and related pressor amines are present in relatively large amounts in various fruits (pineapple, banana, tomato) and fermented foods (cheese, wine, beer, sauerkraut). Recent reports of hypertensive crises in mental patients receiving tranquilizer drugs, such as Parnate, have led to the discovery that such crises follow the consumption of food containing pressor amines. The explanation appears to be that many of the tranquilizers are MAO inhibitors and hence interfere with detoxification of the amines^{1,2}.

Carcinogens

Aflatoxin represents the best publicized example of a carcinogenic natural product. Another such compound is cycasin, the glucoside of methyl-azoxy methanol (MAM). This natural component of the cycad nut is hydrolyzed *in vivo* to release the active toxin, in this case the free aglycone, MAM. Feeding of cycasin to weanling rats results in the production of kidney

neoplasms in nearly all of the animals⁷. The substance favourably acts as an alkylating agent since *in vitro* treatment of nucleic acids with cycasin under physiological conditions of temperature and pH leads to the formation of 7-methylguanine⁸. The tumours produced are similar in type and distribution to those caused by nitrosoamines, and both agents probably act through the intermediate formation of diazomethane.

Luteoskyrin, a toxic pigment produced by *Penicillium islandicum* growing on moldy rice, has been reported to cause liver damage and tumours in mice fed on low protein diet based on rice. Similarly treated animals were not affected when they were maintained on a normal stock diet⁹.

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Clostridium perfringens (Welchii) as a Food Poisoning Agent

Speaker: DOROTHY W. STRONG

Department of Foods and Nutrition, University of Wisconsin, Madison, Wisconsin, U.S.A.

There appears to be an upsurge of interest in the study of bacterial food poisons in the United States. This has probably been necessitated by certain changes in the preparation and processing of foods both for individual families and for group feeding. For example, at the present time, many food preparations pass through processing plants and the products reach the consumer in a ready-to-eat condition. In the preparation of such foods, an unknown number of persons will have been involved, and this by itself creates food sanitation problems; and frequently, the human being is a source of food contamination.

Organisms for which particular concern is felt include *Clostridium botulinum* and the *Staphylococci*, enteropathogenic *Escherichia coli*, *Streptococci* and *Clostridium perfringens* (Welchii).

The problems of bacterial food poisoning in India may be, and probably are, quite different from those in the United States. Among obvious reasons is the difference in procedures for the preparation of food for table use, and the incorporation of large quantities of spices which may have bactericidal properties. It should be emphasized, however, that the problems of diarrhoea does exist in India and in some instances, the diarrhoeas may have their origin in contaminated food. Furthermore, India may have certain problems of food contamination which are

unique. An examination of the bacterial quality of food as eaten by the people might be beneficial.

In order to assess the true status of food-borne illnesses it is necessary to have ordinances, with the force of laws, which regulate the reporting of illnesses presumed to be caused by processed food to appropriate public health authorities. This procedure permits both proper investigation and accurate statistics.

Clostridium perfringens (Welchii) food poisoning is well recognized in England since the report of Hobbs and associates in 1953. It has been receiving increasing attention in other countries, including the United States.

Inherent in the present work is the need for a means of securing improved sporulation of cultures and a means of determining the food poisoning potential of a given strain for human beings.

A medium which has been developed and which shows improved sporulation for some strains of *Cl. perfringens* has the following formula:

	%
Yeast extract	0.4
Proteose peptone	1.5
Starch	0.4
Sodium thioglycollate	0.1
Na ₂ HPO ₄ 7H ₂ O	1.0

For certain strains, a further improvement in sporulation is realized if 1 per cent of activated carbon is added to the medium.

An attempt has been made to utilize the technique described by De and Chatterji in their study of the cholera organism. It involves the injection of the test substance into a loop of the ileum of a young rabbit, which has been isolated by ligation and exposed.

The objective was to determine if by the use of this procedure, potentially food-poisoning *C. perfringens* could be identified in contrast to non food-poisoning groups. To date, it appears that *C. perfringens*

strains recovered from foods presumed to have caused poisoning are more likely to give a positive result in ligatured ileum loop than strains which do not have such a history. This is true if the organisms from both groups have been cultured by one passage through skim milk medium. A positive result under this condition must be looked upon as a presumption only since it has been further shown that the manipulation history of the strain influences the final outcome of the test. The latter observation suggests that under circumscribed conditions any strain of *C. perfringens* may conceivably become a cause for human illness.

Volatile Substances from Black Tea

Speaker: DR S. A. KOZHIN

Leningrad University, Leningrad, U.S.S.R.

The study on chemical nature of tea aroma is an important problem for tea industry because the flavour is the most valuable factor for quality of tea. The solving of this problem is essential for controlling the changes of volatile substances during tea manufacture from tea leaves.

Volatile substances from Georgian black tea were examined by gas liquid chromatography (GLC). Two methods of isolating the mixture of volatile substances from black tea were compared in the first stage of our work i.e., steam distillation and sweeping the volatiles with gas. Steam distillation was carried out in modified Clevenger apparatus and the volatile substances trapped in cold ether. The ethereal solutions of essential oils were concentrated and analysed by GLC. In the second method helium was passed through the freshly made hot brew of black tea at 70-80°C. The swept volatiles were condensed in cold ether traps. The ethereal solutions were concentrated and analysed. Comparison of the two methods showed that both of them gave similar results but the number of peaks was comparatively greater using steam distillation. It is important to mention that some of the higher boiling substances could be caught only by steam distillation. Hence we used the simpler procedure of steam distillation of black tea. Model UC-1, with thermal conductivity detector was used for GLC analyses. Several columns (not less than two), packed with different stationary liquid phases/Reoplex 400, polymethylphenylsiloxane, Hyprose, Tween 40 and hexakis (B-cyanoethoxy) hexan/, at the temperatures 120° and 180°C were used for identification of tea volatile components.

There were found at least 50 volatile substances which were constituents of essential oil from black tea. The following 10 compounds were identified by us in essential oil from black tea for the first time, namely: oenantaldehyde, n-amyl alcohol, borneol, 1-terpineol, methyl valerate, iso-amyl formate, n-amyl acetate, bornyl acetate, geranyl acetate and phenyl ethyl acetate.

Besides that we could confirm the presence of 20 other substances which were found among volatile components of essential oils of black tea by previous authors: n-butyraldehyde, iso-butyraldehyde, n-valeraldehyde, iso-valeraldehyde, capronaldehyde, benzaldehyde, salicylaldehyde, acetophenone, isoamyl alcohol, n-hexyl alcohol, benzyl alcohol, phenyl ethyl alcohol, geraniol, linalool, linalooloxide (trans), linalooloxide (cis), cis-3-hexen-1-ol, ethyl acetate, benzyl acetate and methyl salicylate.

All the substances mentioned were identified on the basis of the relative retention time coincidence with authentic compounds using two or more columns. Some chemical reactions were applied together with gas chromatographic technique for detecting some components from tea essential oil, namely acetylation of alcohols, saponification of esters and reaction of carbonyl compounds with 2, 4-dinitrophenylhydrazine. The comparison of the chromatograms of tea essential oil before and after such reactions allowed us to confirm the presence of 10 of the above mentioned alcohols, 5 esters and 2 aldehydes. Some suggestions were also made concerning chemical nature of unidentified peaks on the basis of chemical reactions. We could not confirm the presence of some substances mentioned in literature in Georgian black tea.

Growth Depressing Factors in Groundnut

Speaker: DR. K. ANANTHARAMAN

Broodbank Fellow, School of Agriculture, University of Cambridge, Cambridge

The presence of trypsin inhibitor activity in groundnut was reported as early as 1948 by Borchers. Later it was shown that moderate heat treatment resulted in improvement of the nutritive value of the protein. In 1963 Czechoslovakian workers reported on the presence of a protease inhibitor in the groundnut red skin. In order to determine the nature of these factors nutritional studies using groundnut skin added to other protein diets, were initiated by Anantharaman and Carpenter. Dr Anantharaman presented data secured in the above investigations.

Supplements of raw skin (groundnut) resulted in growth depression and lowered PER in rats and chicks maintained on a soya diet. Aqueous (pH 3.0) and alcoholic extracts of groundnut skin were shown to have trypsin inhibitor in *in vitro* studies. Pancreatic hypertrophy in animals given the skin supplement was observed. Pancreatic hypertrophy is usually associated with the presence of trypsin inhibitors in the meal. The factor (s) in groundnut skin responsible for the growth depression was shown to be partly heat labile and was acid soluble. The presence of tannins and

polyphenols in the raw skin is known and hence further studies were carried out on the effect of gallic acid (derived from tannin).

In rats given supplements of gallic acid or high amounts of the raw skin, urinary excretion of 4.0 methyl gallic acid was observed. The speaker pointed out that this resulted in an increased requirement for 'methyl' groups, and possibly of methionine. The fact that growth depression caused by the skin supplement could be reversed by supplemental methionine corroborated the above findings. It was also pointed out during the discussion that in pancreatic hypertrophy more methionine is excreted and another factor could be responsible for growth depression observed and that the trypsin inhibitor activity of the aqueous and alcoholic extracts were of a non-specific nature.

The speaker stressed that the presence of tannins was not restricted to groundnut skin and that high content of tannins was observed in several batches of sorghum they had preliminarily screened and that further investigations were warranted.

Utilization of poor vegetable proteins at high levels of feeding

Speaker: DR. K. ANANTHA VARMA

Equations developed by Miller and Payne for prediction of the protein value of diets from analytical data require the expression of the protein content of the diet as proportion of total metabolizable energy coming from proteins. The prediction equations were developed based on the data obtained for wheat gluten, beef and casein at different levels of protein intake. Values calculated for a number of human diets by the proposed equation were comparable to those obtained by actual rat assay. However, in studies carried out in Cambridge in 1965 it was shown that chicks fed on diets containing high levels of groundnut flour grew faster than expected from the formulas of Miller and Payne.

With a view to analyse the cause of the differences between predicted and actual results, 'P' values (per cent of dietary metabolizable energy from protein) were determined using rats and chicks fed diets based on wheat gluten, groundnut protein, egg or a practical mixed ration for a 10 day period. Control groups received a N-free diet. Carcass nitrogen determinations were made at the end of the period and the values used for calculation of net nitrogen utilization. Pro-

jections were made of the determined values and the predicted values obtained by Miller Paynes equation.

The predicted values were at gross variance with the determined values; the determined values also did not fit the prediction equation of Morrison and co-workers.

Using male chicks from a strain selected for rapid growth, a value of 19.1 for NDP-Cal. per cent was obtained for the practical mixed ration. This observation was also contradictory to the findings of Miller and Payne, who predicted a maximum value of 14.6 per cent for NDP-Cal. per cent for any species with any diet. Also differences in the dietary value of proteins as shown by NDP-Cal. per cent differed in different species. According to Miller and Payne the dietary value of a protein is independent of the species used for experimentation.

Published data also indicate that poor proteins at higher levels of feeding give nitrogen retention greater than predicted by Miller and Payne. On the basis of the evidence, it appeared that the prediction equations of Miller and Payne require further modification.

Book Review

Ice Cream: By W. S. ARBUCKLE (AVI Publishing Company, Inc., Westport, Connecticut, U.S.A.), 1966, pp. X+403. Price: \$ 12.50

The present volume, which is the second revised and enlarged edition of a well known book, deals with some important general subjects previously covered in the first edition. The information on the rapid changes which the ice-cream-industry has been experiencing presently, as well as the data on the process of ice-cream manufacture make the book educative and instructive.

The book with 23 chapters covers a wide range of subjects from the early history of ice-cream industry to the importance of ice-cream as a nutritious food, classification, new formulas, composition and properties, standards, mixes and their calculations, ingredients, process of manufacture, sanitation and quality control, laboratory tests, sales promotion, etc. The book would serve as a useful compendium for reference and also as a text book for students and teachers of dairy technology.

The book is well illustrated. It includes a chapter on reference material, and a detailed index with selected bibliographies under each chapter.

C. P. ANANTHAKRISHNAN

Potato Processing: By W. F. TALBURT AND O. SMITH, (AVI) Publishing Co., Inc., Connecticut, U.S.A. 1967, pp. 588, 73 tables and 133 figures, price \$17.

The second revised and enlarged edition of 'Potato Processing' is a welcome addition to the series of books on food processing published by A.V.I. Besides revising the subject matter of the twenty chapters and providing references to the most significant articles published up to April 1966, an additional chapter dealing with 'waste disposal' has been included, which summarizes information on potato processing, effluents and their treatment.

Eminent experts in the field of potato technology have written various sections covering all phases of potato processing, including detailed descriptions of processing procedures for all types of frozen, dehydrated canned and fried products, a complete discussion of raw materials storage problems, methods for selection of potatoes for processing, a thorough treatment of storage diseases, an evaluation of most important

potato varieties and detailed treatment of nutritive value of potatoes. Also included in the subject matter are details of pre-peeled potatoes and miscellaneous products like salad, soup, pancakes, chipbars, confections, nuts, puffs and some fermented products like alcohol and lactic acid.

Throughout the book copious use is made of illustrative figures. The style is lucid and easy to understand. While original references given at the end of each chapter and subject index at the end of the volume are very useful, inclusion of an author index would have enhanced the value of the book.

The volume is a most valuable reference book for those directly engaged in any type of potato processing. It is also useful as a text book for college courses covering the handling, storage and utilisation of potatoes.

B. S. BHATIA

Bulletin of the International Institute of Refrigeration, Boulevard Malesherbes, Paris 17, France. Annex 1965-1. pp. 262. 177.

The Bulletin includes 26 papers from 9 different countries presented at the meetings of Commission-4 of the International Institute of Refrigeration in 1965 (19 to 21 May) at Karlsruhe. They are grouped under three sections: (i) prepacked meat, (ii) eggs and (iii) poultry.

(i) The investigations reported in the section on prepacked meat relate to technological and microbial problems. It is pointed out that keeping the temperature of meat as low as possible without freezing would help in reducing moisture loss by evaporation or exudation. A storage temperature of -1°C (30°F) is recommended in preference to 4°C (40°F), to check evaporation loss, maintain good colour, and restrain microbial contaminations. The possibility of storing meat at -2°C (28°F) is also discussed.

Most of the fresh meat distributed in U.S.A. is prepackaged. Investigations have shown that with proper refrigeration and good sanitation practices, meat can have a shelf life of 7 days. The recommended temperatures are: (a) carcass meat in storage cooler, $30-33^{\circ}\text{F}$; (b) processing area, $32-40^{\circ}\text{F}$; (c) selection cooler, $30-33^{\circ}\text{F}$; (d) refrigerated truck, $28-31^{\circ}\text{F}$; (e) store cooler $31-33^{\circ}\text{F}$; (f) and retail display cases $29-32^{\circ}\text{F}$.

The film material and storage conditions should be carefully selected in order to secure good meat quality. Various pasteurization techniques, such as heat treatment and irradiation, to check microbial growth and to avoid spoilage of prepacked meat, have been discussed.

(ii) The papers on egg and egg products relate to various aspects of pasteurization, surface treatment of shell eggs, and physico-chemical and bacteriological changes in eggs and egg products during handling, storage and transport. It is reported that by heating liquid whole egg to 64.4°C (148°F) for 2.5 min. and liquid egg white to 57°C (134.6°F) for 2 min. *Salmonella* can be destroyed. Conalbumen is unstable when modified liquid egg white (which withstands heating to high temperature) is heated for 3.5 to 4 minutes at 60-62°C (140-143.6°F) at pH 6.6 to 7. Addition of aluminium sulphate-lactic acid solution stabilizes egg white and permits pasteurization at 60-61°C (140-141.8°F) without much change in functional properties.

Treatment of shell eggs with mineral oil containing gordecin is recommended for improving storage stability. Sodium silicate and mineral oil type industrial oil 50 SU are used for closing shell pores. Wax coating of eggs and sterilization with formaldehyde vapour are helpful in prolonging the storage life of shell eggs at different temperatures. Studies conducted to determine the influence of packaging on egg quality have shown that cellophane MSAT is more suitable than cellophane ISAT and MXT. The differences in taste between eggs packed in cartons without over wrap and in cartons wrapped with cellophane MSAT was highly significant after storing for 10 days at 15°C (59°F).

(iii) Processing, freezing and microbiological aspects of dressed poultry have been discussed in the third section. The influence of scalding temperature, chilling method and packaging on the quality of the final product have been discussed. Recent developments in the use of refrigeration in the British poultry industry and the influence of freezing on the quality of poultry meat have been also dealt with. The importance of avoiding contamination of chicken during processing is emphasised. The addition of 200 p.p.m., chlorine to chill tanks provides an effective means of destroying bacteria.

The bulletin will prove useful to scientists, teachers and students engaged in the area of processing, preservation and marketing of meat, eggs and poultry.

B. PANDA

Toxicants Occurring Naturally in Foods (Food Protection Committee, Food and Nutrition Board, Publication No. 1354, 1966, National Academy of Science, National Research Council, Washington, DC, U.S.A.), pp. 301.

The Public Health authorities are well aware of the adventitious poisons in foods, like pesticides or toxins produced by microorganisms but the knowledge of toxins inherent in foodstuffs is not so widespread. The reason is that while most of the adventitious poisons have immediate or spectacular effects, the toxins present in food stuffs as natural constituents do not have any immediate effect because of the low concentration. Often they are cumulative and slow acting. In many cases the knowledge of the presence of these has been accumulated over the years by the slow process of cause and effect correlations. Man has learnt in a painful way over long years, which plants to avoid and how best to use plants which do have toxins. But the more dangerous are those toxins which are in minute quantities but which exert cumulative effects when ingested over long periods. To this group belong the neurotoxins like lathrogens or the fungal toxin like aflatoxin. While knowledge of health hazards from pesticides and other poisons entering food by artificial contamination has grown vastly, the knowledge of toxins naturally occurring in foodstuff is still meagre and only in research papers. The book under review is an eminently informative contribution which has attempted to overcome this lacuna.

The toxins occurring in foods have been conveniently divided into several categories based on the physiological effects—goitrogens, estrogens, tumorigens, carcinogens, lathrogens, etc. Other toxins present in foods like, hemagglutinins, cyanogenetic glycosides, gossypol, oxalate and nitrites are also dealt with. The book is mainly concerned with naturally occurring toxins in foods. But discussion on topics like aflatoxin, toxicity of vitamins, excess of indispensable amino acids and toxicity of essential minerals, have also been included.

Most of the sections are very brief but are followed by an extensive bibliography covering recent literature. The object is apparently to stimulate the interest of the research worker and provide him enough literature citations to extend his knowledge. As a result of this brief treatment it has been possible to cover as many as 26 groups of toxins within the short space of 285 pages. An introduction at the beginning and discussion by J. M. Coon at the end provide the reader with information on the *raison d'etre* of the monograph. An index at the end completes the book.

This is a very useful and informative volume which should find a place on the shelves of the food scientist, nutritionist and the research worker in this field.

M. R. CHANDRASEKHARA

Studies on Cold Storage of Fruit and Vegetables including controlled atmosphere storage: Issued by International Institute of Refrigeration, Paris, pp. 673.

This publication contains the papers (and the relevant discussions) presented at meetings of Commissions 4 and 5 of the International Institute of Refrigeration held at Bologna, Italy, during June 4-10, 1966.

The publication is divided into 4 sections. Section 1 deals with controlled atmosphere storage of fruit and vegetables, section 2 with influence of pre-storage treatment upon the refrigerated behaviour of fruit and vegetables, section 3 with topical problems concerning the refrigerated storage of fruit and vegetables and section 4 with various aspects concerning cold stores, ice-making plant, quick-freezing and cooling of meat.

Publication contains 77 papers. The gist of 10 randomly-selected papers are given here. G. Goidanic has traced the phenomenal increase in controlled atmosphere storage capacity in Italy from 1959 to 1965. J. C. Fidler and G. Mann have reviewed the progress made by the controlled atmosphere storage industry in United Kingdom during the last 35 years. W. W. Boyes has shown that, for the removal of field heat, precooling of Waltham Cross grapes should be done at the centre of production rather than at the Cape Town Harbour, which is the port of export for South African grapes. A. Cessari and G. Paltrinieri have shown that oxygen is more efficient than ethylene for the de-greening of Washington Navel oranges. L. Van Den Breg and C. P. Lentz have reported that in the long-term storage at 32-34°F of fresh carrot and cabbage, decay, weight loss and changes in quality were less when the relative humidity was maintained at 98-100 per cent as compared to a lower level, i.e., 90-95 per cent. I. Malinowska and collaborators found that among the factors determining the stability of quality of frozen strawberries during freeze-storage, variety of fruit was of primary importance and the freezing rate only of secondary importance. V. M. Chernishev reported that solutions containing glycerol have a definite beneficial action on the quality of frozen grapes and plums. I. Saerberunn has dealt with the advantages of a pre-fabricated cold store over the conventional type. P. Clement has described the various problems encountered in the quick-cooling of meat. J. Mlynarczyk has pointed out the possibility of using

the evaporators and fans of existing freezing tunnels for fluidized freezing processes.

This publication should be considered as an excellent source of reference for workers in the field of refrigerated storage of fruits and vegetables.

P. B. MATHUR

Meat Hand Book: By ALBERT LEVIE, AVI Publishing Co. Inc., Connecticut, U.S.A., 1967, pp. 326. Price \$10.0.

The revised edition of the Meat Handbook covers the full product cycle from livestock to cut steak and other processed products and deals with beef, pork and lamb. There are 18 chapters dealing with livestock production, slaughter inspection, grading, merchandising, handling, storing and cooking. In each chapter, practical aspects of the meat business have been well emphasised. Today meat is America's third largest industry, next to steel and automobiles. Annual sales of product exceeds eighteen billion dollars (1350 crores of rupees).

The slaughtering of livestock is complicated, keenly competitive and ingeniously devised business. Every aspect of this has been thoroughly discussed by the Author. The U.S. Federal Meat Inspection Act which is responsible for the control of quality of meat and meat products offered for inter-state or foreign commerce, has been dealt with in detail in this book. Carcasses are of all sizes, many breeds and varying ages. By grading these are separated into various categories, and this aspect has been covered in some detail in one chapter. The subject material on structure deals with muscles, connective tissue, fat, water, organic extractives, enzymes, pigments, etc. Problems of refrigeration of meat has been adequately covered in Chapter 5.

This handbook provides a practical source of information for the food service industry, locker plant and meat retailers with particular reference to business in U.S.A.

There is a well written chapter on how to set up meat shops. This will be helpful to those in developing countries who intend to go into meat business.

Information is also provided on meat cutting, processed smoked meats and on cooking style preparations.

On the whole the book is useful for those who intend to go into meat packing industry and as a reference book for students, teachers and extension workers engaged in the field of meat science and technology.

N. L. LAHIRY

Indian Farming, November 1967, Special Animal Sciences Number. Indian Council of Agricultural Research, New Delhi 1.

'In these more than hundred pages of text, the reader will find a blue print for progress enveloping all aspects or spheres of animal husbandry, how to increase yield, produce better stock, safeguard their health, augment foreign exchange potential; in short it enables one to grasp in essential the progressive growth of this developmental activity into one of the major industries of the nation'. The above comments of the Editor in introducing the special issue, summarize the contents very succinctly. The number

encompasses within 106 pages, aspects of dairying, breeding of sheep and goats, fish farming and many general articles of much interest, including reports of progress of livestock development in the States. The major part of the volume is devoted to improvement of livestock. It is estimated that the annual production of milk per cow in India is 173 kg. while in Denmark it is 3810 kg. This shows the lee-way that has to be made up in animal sciences. If the present volume and similar contributions from ICAR could focus the attention of scientists and others concerned in these problems and help in overcoming the shortfall, the purpose of the publication will have been amply fulfilled.

Notes and News

A New Steriliser

A continuous cooker/precooler has been designed which incorporates means for conveying cans, jars, pouches, or tubes through a water-sealed pressure lock, steam, and precooling water. Sterilization and precooling take place in the same chamber. Air over-pressure is applied when needed to balance pressure inside the container and avoid seam or closure damage. The machine is also equipped with carrier bars that exert protective pressure on the sides of pouches during sterilizing and precooling. The unit is designed to process food materials at temperatures upto 265°F and the time is variable.

Food Engineering 39 (7), 73-75 (July '67)

Flexible Packaging for Pressurised Foods

A semi-automatic, continuous, flexible foil packaging system has been developed for processed foods. The product (in this case sauerkraut) is drawn from a circulating brine tank by vacuum to the filter head. A piston plunger forces the slug of kraut into a pre-formed tube of laminate, a metered dose of clear brine is added, and the final seal is made. Excess air is expelled by mechanical displacement and partial vacuum prior to closure. The package is flattened and weighed and then lowered into a tank of water at 200°F for 20 minutes. It is then spray rinsed and cooled rapidly to prevent quality deterioration. It is again spray rinsed, drained, and packed in aluminium foil bags lined with polyethylene. The incidence of leaks caused by poor seals has been reduced to less than 2 per cent, and a complete series of quality-control checks has been established as part of the process.

The final product has the convenience of the flexibag and the shelf life of the can; it requires no refrigeration or preservative.

Food Engineering 39 (7), 76-79 (July '67)

Mr M. V. Tracey has been appointed to succeed Dr J. R. Vickery as the Chief of C.S.I.R.O., Australia. After graduating in biochemistry from the University of Cambridge, Mr Tracey spent several years in the Biochemistry Department at the Rothamsted Experiment Station, Harpenden. He came to Australia in 1956 to join C.S.I.R.O. Division of Protein Chemistry, and in 1958 was appointed to his present position as

Leader of the C.S.I.R.O. Wheat Research Unit. Mr Tracey has published two books and over 40 scientific papers on the biochemistry of structural materials in plant and animal cells. He has also been joint editor of a seven-volume treatise on 'Modern Methods of Plant Analysis'. His recent research interests have been concerned with the effects of water on the properties of some biological systems.

C.S.I.R.O. *Australia*

Short-term Course in Fruit and Vegetable Technology

A Short Term Course in Fruit and Vegetable Technology was conducted at the Central Food Technological Research Institute, Mysore from 4 September to 27 October 1967. In all 23 students participated in the Course. Of these 4 represented Government Organizations, 17 were from various food industries in the Country and 2 from Ceylon.

This Course dealt with major aspects of fruit and vegetable Technology, such as handling, storage and transport, processing, marketing, quality control, their pre- and post-harvest physiology, and packaging and transport, were covered.

Also dealt were important principles of fruit and vegetable technology such as canning and bottling, fruit juices, concentrates and powders; jams, jellies and marmalades; candied, crystallised and glazed fruits; pickles, chutneys, sauces and soups, vinegar, etc. Utilization of by-products formed an important subject of study. Emphasis was placed on manufacture and quality control in products, such as vinegar, tomato ketchup, fruit sauces, Fruit Products Order, etc. Layout and management of fruits and vegetable factories, small as well as large, maintenance of equipment, costing of products and their marketing was discussed.

The practical aspects were highlighted during the Course by supplementation with study tours to some fruit and vegetable and other allied food industries in and around Bangalore and to the ICAR citrus experimental orchards at Gonikoppal and Chethalli in Mysore State. The classes were handled by about 25 expert Scientists from the various Disciplines of the Institute.

Association of Food Technologists



Dr R. Rajagopalan, Chairman, Protein Technology Discipline, C.F.T.R.I., Mysore retired from service on 11, September, 1967. His contributions to the development of the Indian Multipurpose Food have been recognized the world over and opened up new possibilities of solving the protein problem in the developing Nations.

Prior to his joining the C.F.T.R.I. in 1957, Dr Rajagopalan guided research work in the Biochemistry Department of the Indian Institute of Science, Bangalore for nearly 10 years. His interests covered a wide range of problems such as intestinal synthesis of B-complex vitamins on ingestion of lactic curds, Maillard reaction in protein foods, nutritional effects of heated oils and oilseed protein concentrates for human consumption. A number of students completed the requirements of AIISc, M.Sc. and Ph.D. degrees under his supervision on these problems.

Dr Rajagopalan graduated with B.Sc. (Hons.) degree from Rangoon and obtained his AIISc diploma and Ph.D. (Bombay) by research work at the Indian Institute of Science, Bangalore. Except for a period of 4 years during 1938-42 when he was at Rangoon as a lecturer in Chemistry, Dr Rajagopalan spent the best part of 22 years at the Indian Institute of Science and had carried out researches on soil science, sewage farming and utilization of textile trade wastes.

Dr Rajagopalan rendered valuable service as Honorary Secretary of the Society of Biological Chemists' (India) and the Association of Food Technologists (India) for many years and greatly contributed to the

cause of these Societies. His endearing human qualities of head and heart and liberal outlook made him a true friend of one and all. The Association of Food Technologists wishes him many more years of happy life.

List of new members accepted:

Life Members

1. Mr M. R. Chandrasekhara, Scientist, C.F.T.R.I., Mysore 2.

Members

1. Mr R. N. Ramani, 51, Thambu Chetty Street, Madras 1.
2. Mr T. Pukrushpan, F. A. O., I.F.T.T.C., C.F.T.R.I., Mysore 2.
3. Mr V. B. Dingal, Zenith Tin Works (P) Ltd., Opp. Race Course, Clerke Road, Bombay 34.
4. Mrs. Chandra Dissanayake, No. 8, 36th Lane, Off Bullers Road, Colombo 8, Ceylon.
5. Mrs T. Goonetilleke, 50/11, Siripa Road, Thim-birigasyaya, Colombo 5, Ceylon.
6. Dr B. Krishnaswamy, Nehru Nagar, Gudur, Nellore District, A.P.
7. Mr Gostha Behari Dey, P.O. Kancharapara, Dist., 24 Paraganas, W.B.
8. Miss Padmini Pattabhiraman, 'The Grove', Teynampet, Madras 18.
9. Mr C. L. Saha, M/s Malda Fruit Products Company, Station Road, Malda, West Bengal.
10. Mr Kanai Chakraborty, Govt. Milk Plant, Bel-danga, Murshidabad, West Bengal.
11. Mr S. B. Kadhkol, Scientist, C.F.T.R.I., Mysore 2.
12. Mrs Vimla Goenka, Foods, Fats and Fertilisers Ltd., Tadepalligudem, West Godavari District, A.P.

Change of address

1. Dr V. R. Bhale Rao, Deputy Animal Husbandry Commissioner (Dairying), Indian Council of Agricultural Research, New Delhi.
2. Mr P. C. Panda, Reproductive Biology Research Unit, All India Institute of Medical Sciences, Ansari Nagar, New Delhi.
3. Mr S. N. Raghavendra Rao, International Rice Research Institute Los Banos, Philippines.

4. Mr V. B. Mathur, 1517, Kashmiri Gate, Delhi
5. Mr K. N. Khanna, Greenland Foods (P) Ltd., Shriram Nagar, Saharanpur (U.P.).
6. Mr V. V. Koteswar Rao, Lecturer, Food Craft Centre, Govt. Poly-technic Building, Kalamassery, Alwaye 4, Kerala State.
7. Mr G. S. Sreenivasan, Standards Department, The Britannia Biscuit Co. Ltd., M.T.H. Road, Padi, Madras 58.

1. Dr V. R. Bhale Rao, Head of the Dairy Chemistry Division, National Dairy Research Institute, Karnal has taken over the new Assignment as Deputy Animal Husbandry Commissioner (Dairying), Indian Council of Agricultural Research, New Delhi.

2. Mr P. C. Panda, Scientist, C.F.T.R.I., Mysore has been awarded a fellowship by the Indian Council of Medical Research and has joined the Reproductive Biology Research Unit at the All India Institute of Medical Sciences, New Delhi for undergoing post-graduate training.



3. Sri S. N. Raghavendra Rao, C.F.T.R.I., Mysore left for Philippines on a fellowship from International Rice Research Institute, Los Banos,

Philippines for higher training in the field of rice technology for one year.

Pestonji Polson Award Development of Food Industry in India

To encourage and stimulate progress and development of the Indian Economy, the Indian Merchants Chamber, during its Diamond Jubilee Year instituted a scheme of Awards for recognition of outstanding performance and achievements in various fields in Scientific, Technological, Research and other similar activities. The Management of the Scheme has been vested to a Board of Trustees, comprising of leading personalities in the sphere of business, industry and technology.

Mr M. P. Polson, Managing Director of Polson Limited, has announced a contribution of Rs 25,000 to the Scheme in memory of the Founder of the Company, late Seth Pestonji Polson, the pioneer of the organised Dairy Industry in India. The contribution will be utilised for conferring the PESTONJI POLSON AWARD for outstanding contribution to the Development of the Food Industry in India by way of either original research or technological development or Management and/or Marketing efficiency.

Indian Standards Institution

The Following standards have been published:

Citric acid (Food grade)	DOC: AFDC:19(589)
Tartaric acid—Food grade	DOC: AFDC:19(590)
Sodium benzoate—Food grade	DOC: AFDC:19(591)
Benzoic acid—Food grade	DOC: AFDC:19(623)
Mineral Mixtures for supplementing cattle feeds	DOC: AFDC:15(632)
Bone Meal as livestock feed	DOC: AFDC:15(633)

Copies can be obtained from the Indian Standards Institution, New Delhi, Bombay, Calcutta, Kanpur and Madras.

Food Science and Technology Abstracts

(A. A.—Author's Abstract)

1. General

1.24 *Need, limitations and development of food industries in Asia and the Far East*, S. S. DE, *Indian Fd Packer*, 1967, 21 (2), 44.

1.25 *Parallel food classifications in developing and industrialized countries*, DERRICK B. JELLIFFE, *Am. J. clin. Nutr.*, 1967, 20 (3), 279.

Review. 4 references.

1.26 *Use of disinfectants in food industry*, N. GOLDENBERG AND C. J. RELF, *J. appl. Bact.*, 1967, 30 (1), 141.

Review. 4 references.

1.27 *Disinfectants in the dairy industry*, L. F. L. CLEGG, *J. appl. Bact.*, 1967, 30 (1), 117.

Review. 113 references.

1.28 *Legal implications of using disinfectants in relation to food*, J. M. ROSS, *J. appl. Bact.*, 1967, 30 (1), 51.

2. Cereals

2.70 *Assessment of factors influencing estimation of availability of threonine, isoleucine, and valine in cereal products*, H. J. H. DEMUELENAERE, M. L. CHEN AND A. E. HARPER, *J. agric. Fd Chem.*, 1967, 15 (2), 318.

The availability of these amino acids was tested in corn and rice. Measurements of threonine availability were influenced by changes in the composition of the basal diet and in the amounts of protein and calories in the experimental diets. The low availability values for isoleucine in zein and corn by growth method was mainly due to leucine-isoleucine antagonism in the experimental diet. Elimination of the antagonism resulted in higher availability values.

B. S. N.

2.71 *Assessment of factors influencing estimation of lysine availability in cereal products*, H. J. H. DEMUELENAERE, M. L. CHEN AND A. E. HARPER, *J. agric. Fd Chem.*, 1967, 15 (2), 310.

In general, the lysine of corn and rice proteins was highly available. Values obtained by the growth method were influenced by changes in the composition of the diet and the method of calculating availability. They were most reproducible and least influenced by other factors when availability was calculated as a function of lysine consumption rather than lysine level in the diet. The faecal analysis method gave somewhat lower values for corn products.

B. S. N.

2.72 *Weathering of mature wheat by rain and snow and their influence on grain quality*, C. A. WATSON, F. H. MCNEAL, M. A. BERG AND G. P. HARTMAN, *Cereal Sci. To-day*, 1967, 12 (3), 86.

Effect of slight weathering was tested on Sidney samples and of severe weathering on Bozeman samples. Weathering adversely affected test weight, flour protein and flour absorption; flour yield, flour ash, farinograph stability, mixing time, loaf volume, and grain and texture were improved by weathering, which however, had little effects on farinograph peak or valorimeter. Bozeman samples which underwent severe weathering showed most improvement in quantity.

J. v. S.

2.73 *Modification of the Buhler laboratory mill for milling semolina*, H. C. BLACK AND W. BUSHUK, *Cereal Sci. To-day*, 1967, 12 (4), 164.

2.74 *Nutritive value and cooking quality of Gujarat rice varieties*, M. M. PATEL AND H. J. RAJANI, *Indian Fmg, N.S.*, 1967, 17 (3), 34.

Information on 19 varieties of rice.

2.75 *A survey of storage methods and the quality of grain stored in Irish farms*, P. A. SPILLANE, *Irish J. agric. Res.*, 1967, 6 (1), 123.

Survey of grain storage conditions on farms in 1964-65 showed that the bulk of the grain was stored at moisture levels well above safe limits and figures as high as 27 per cent were recorded. Most of the samples were contaminated with moulds and mites after a storage period of less than 3 months. Some samples were infested with weevils and beetles. Fungi known to be pathogenic to livestock due to the production of toxins were identified on a number of samples.

A. A.

2.76 *Saving stored rice from attacks of insect pests*, P. B. MOOKERJEE AND B. N. BOSE, *Indian Fmg, N.S.*, 1967, 17 (3), 32.

General.

2.77 *Distribution of protein, calcium and phosphorus between the husk and endosperm of bajra seeds (*Amaranthus paniculatus*)*, P. P. KURIEN, *J. Nutr. Dietet.*, 1967, 4 (2), 153.

Husk forms about 20 per cent of grain of bajra (*Amaranthus paniculatus*), which is composed of cellulose and hemicelluloses and probably accounts for lower digestibility co-efficient and nutritive value when fed as main diet. The need for developing a refined flour with very little fibre is stressed for such a purpose.

B. S. N.

2.78 *Nutritive value of refined ragi (*Eleusine coracana*) flour. I. The effect of feeding poor diets based on whole, refined and composite ragi flours on the growth and availability of calcium in albino rats*, P. P. KURIEN, *J. Nutr. Dietet.*, 1967, 4 (2), 96.

Refining of ragi flour adversely affects growth promoting value in rats. Addition of wet processed flour fraction from composite flour appears to make up for this loss in part and also accounts for increased calcium supply; calcium content of refined flour is, however, found to be more than that of whole ragi flour.

B. S. N.

2.79 *Nutritive value of refined ragi (*Eleusine coracana*) flour. II. Effect of replacing cereal in a poor diet with whole or refined ragi flour on the nutritional status and metabolism of nitrogen, calcium and phosphorus in children (boys)*, P. P. KURIEN AND T. R. DORAISWAMY, *J. Nutr. Dietet.*, 1967, 4 (2), 102.

Children subsisting on a poor diet supplemented with either whole or refined ragi flour were found to have almost the same nutritional status at the end of 5½ months feeding period with regard to height, weight, RBC, haemoglobin content of blood and retention of N, Ca and P. A significant increase in apparent

digestibility of proteins of refined ragi flour diets as compared to whole ragi flour diet was, however, observed.

B. S. N.

2.80 *Milling quality of Belle Patna Rice in experimental storage: A study of the effects of field fungi on subsequent invasions by storage fungi*, H. W. SCHROEDER, *J. Stored Prod. Res.*, 1967, 3 (1), 29.

Storage of rough rice under constant conditions of 75° R.H. and 30°C yielded no evidence to indicate that preharvest infections by *Helminthosporium oryzae* or other field fungi predisposed the rice to post-harvest invasions by storage fungi or to more rapid deterioration in milling quality. The xerophytic fungus, *Aspergillus restrictus* became the dominant species in the rice within 71 days and remained dominant throughout 385 days of the experiment.

A. A.

2.81 *Effect of oxygen concentration on deteriorative mechanisms of rice during storage*, TETSUYA IWASAKI AND TATSUO TANI, *Cereal Chem.*, 1967, 44 (3), 233.

Interseed air of rice in storage is made up of various concentrations of oxygen and carbon dioxide, whether rice is stored in sacks or in bulk. Rice stored in low oxygen showed decrease in acidity of water extract with a high increase of reducing sugars during storage. Amylase activity remained, however, unaffected. Production of small amounts of alcohol was also observed due to anaerobic respiration in rice. Losses in weight noticed during storage of rice may be partially due to evaporation of alcohol.

B. S. N.

2.82 *Studies on idli—an Indian fermented black gram-rice food*, K. H. STEINKRAUS, A. G. VAN VEEN, AND D. B. THIEBEAU, *Fd Technol. Champaign*, 1967, 21 (6), 916.

Idli with satisfactory acid flavour and texture was produced using any proportion of rice to blackgram from 1:3 to 3:1 (by weight). The dhal and rice can be presoaked before grinding and mixing or ground and mixed directly at the start of fermentation. Dehulled Clark soyabeans, soja max and *Phaseolus vulgaris* cotyledons were substituted for black gram to make *idli* like products. An initial presoak of dhal or rice resulted in complete rehydration in about 2 hr at 25°C.

A. A.

2.83 *New X-M rice bran*, LAWRENCE LYNN, R. M. ANDERSON AND D. L. CARPENTER, *Cereal Sci. Today*, 1967, 12 (6), 221.

In this process, the brown rice free from paddy is treated with rice oil to soften the bran layers. After the conditioning period the rice is introduced into a rice oil hexane miscella where the bran is gently removed by the rubbing action of the rotor and the working action of the miscella. Extraction of the oil and rice kernel is virtually instantaneous. Subsequently the bran layers as well as the rice germ are separated from the rice stream, and the miscella rinsed with dilute and desolventised in super heated hexane vapor. The resulting product is a dry, light-tan-coloured, free-flowing powder with a clean, sweet, rather pleasing flavour. It has several possibilities like use in dry-mix products, snacks and thickeners. It is an important protein source for humans.

J. V. S.

2.84 *Protein composition and bread making potentialities of wheat flour*, YESHAJAHU POMERANZ, *Cereal Sci. Today*, 1967, 11 (5), 192.

The importance of extracting media and sulfhydryl-blocking and hydrogen bond disrupting agents in the isolation and fractionation of cereal proteins was studied. Hydrogen bonds were found to affect solubility and aggregation of wheat proteins and

the unique viscoelastic properties of wheat flour doughs and to a certain extent, to govern oxidant requirements of flours.

J. V. S.

2.85 *Protein solubility and baking quality*, EDWARD E. A. MAES, *Cereal Sci. To-day*, 1966, 11 (5), 200.

A fractionation technique by which the solubility of flour proteins in a series of solvents held sequentially by percolation, can be correlated with baking quality. The natural or baking quality of flours can be determined rapidly on a 10 g. sample of flour by determining the proteins soluble in 40 per cent isopropyl alcohol (V/V) after extraction of those proteins soluble in water.

J. V. S.

2.86 *The addition of iron to flour. I. The solubility and some related properties of iron powders including reduced iron*, J. J. C. HINTON, J. E. CARTER AND T. MORAN, *J. Fd Technol.*, 1967, 2 (2), 129.

The percentage solubility of different commercial samples of reduced iron added to flour for enrichment were tested by (1) 0.1 N HCl, 30 min. at 23°C (2) 0.1 N HCl, pepsin, 0.4 per cent, 2 hr at 37°C and (3) *In Vivo* in the rat. It is concluded that the form of iron suitable for enrichment should be one combining the maximum solubility or ease of solution consistent with minimum tendency to become oxidized during storage. The temperature to which the iron oxide is subjected either before or during the reduction process is probably the critical factor.

K. A. R.

2.87 *The addition of iron to flour. II. The absorption of reduced iron and some other forms of iron by the growing rat*, J. J. C. HINTON AND T. MORAN, *J. Fd Technol.*, 1967, 2 (2), 135.

Reduced iron, electrolytic iron powder and also other forms of iron, used for enrichment have been fed to rats. The results showed that in general the different forms of iron when baked into bread were all well absorbed. About 28 per cent of the iron was absorbed constantly from the non-enriched bread. Haemoglobin content at 11 days showed no significant difference between ferric ammonium citrate and ferrous sulphate. Between citrate and reduced iron the results were significant at 5 per cent level, whilst that between ferrous sulphate and reduced iron it was less significant.

K. A. R.

3. Pulses

3.14 *On plant lipids. I. Bean lipids*, L. FORMAN AND J. POKORVNY, *Nahrung*, 1967, 10 (3), 267.

The bean lipids, like in other pulses, contain high linolenic acid. The marked unsaturation of these lipids is likely to cause certain instability which should be considered in storing and processing them.

A. A.

3.15 *Chemical composition of some wild Indian leguminous seeds*, RADHA PANT AND PUSHPLATA BISHNOI, *Curr. Sci.*, 1967, 36 (14), 376.

Chemical composition data of the seeds of *Bauhinia purpurea*, *Cassia glauca*, *Delonix regia*, *Pongamia glabra*, *Prosopis juliflora* and *Sesbania grandiflora* are presented.

B. S. N.

3.16 *Nutritive value of legume seed proteins*, ROBERT J. EVANS AND SELMA L. BANDEMER, *J. agric. Fd Chem.*, 1967, 15 (3), 439.

Peas, cowpeas, beans, soybeans, lupines and vetches were deficient in S-containing amino acids; most of them contained

thermolabile growth inhibitors. Rats fed heated legume seeds supplemented with methionine grew normally in most cases. Blanco beans and *L. hartweighii* appeared to contain toxic materials not destroyed by heat.

B. S. N.

3.17 *Studies on the nutritive values of cow pea (Vigna catiung) and tur dhal (Cajanus cajan)*, E. SIVARAMAN AND MAGGIE MENACHERY, *Indian Vet. J.*, 1967, 44 (2), 107.

Cow pea flour at 18 per cent protein level, on feeding for 28 days, promoted significantly higher growth response in rats than tur (*Cajanus cajan*) dhal supplied through an isoproteic diet. The growth rate with cow pea flour is same as that observed with a control diet containing 18 per cent casein as the sole source of nitrogen. No significant difference is noticed between the diets in their ability to support the formation of red cell, haemoglobin and plasma protein in the normal growth rates. However, for promoting haemoglobin formation, the two pulse proteins are less efficient than the control diet containing casein.

K. A. R.

4. Fruits, Vegetables and Tubers

4.93 *Collaborative study of capillary viscometer method for consistency of fruit nectars and fruit juice products*, FRANK C. LAMB, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 288.

Collaborative results from 12 analysts from 9 laboratories, using capillary viscometer on samples of apricot, peach and papaya nectars and on pineapple—grape fruit and pineapple—pear fruit juice drinks. The methods are recommended for adoption as official, first action.

J. V. S.

4.94 *Investigations on gas-liquid chromatography of fruit acids*, EARL HAUTALA, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 287.

Seven fruit acid standards (oxalate, fumarate, benzoate, succinate, malate, tartarate and citrate) were esterified with diazomethane and the esters were gas chromatographed at various column temperatures. All the esters except benzoate could be seen as separate peaks, but were not suitable for quantitation.

A. A.

4.95 *Studies on ethylene production by a subcellular fraction from ripening tomatoes. I. Effects of several substrates, co-factors and cations*, MICHAEL MEHERIUK AND MARY SPENCER, *Phytochem.*, 1967, 6 (4), 535.

4.96 *Studies on ethylene production by a subcellular fraction from ripening tomatoes. II. Effects of several inhibitors*, MICHAEL MEHERIUK AND MARY SPENCER, *Phytochem.*, 1967, 6 (4), 545.

4.97 *Studies on ethylene production by a subcellular fraction from ripening tomatoes. III. Effects of addition of 3-alanine and co-factors for decarboxylation*, MICHAEL MEHERIUK AND MARY SPENCER, *Phytochem.*, 1967, 6 (4), 551.

4.98 *Role of dissolved metals in retrieving old apple juice by fermentation*, B. REVIS, S. M. JAFAR AND W. B. DATE, *Res. Ind.*, 1967, 2 (1), 8.

Good cidar was obtained from old stocks of canned apple juices. Iron and tin together upto 150 p.p.m. each slightly accelerate fermentation; tin aided clarification. EDTA removed the metallic taste and cloudiness.

B. S. N.

4.99 *The effect of conditions of storage on the respiration of apples. I. The effect of temperature and concentrations of carbon dioxide and oxygen on the production of carbon dioxide and uptake of oxygen*, J. C. FIDLER AND C. J. NORTH, *J. hort. Sci.*, 1967, 42 (2), 189.

The mean rate of respiration of apples in air varied directly with temperature. In some types of apples, the rates of CO₂ output and oxygen uptake, at temperatures below 35°F increased with time and with onset of low temperature injury; the rates fell again when injury became severe. The course of respiration activity of different apple varieties stored under controlled atmosphere did not differ. Increasing CO₂ concentration or decreasing O₂ concentration in the storage atmosphere reduced the respiration rate.

K. A. R.

4.100 *The relationship of wounding and inoculation of Grand Alexander apples to the development of storage decay caused by Alternaria tenuis* RUTH BEN ARIE, *Israel J. agric. Res.*, 1966, 16 (4), 179.

Alternaria tenuis was found to penetrate wounded fruit both before and after harvest. Fruit inoculated in the orchard up to 7 weeks before harvest, does not rot while on the tree, but after harvest, the fungus continues to develop and cause storage decay within two months at 0°C.

4.101 *Effect of delayed storage and the stage of maturity at harvest on the keeping quality of peaches in Israel*, SYLVIA GUELFAT-REICH AND RUTH BEN ARIE, *Israel J. agric. Res.*, 1966, 16 (4), 163.

Elberta and *Red Haven* peaches stored at 0°C immediately after harvest, suffered after a fortnight from 'mealy breakdown' and loss of flavour and juiciness. Storage at room temperature (26°C) for 48-72 hours before storage at 0°C improved the keeping quality of fruit picked at all stages of maturity and lengthened the storage by 10-15 days. Fruit picked at the hard ripe stage of maturity responded better to delayed storage treatment than did fruit at more advanced stages of maturity, which showed higher percentages of breakdown.

A. A.

4.102 *Study of blanching conditions on some characteristics of canned Bhindi (Hibiscus esculentus)* S. M. JAFAR, B. REVIS AND W. B. DATE, *Indian Fd Packer*, 1967, 21 (1), 5.

Firmness of canned *Bhindi* was better under LTST (135°F for 15 min.) blanching. It can further be improved by using calcium salts 0.5 per cent solution for 30 min. and addition of citric acid. Addition of ascorbic acid to brine does not prevent red discolouration of the seeds and seed bearing stalk of the vegetable. *Lucknow Resmi* is a good canning variety.

K. A. R.

4.103 *Preparation of pre-cooked dehydrated powder from pumpkin (Cucurbita maxima)* RAJINI A. PADIVAL AND M. SRINIVASAN J. *Fd Sci. Technol.*, 1967, 3 (4), 164.

4.104 *Leucoanthocyanin in cabbage and pink discolouration*, S. RANGANNA AND V. S. GOVINDARAJAN, *J. Fd Sci. Technol.*, 3 (4), 1966.

4.105 *The influence of the temperature and oxygen content of the water on the loss of vitamin C during cooking*, K. SZOKE, *Nahrung*, 1967, 10 (3), 239.

The vegetables were added to cold, boiling and de-aerated (by boiling for 5 min.) water respectively. Within the same period of cooking (calculated from the beginning of the boil) the losses of vitamin C showed no marked differences.

A. A.

4.106 *Irradiation of potatoes in Pakistan*, W. A. FAROOQI, M. MOHYUDDIN, M. A. HAMID, *Fd Irrad.*, 1967, 7 (3), 41.

Potatoes 15 days after harvest, were irradiated in bulk in polythene packages with doses of 2, 4, 6, 8 or 10 Krad and were

stored in a wooden rack at 83°F and 69 per cent R.H. With the increase of radiation dose, loss of water content and the incidence of storage rot was greatly reduced. The radiation dose of 2 Krad showed a stimulation effect on sprouting.

K. A. R.

4.107 *Metabolic activity of starch granules from the tapioca (M. utilisissima) plant. IV. Further studies on the enzyme make up of starch granules*, P. N. VISWANATHAN, *Indian J. Biochem.*, 1967, 4 (1), 6.

Starch synthesising activity of the starch granules of tapioca with ADPG as the substrate was not significantly different from that with UDPG. About 55 per cent of total nucleoside diphosphate kinase activity present in the whole tuber homogenate was also present in the granules. ADPG—pyrophosphatase and ADPG (UDPG) phosphorylase activities were absent. Soluble starch synthesis was apparently absent in the tuber.

A. A.

4.108 *Studies on the quality of pectin in fruits and vegetables, with special reference to changes in the properties of pectic substances in fresh and refrigerated fruits*, HIROSHI MIURA, SHIKO HAGINUMA, TAKASHI MIZUTA AND KAZUKO TAKANO, *Rep. Fd Res. Inst., Japan*, No. 22, 1967, 103.

Materials studied, were apple, Japanese persimmon, and sweet cherry during maturation, and beet root, Japanese radish root, and tomato in full maturity, and refrigerated fruits of straw berry, sweet cherry, Japanese persimmon and apple.

A. A.

4.109 *Role of skin coating on the transportation of perishables. IV. Studies on the transportation of mangoes*, G. D. SHARMA AND N. S. KAPUR, *Indian Fd Packer*, 1967, 21 (2), 34.

Six varieties of mangoes *Dusehri*, local juicy (Gwalior), *Langda*, local juicy (Indore), *Parry* and local juicy (Bhopal) were treated 3 per cent wax emulsion. The physiological loss in weight of treated fruits during storage even after transportation was significantly less. Wax coating helps in retaining the better appearance of the fruits and prolongs its storage life by 25 per cent at room temperature.

K. A. R.

4.110 *Changes in the pectin content of banana during storage*, G. C. BHATTACHARYA, K. C. BHATTACHARYA AND J. J. GHOSH, *Sci. Cult.*, 1967, 33 (6), 280.

In bananas (*Martaman*, *Champa* and *Kanthali*) stored at 30°C and 85 per cent R.H., the water soluble pectin and protopectin decreased with progress in storage.

B. S. N.

4.111 *Grape juice flows with this plants' control system*, *Fd Technol. Champaign*, 1967, 21 (4).

A process where grape juice is extracted, the flavour is separated and the rest concentrated in an accurate evaporation system. Subsequently this whole batch is remixed to get a juice retaining the flavour properties of the fruit.

J. v. s.

4.112 *Studies on varietal suitability of guava fruit by canning*, S. S. TEAOTIA AND R. K. AWASTHI, *Indian Fd Packer*, 1967, 21 (2), 28.

Of the thirteen white fleshed and five red fleshed guava varieties studied after canning and storage at room temperature, *Safeda Allahabad* was judged best in respect of texture, colour, taste and flavour. *Smooth Green*, *Lucknow-49*, *Chittidar* and *Habshi* are also suitable for canning. Other varieties tested were not suitable for canning.

K. A. R.

4.113 *Effect of temperature on storage stability of apple essence obtained from different varieties*, D. G. GUADAGNI, S. OKANO AND JEAN HARRIS, *Fd Technol. Champaign*, 1967, 21 (4), 665.

Aroma intensity and quality of apple essences were maintained best at—30°F. Delicious apple essences lost their aroma faster at 25° than at 30°F. Large losses in aroma intensity were correlated with decreases in peak areas in gas chromatograms of apple essences. Unknown factors, other than temperature alone appear to be involved in maintaining aroma intensity and quality.

A. A.

4.114 *Studies on market diseases of fruits and vegetables*, C. V. RATNAM AND K. G. NEMA, *Andhra agric. J.*, 1967, 14 (2), 60.

Percentage decay and loss of fruits and vegetables in Jabalpur market vary from 13.96 to 26.62 depending on the month. The fruits investigated include, apple, banana, orange, mango, pears and tomato. *Alternaria tenuis* on grapes, *Curvularia geniculata*, *Gliocladium* Sp. *Helminthosporium* Sp. *Monilia* Sp. *Rhizopus arrhizus* on tomato and *Fusarium* Sp. on papaya causing decay in storage and market were found to be new records.

K. A. R.

4.115 *Methionine utilization in ripening mangoes*, A. K. MATTOO AND V. V. MODI, *Indian J. exp. Biol.*, 1967, 5 (2), 126.

Comparative utilization of methionine was studied in unripe, partly ripe, ripe and over ripe mango slices incubated at 40°C in a solution containing methionine (3 mM) and acetate buffer (0.1M; pH 4.5) for 20 min. Methionine uptake was maximum (21 ± 1 per cent) in partly ripe mango slices. Methionine utilization was enhanced in presence of Cu⁺ and ascorbic acid.

A. A.

4.116 *Free amino acids and sugars in Sathgudi (Citrus sinensis) healthy and virus affected trees*, S. N. RAO, B. V. RAMA RAO AND M. RAMA RAO, *Andhra agric. J.*, 1967, 14 (3), 52.

Eight amino acids (histidine, serine, glycine, threonine, proline, β-alanine, glutamic acid, asparagine) in the healthy and 7 amino acids (all the above except asparagine) in the declining, were observed. Proline was comparatively less in the declining fruit. Proline and asparagine were found to have been more affected due to the virus infection. Eight sugars (galactose, fructose, arabinose, glucose, ribose, rhamnose, sucrose and an unidentified sugar) were found both in the healthy and declining fruit samples.

K. A. R.

4.117 *Some physiological effects of various skin coatings on orange fruit*, S. BEN-YEHOSHUA, *Israel J. agric. Res.*, 1967, 17 (1), 17.

Effect of skin coating of oranges by Tag (a polyethylene wax emulsion) and by several commercial waxes (Zivdar, Britex, Flavorseal) was found to depend on the type of coating and thickness. All the coatings improved appearance and reduced drying and shrinkage. Tag extended storage life by 100 per cent and the other coatings by 50 per cent. Dipping fruit in 13 per cent Tag emulsion gave good result. Tag coating reduced markedly the rate of weight and volume loss and the respiratory activity of oranges. All coatings lowered the internal O₂ and raised the internal CO₂ concentrations. The extension of storage life seemed to be related to the effect of the coatings in preventing the peel from drying rather than to its effect on the internal atmosphere.

A. A.

4.118 *Consistency of tomato products. I. Effects of tomato enzyme inhibition by additives*, J. R. WAGNER AND J. C. MIERS, *Fd Technol. Champaign*, 1967, 21 (6), 920.

Strong acids added to tomato tissue samples before processing were best for inhibiting loss of consistency in tomato juices.

When acidification below pH 2 was combined with heat treatment there were large increases in juice consistency. Acidification below pH 1.3 was necessary to prevent loss of consistency in unheated juices.

J. V. S.

- 4.119 *Effect of pH during extraction on tomato juice consistency*, J. C. MIERS, J. R. WAGNER AND D. W. SANSHUK, *Fd Technol. Champaign*, 1967, 21 (6), 293.

Tomatoes were extracted at pH levels ranging from 1 to 9 and then heated to 90°C. Extraction at low pH levels and then heating, yield juices with much higher consistencies than juices prepared at natural pH. Their consistencies change little when the pH levels are restored to normal by adding NaOH. Extraction at higher pH levels and then heating, also yield juices having higher consistencies. But in this case tomato gels are formed, when pH is decreased by adding HCl. To achieve these effects, immediate contact between the tomato tissue as it is macerated and the acid or base, is essential to assure pH control during breaking and heating.

A. A.

- 4.120 *Evaluation of break strength of pineapple slices*, R. P. BOWDEN, *Fd Technol. Aust.*, 1967, 19 (8), 358.

An apparatus has been developed for measuring the break strength. Centrifugal force is applied to a peeled and cored slice by rotating it on a roughened metallic disc, fitted centrally with a vertical rod equal in diameter to the removed cone. The speed at which the slice breaks is recorded as the break strength of the slice. The break strength, which represents the index of fragility is of economic importance to the consumer.

K. A. R.

- 4.121 *Translucency as an index of ripeness in pineapples*, R. P. BOWDEN, *Fd Technol. Aust.*, 1967, 19 (9), 424.

Fruits were sorted into three translucency ranges—low, medium and high using translucency meter and were served to a panel of tasters. In fresh fruit, medium translucency was preferred, those of low translucency being too sour and lacking pineapple flavour, and those of high translucency being too flat and having over ripe off-flavours. This was supported by chemical analysis, which showed that translucency was correlated with pH, Brix/acid ratio and ester concentration. Thus translucency, besides serving as an index of ripeness, was also correlated with break strength, porosity and internal colour thereby serving as a partial index for canning suitability.

In the canned product, sourness was not evident in low translucency fruit and there was no significant difference between the mean edible quality scores recorded by the panel for the low and medium translucency fruit. High translucency canned fruit being too flat and having over-ripe off flavours was significantly lower in edible quality.

K. A. R.

- 4.122 *Potato processing for dehydration*, JUDITH A. KINTNER AND ELISABETH TWEEDY, *Fd Technol. Champaign*, 1967, 21 (6), 865.

Review. 56 references.

5. Oilseeds and Nuts

- 5.28 *A simple method for making full fat soy flour*, W. J. ALBRECHT, G. C. MUSTAKAS, J. E. MCGHEE AND E. L. GRIFFIN JR., *Cereal Sci. Today*, 1967, 12 (3), 81.

A simple procedure (whole soybeans → water soaking → immersion cooking in boiling water → air drying → hand cracking → dehulling → hand grinding → full fat soya flour) that gives soy

flours of good quality is described. The equipment used is inexpensive and manually operated. The heat requirement is only that needed for boiling water.

J. V. S.

- 5.29 *Enzymatic modification of the extractability of protein from coconuts (Cocos nucifera)*, ARTHANARICHETTY CHANDRASEKHARAN AND KENDALL W. KING, *J. agric. Fd Chem.*, 1967, 15 (2), 305.

A toxin-free coconut protein extract possessing normal nutritive value may be obtained by treating coconut flour with enzyme extracts obtained from *Pestalotiopsis westerdijkii* in tray cultures; incubating for 10-11 days at 31-2°C, extracting with water, precipitating with (NH₄)₂ SO₄ and dialysing by gel filtration. Optimum conditions for this process are temperature, 40°C for 3 hr at pH, 5.6-6.0 using about 50 mg./g. of enzyme of coconut residue.

B. S. N.

- 5.30 *Studies on the biosynthesis of amygdalin the cyanogenic glycoside of bitter almonds (Prunus amygdalus Stokes)*, YASHPAL ABROL, *Indian J. Biochem.*, 1967, 4 (1), 124.

Phenylalanine serves as an effective precursor of amygdalin [D(-)-mandelonitrile-β-D-gentiobioside]. Conversion takes place by a α carbon of phenylalanine contributing towards the carbon atom of nitrite moiety while β-carbon is incorporated into the aglycone.

A. A.

- 5.31 *Evaluation of groundnut (Arachis hypogea) varieties for protein quality*, P. S. CHEEMA AND G. S. RANOTHTRA, *J. Nutr. Dietet.*, 1967, 4 (2), 93.

The agro-climatic conditions did not influence to any significant extent the protein content of 30 varieties examined. Methionine content ranged in them from 0.62-0.95 g/16 g. N.

B. S. N.

- 5.32 *Importance of cellular constituents to cotton seed meal protein quality*, WILDA H. MARTINEZ, LEAH C. BERADI, VERNON L. FRAMPTON, HAROLD L. WILCKE, DARGLE E. GREENE AND ROBERT TEICHMAN, *J. agric. Fd Chem.*, 1967, 15 (3), 427.

To determine the relative importance of cellular constituents to the nutritive value of cotton seed meals, three meals differing in chemical content were prepared from glandless cotton seed by extracting: free lipids, phospholipids from portions of lipid free material, and both phospholipids and carbohydrates. Treatments consisted of autoclaving each meal in the presence and absence of pure gossypol contained in a fraction of isolated cotton seed pigment glands. In a 4-week feeding test with weanling rats, the unautoclaved meals were equal in nutritive value to the soybean meal control. Autoclaving reduced the protein efficiency ratio (PER) of all meals, but less in the meals from which the phospholipids and carbohydrates were removed. The binding of gossypol and its effects on protein quality were dependent on both its physical state and other constituents of the meal. Within a series, PER was significantly correlated with E-free lysine content. However, the processing history of the cotton seed meal must be considered in any comparison of E-free lysine values as criteria of protein quality.

A. A.

- 5.33 *Polysaccharide components of soyabeans*, G. O. ASPINALL, R. BEGBIE AND J. E. MCKAY, *Cereal Sci. To-day*, 1967, 12 (6), 223.

Summary of the work done at Edinburgh on the extraction and characterisation of polysaccharides in soyabeans.

- 5.34 *Products from soybeans-laboratory preparation of tofu*, H. L. WANG, *Fd Technol. Champaign*, 1967, 21 (5), 799.

The laboratory procedure involves, preparation of soy milk from beans, coagulation of soybean protein to form a suitable curd and transfer to a perforated box where *tofu* cake is hand pressed to remove whey.

J. V. S.

5.35 *Nutritive value of coconut protein concentrates obtained by wet processing*, G. RAMA RAO, G. RAMANATHAN, K. INDIRA, U. S. BHIMA RAO, M. R. CHANDRASEKHARA, K. J. CARPENTER AND D. S. BHATIA, *Indian J. exp. Biol.*, 1967, 5 (3), 114.

In vitro digestibility and protein efficiency ratio (PER) of skim milk concentrates from fresh and autoclaved coconuts as well as the acid and heat coagulates and whey solids have been determined. The supplementary effects of whey solids and minerals on the poor PER of coconuts have also been investigated. PER of skim milk concentrates from autoclaved coconuts was negative while that from fresh coconuts was fairly high (1.4-1.9); acid and heat coagulates had also higher PER (1.9-2.4). The *in vitro* digestibility of both acid and heat coagulates was higher than that of concentrates from fresh coconuts. The results suggest that the protein in skim milk suffers some damage during autoclaving and concentration.

A. A.

6. Oils, Fats and Waxes

6.29 *Salad oil manufacture and control*, T. J. WEISS, *J. Am. Oil Chem. Soc.*, 1967, 33 (4), 146A.

A recent approach is to winterise the oil from solvent which improves salad oil yield. The quality control is by cold test, a measure of time required for the oil to cloud in an ice bath. Crystal inhibitors such as oxystearin or polyglycerol esters are used to lengthen the cold test.

J. V. S.

6.30 *High oleic safflower oil: stability and chemical modification*, G. FULLER, M. J. DIAMOND AND T. H. APPLWHITE, *J. Am. Oil Chem. Soc.*, 1967, 44 (4), 264.

High oleic acid safflower oil has been shown to have high temperature oxidative stability comparable with that of hydrogenated vegetable oils. This stability added to the ease of handling at low temperatures, should make the oil attractive as a commercial cooking oil. Epoxidation of new safflower oil led to a product similar to epoxidised olive oil but lighter in colour.

6.31 *Measurement of some rheological properties of plastic fats with an extrusion modification of the Shlar press*, ILIJA VASIR AND JOHN M. DEMAN, *J. Am. Oil Chem. Soc.*, 1967, 44 (4), 225.

An extrusion attachment for the Lee-Kramer shear press is described. With this instrument some rheological properties of lard, margarine and shortening were measured.

J. V. S.

6.32 *An improved 2—thiobarbituric acid (TBA) procedure for the measurement of autoxidation in fish oils*, T. C. YU AND R. O. SINNHUBER, *J. Am. Oil Chem. Soc.*, 1967, 44 (4), 256.

Air oxidation of lipid during TBA reaction produces misleading results, but can be controlled by adding antioxidants. The comparative peroxide and TBA values in autoxidised menhaden oil is given.

J. V. S.

6.33 *Study on the changes of lard added with antioxidants during heating*, B. A. J. SEDLACEK, *Nahrung*, 1967, 10 (2), 155.

Antioxidants (propyl gallate, BHA, NDGA and dodecyl gallate) added during heating upto 35 hours at $175 \pm 5^\circ\text{C}$ underwent rapid breakdown. Only aldehydes in lard was lower as compared to lard without antioxidants. The other products are not influenced by the antioxidants.

6.34 *Formation of non volatile decomposition products in heated fats and oils*, EDWARD G. PERKINS, *Fd Technol. Champaign*, 1967, 21 (4), 611.

In deep fat frying of cotton seed oil, the polymeric material increased with progress in heating time. Alternate cycles of heating and cooling increased the deterioration of the oil. From thermally oxidised corn oil, 20 compounds (mol. wt., 390 to 970) were isolated; one of them appears to be a phthalic ester. The presence of phthalic ester was also demonstrated in the oxidised synthetic triglycerides.

J. V. S.

6.35 *Compounds in cotton seed oil that cause pink discoloration in stored eggs*, ROBERT JOHN EVANS, SELMA L. BANDEMER AND J. A. DAVIDSON, *Poult. Sci.*, 1967, 46 (2), 345.

A fraction of the cotton seed oil soluble in acetone and petroleum ether at 60°C gave a strong Halophen reaction, contained 3-4 per cent of stercularic acid and when fed to laying hens, the eggs obtained developed very pink whites and enlarged thick brown yolks during storage and contained increased levels of stearic acid. Separation of the fraction indicated that it contains either a fatty acid without a cyclopropenoid ring that causes 'pink white' discoloration and does not readily form a urea inclusion compound, or a fatty acid with a cyclopropene ring which is isomerized or substituted during the fraction procedure to the active agents for 'pink white' discoloration; these active agents are produced by the hen from the cyclopropene fatty acids during the metabolic process. Heat (100 to 250°C for 1 to 4 hr) destroyed the Halophen activity and pink white activity of crude cotton seed oil, refined cotton seed oil and a mixture of corn oil and *Sterculia foetida*.

K. A. R.

7. Starch, Sugar and Confectionery

7.10 *Determination of pectic substances in the presence of dextrans*, M. A. JOSLYN AND TUNG-SCHAN-CHEN, *J. agric. Fd Chem.*, 1967, 15 (3), 398.

Combination of calcium precipitation technique with calcium and colorimetric carbazole determination of galacturonic acid in the precipitate appears suitable for determination of pectic substances in the presence of dextrans.

B. S. N.

7.11 *The use of enzymes in dextrose and starch sirup production*, H. BARFOED, *Starke*, 1967, 19 (1), 2.
General article.

8. Spices and Condiments

8.8 *Preservation of green colour in cardamom*, C. P. NATARAJAN, S. KUPPUSWAMY, M. N. KRISHNAMURTHY, THOMAS D'SOUZA AND K. K. GOPALAN, *Indian Spices*, 1967, No. 1, 5.

Treating the green coloured cardamom with 2 per cent washing soda for 10 minutes before drying helps in the increased rate of drying and retention of green colour. The cost of alkali treatment works out to 4 to 5 paise per kilogramme.

K. A. R.

8.9 *A simple and rapid test for the detection of adulteration in cardamom seeds*, B. M. KULKARNI AND J. S. PRUTHI, *Indian Fd Packer*, 1967, 21 (1), 14.

Examination under an ordinary dissection microscope ($\times 20$) or under hand lens (7.5 cm diam. and focal length 10 cm) confirmed that *E. cardamomum* seeds had pitted surface and streaks, while *E. ammomum* had smooth surface and were free from pits and streaks. These differences enabled detecting adulteration of former with the latter.

K. A. R.

- 8.10 *Reactions involved in formation of a pink pigment in onion purees*, S. SHANNON, M. YAMAGUCHI AND F. D. HOWAD, *J. agric. Fd Chem.*, 1967, 15 (3), 417.
A colourless ether soluble precursor in onion puree reacts with some amino acids of onions to form a second compound, colourless, but insoluble in ether. Reacting with formaldehyde or naturally occurring carbonyls, this then forms the pink pigment at pH 4.8.
B. S. N.
- 8.11 *Precursors involved in the formation of pink pigments in onion purees*, S. SHANNON, M. YAMAGUCHI AND F. D. HOWAD, *J. agric. Fd Chem.*, 1967, 15 (3), 423.
A preparation of allinase from garlic and a system of pyridoxal and Cu²⁺ which stimulates the catalytic action of allinase caused the formation of pigment precursors in the amino acid fractions from onions. The precursors formed were an ether soluble, ultra violet absorbing compound and one or more unidentified carbonyl compounds.
A. A.
- 8.12 *A review of some of the commercial aspects of cinnamon*, BRIAN M. LAWRENCE, *Perf. essent. Oil Rec.*, 1966, 58 (4), 236.
Review (botanical designation, nomenclature of cinnamon, volatile oils in cinnamon of commerce, adulteration, etc.). 38 references.
A. A.
- 8.13 *Increasing yields and reducing storage losses of onion*, S. N. RAO, M. RAMA RAO AND G. GOPALAKRISHNAMURTHY, *Indian Fmg. N.S.*, 1967, 17 (4), 14.
Storing onions in *Pandavas* (temporary structures prepared from wooden poles) bamboo *thatties* or *sajja* (*Pennisetum* sp) or predrying onion bulbs in shade for four days or spraying the standing crop with maleic hydrazide at 3,000 p.p.m., 15 days prior to harvest, reduced the storage losses by 75, 66 and 39 per cent respectively.
K. A. R.
- 9. Meat, Poultry and Fish**
- 9.59 *Extraction of lipids from raw beef lean by using various solvent systems*, SUSIE N. HAGAN, ELIZABETH W. MURPHY AND LYDIA M. SHELLEY, *J. Ass. off. Anal. Chem.*, 1967, 50 (2), 250.
Chloroform-methanol extraction yielded the same or greater percentages of total fat from beef than by AOAC method. Acid-hydrolysis-Rohrig gave the lowest yield of total lipid and of phospholipid. Sample preparation method or drying method showed few significant differences in the proportion of total solids and of total lipids in the beef cuts analysed.
J. V. S.
- 9.60 *Irradiation of raw meat (chicken) with special regard to the survival of some Salmonella and Staphylococcus species*, K. INCZE AND E. S. IDZIAK, *Husipar*, 1967, 16 (2), 74.
Shelf life of eviscerated chicken irradiated with 0.5 Mrad increases three times in comparison to unirradiated samples. The dosage further assures the desired 10⁻⁸ fold decrease in numbers of Staphylococci and Salmonellae.
B. S. N.
- 9.61 *Studies on adhesion of meat material on casing in fish sausage and Kamaboko. I. Some trial to estimate the degree of adhesion*, MICHIO YOKOYAMA, *Bull. J. Soc. sci. Fish.*, 1966, 32 (12), 1023.
Keeping quality of sausage has been known to depend on the degree of adhesion of meat to casings. Adhesion strength was measured by a specially designed tensile adhesion tester consisting of a tensile instrument, a tension meter, an amplifier and a recorder. The best condition for measuring adhesion strength was: sample width, 3 cm.; measuring temperature, 30°C; the peeling angle, 90°; and peeling direction, clockwise.
J. V. S.
- 9.62 *The influence of temperature on fish*, W. VYNCIE, *Fish. News Internat.*, 1967, 6 (4), 39.
The influence of three temperatures (20°C, 15°C, 0°C) during 18 hours on the spoilage of Cod (*Gadus morhua*) red fish (*Sebastes marinus* L) herring (*Clupea harengus* L) and dog fish (*Squalus acanthias* L) was tested by means of following objective tests refractive index (RI) of the eye fluid, electrical resistance of fish flesh, total volatile bases, trimethylamine, volatile reducing substance (VRS) volatile acids and volatile ammonia. With dog fish, VRS and volatile ammonia determinations proved to be of real value for quality assessment, whereas in all others, other methods except refractive index successfully accomplished the assessment.
B. S. N.
- 9.63 *Studies on discolouration of fishery products. II. Influence of extracts on discolouration by lipid oxidation of Jack Mackerel dark muscle*, MOSAMICHI, TOYOMIZER, TUNEMICHI YAMAZAKI AND HIROKI NAGAKAWA, *Bull. J. Soc. sci. Fish.*, 1967, 33 (1), 27.
Discolouration rate and TBA values were measured during cold storage in leached and dialysed dark muscle mixed or not mixed with dark muscle extracts before freeze-drying. Muscle, dialysed or dark not mixed with extracts did not develop discolouration. Leached dark muscle containing extracts developed discolouration like untreated dark muscle. Low molecular weight fractions obtained from dark muscle extracts promoted discolouration and increased lipid oxidation. The browning test by heat processing of low molecular weight fraction of dark muscle extracts at 120°C for 1 hr with or without amino acids and sugars showed that it acts as an amino source and an accelerator in amino-carbonyl reaction.
J. V. S.
- 9.64 *Studies on retention of meat colour of frozen tuna. IV. Acceleration of discolouration of tuna meat by freezing and its relation to storage temperatures*, MOSAMICHI GITO AND SUSHMU HONMA, *Bull. Soc. sci. Fish.* 1967, 33 (1), 33.
Tuna meat frozen in polyethylene bags was stored at temperatures ranging from -3 to -10°C. In general, the inner parts discoloured more considerably than the samples of meat. Maximum discolouration occurred between -3 to -4°C in the outer surface, and -6 to -7°C in the inner parts. This difference in temperature range for maximum discolouration (at inner parts and outer surface) was suspected to be due to the differences in the partial pressures of O₂ between each portion of meat. Vacuum pack with aluminium foil laminated by polyethylene was superior in colour retention in the inner parts of meat.
J. V. S.
- 9.65 *Net protein utilization of fish products—prediction using a modified pepsin digest procedure*, JUNE OLLEY AND P. R. PAYNE, *Fish. News Internat.*, 1967, 6 (1), 34.
A measure of the available sulphur-containing amino acids may be obtained by digesting fish products used as animal feeds with 0.002 per cent pepsin. When corrected for the acid soluble material present, the value obtained is close to that of NPU of the product.
B. S. N.
- 9.66 *Fish protein concentrate—present status and future potential. I and II. Production, cost, application*, BERNARD WEINBERG, *Fish. News Internat.*, 1967, 6 (1), 16 (2), 35.
Review. 15 references and 5 tables.

- 9.67 *Drained weight of frozen shrimp*, J. C. WERREN AND R. W. WEIK, *J. Ass. off. anal. Chem.*, 1967, 50 (3), 267.
Collaborative study. Results indicate good precision or within a laboratory repeatability. A water flow rate of 1-3 gallons/minute was as accurate as the prescribed rate of 6 gallons/minute.
A. A.
- 9.68 *A study of the net weight and drained weight relationship of frozen shrimp products*, J. C. WERREN, ARTHUR R. JOHNSON AND R. W. WEIK, *J. Ass. off. anal. Chem.*, 1967, 50 (5), 278.
The method permits complete thawing of the shrimp and enables the analyst to evaluate the frozen and thawed product and to detect and estimate the severity of freezer burn (dehydration). It is better than AOAC method 10.008.
A. A.
- 9.69 *Measurement of applied mechanical pressure during processing of Turkey rolls*, PETER M. VOISEY AND M. M. AREF, *Fd Technol. Champaign*, 1967, 21 (4), 655.
The pressure applied to the meat during processing affects both the weight loss and the binding of meat pieces together. The optimum pressure had to be determined and an apparatus has been devised for this purpose.
J. v. S.
- 9.70 *Tenderness and juiciness of freeze dried chicken meat as related to maturity of birds*, G. H. WELLS AND L. E. DAWSON, *Poult. Sci.*, 1966, 45 (5), 1004.
In evaluating the tenderness a correlation coefficient of 0.59 was obtained between sensory panel scores and Warner Bratzler shear values when cooked and rehydrated muscle was used, and the value was 0.80 for non-freeze-dried muscle. Tenderness decreased with age of birds. Sensory evaluations indicated juiciness to be directly related to tenderness.
K. A. R.
- 9.71 *Effect of iron sulphate on egg discoloration caused by gossypol*, A. R. KEMMERER, B. W. HEYWANG, M. G. VAVICH AND E. T. SHEEHAN, *Poult. Sci.*, 1966, 45 (5), 1025.
Yolk discoloration in cold stored eggs caused by gossypol was prevented to a large extent by addition of ferrous sulphate to the rations of laying hens.
K. A. R.
- 9.72 *Microbial counts and certain organic acids in liquid and frozen whole eggs*, L. E. STEINHAUER, J. E. DAWSON, W. L. MAKMANN AND R. J. WILKINSON, *Fd Technol. Champaign*, 1967, 21 (4), 647.
Total plate counts of viable organisms and presence of lactic, acetic, formic and succinic acids were followed in freshly broken and blended liquid whole eggs stored at 16°C for 2 months. Number of microorganisms and the lactic acid content increased; succinic acid was detected in all eggs, formic and acetic acids present were only in traces. Results of examining commercial samples are also given.
- 9.73 *Fish protein concentrate: How made—when used*, *Food Engng*, 1967, 39 (5), 72.
A simple and fast solvent extraction process using whole fish which gives a colorless, tasteless free flowing and stable flour containing 85 per cent protein is described. The process developed by Bureau of Commercial Fisheries is engineered by Chicago Bridge and Ironco and is essentially a three stage counter current solvent extraction. The details furnished include changes and capacities of the three stage temperatures, and comparison of the key streams. A flowsheet of the process is also furnished.
M. C. B.
- 9.74 *Oxidative rancidity in frozen stored cod fillets*, C. H. CASTELL, B. A. MOORE, P. M. JANGAARD AND WANDA E. NEAL, *J. Fish. Res. Bd Canada*, 1966, 23 (8), 1385.
During frozen storage at -18° and -25°C the lipids in cod muscle did not undergo oxidation. They underwent a marked decrease in the ease with which they were oxidized by added Cu⁺⁺, Fe⁺⁺, or hemoglobin. This change preceded the protein denaturation that occurs in stored frozen muscle and appeared to be directly related to the formation of free fatty acids in the muscle. The addition of four pure saturated fatty acids had little or no effect on the development of rancidity in muscle, either in the presence or absence of added metal catalysts.
A. A.
- 9.75 *Desiccation of frozen fish*, J. W. BOYD, B. A. SOUTHCOTT AND G. F. BOOTHBY, *J. Fish. Res. Bd Canada*, 1967, 24 (1), 211.
Loss in weight from frozen fillets packaged in cartons with cellophane liners was approximately 1/10 the amount of weight lost from frozen fillets packaged without cellophane liners.
K. A. R.
- 9.76 *A rapid method to determine stability of sausage emulsions and the effects of processing temperatures and humidities on various characteristics of emulsions*, R. L. SAFFLE, J. A. CHRISTIAN, J. A. CARPENTER AND S. B. ZIRKLE, *Fd Technol. Champaign*, 1967, 21 (5), 784.
The emulsion stability test is fast, reliable and inexpensive. Some practical applications for the test are given. In general, the higher the humidity and temperature the greater was the possibility of emulsion breakdown especially with marginal formulations. The higher temperature and humidity treatments resulted in lower colour intensity and less uniformity of colour of Frankfurters. No significant differences were found for panel peeling scores among the six treatments but the mean panel scores were greater for the three lower humidity treatments than for any of the three higher humidity treatments.
A. A.
- 9.77 *Effect of internal and oven temperatures on eating quality of light and dark meat Turkey roasts*, IRMA M. HOKE, BERNICE K. MCGEARY AND MARIA K. KLEVE, *Fd Technol. Champaign*, 1967, 21 (5), 773.
Cooking times of Turkey roasts of dark and light meat increased with increases in interval and decreases in oven temperatures. In dark meat, when internal temperature increased from 165° to 195° the juiciness of cooked meat decreased but quality scores for palatability factors increased. Only mealiness of roasted meat (light or dark) was changed by oven temperatures.
J. v. S.
- 9.78 *The influence of disease on yield and composition of poultry meat*, A. W. BRANT, W. W. SADLER AND HARRIET LEWIS, *Poult. Sci.*, 1967, 46 (2), 444.
The presence of disease in young chickens and turkeys had no effect on their eviscerated, trimmed and chilled weights; thaw and cooking losses, total bound and free moisture content; cooked skin, bone and meat yield; and proximate analysis of raw and cooked meat and pH of raw muscle; the effect was little on live weight and skin fat.
K. A. R.
- 9.79 *Sanitation practices in egg handling and breaking plants and the application of several disinfectants for sanitising eggs*, J. C. AYRES, A. A. KRAFT, R. G. BOARD, G. S. TORREY AND S. S. RIZK, *J. appl. Bact.*, 1967, 30 (1), 106.
Quaternary ammonium compounds hold promise for sanitising shell eggs, since they have a good germicidal action at alkaline

pH values and at high dilution, they can be used at a high temperature, have a residual effect, and are less influenced by organic matter than most disinfectants. 32 references.

A. A.

9.80 *Factors affecting the discolouration of hard cooked egg yolks*, ROBERT C. BAKER, JUNE DARFLER AND ABRAHAM LIFSHITZ, *Poult. Sci.*, 1967, **46** (3), 664.

The discolouration was found to be due to FeS and caused by the combination of Fe⁺⁺ released from the yolk, and H₂S freed from albumen. High cooking temperature, long cooking time, pH of yolk, long storage before cooking both with and without change in quality, all influence the extent of discolouration. Following cooking, the amount of discolouration is influenced by method of cooling, cooling time and storage. Strain of chickens, size of egg, and egg quality variations within age of eggs had no effect on FeS formation.

A. A.

9.81 *The baking properties of pasteurized whole egg*, R. A. KNIGHT, K. MEARS, T. L. PARKINSON AND J. ROBB, *J. Fd Technol.*, 1967, **2** (2), 143.

Pasteurization resulted in significant loss of baking quality in 'sponge batter' sponges but in 'all-in' sponges it was not significant. Performance of pasteurised egg in baked custards was slightly inferior to that of raw egg. Pasteurized egg stored at 12-16°F deteriorated after 30 weeks of storage when used to make products sensitive to egg quality whereas the raw egg maintained its quality. Pasteurized eggs gave satisfactory results in other baked products even after two years storage. It also showed no significant changes when held at 38-40°F for four days without continuous agitation. Loss in baking quality occurred when the pasteurisation temperature was raised above 148°F or due to the separation of fat when pasteurised egg was kept or transported without agitation.

K. A. R.

10. Milk and Dairy Products

10.42 *The chemical composition of buffalo milk. I. General composition*, M. H. ABDEL-SALAM AND S. EL-SHIBINY, *Indian J. Dairy Sci.*, 1966, **19** (3), 151.

Analysis of 18 buffalo milk samples and 72 individual samples.

10.43 *The chemical composition of buffaloes' milk. II. Effect of lactation period*, M. H. ABDEL-SALAM AND S. EL-SHIBINY, *Indian J. Dairy Sci.*, 1966, **19** (3), 155.

Stage of lactation of buffalo influenced the fat, lactose, total and whey protein, ash, total casein, ester, colloidal and soluble inorganic phosphorus, total and soluble calcium, magnesium, and citric acid, ionizable calcium, sodium, potassium chloride non-protein nitrogen, acidity and pH values in buffalo milk samples.

B. S. N.

10.44 *Studies on some physical and physico-chemical properties of Egyptian buffalo's and cow's milk. I. Freezing point*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHED, *Indian J. Dairy Sci.*, 1966, **19** (3), 113.

Freezing point mean values of individual and herd buffalo's milk were -0.552°C and -0.558°C respectively and were lower than for cow's milk (0.546°C and -0.550°C). Samples of market milk had freezing depression range from 0.278°C - 0.575°C, with a mean value of 0.508°C indicating evidence for adulteration with water. Sterilization and boiling caused significant lowering in freezing point values in cow and buffalo milk.

B. S. N.

10.45 *Studies on some physical and physico-chemical properties of Egyptian buffalo's and cow's milk. II. Refractive index*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHID, *Indian J. Dairy Sci.*, 1966, **19** (3), 118.

Refractive index values of individual and herd bulk buffalo's milk were 1.34492 and 1.34542 respectively and found to be higher (1.34416 and 1.34435) than in cow's milk. Refractive index values were significantly lowered in both species by both sterilization and boiling. Adulteration with added water results in a lower refractive index value of 1.34383 in both species of market milk samples.

B. S. N.

10.46 *Studies on some physical and physico-chemical properties of Egyptian buffalo's and cow's milk. III. Viscosity*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHID, *Indian J. Dairy Sci.*, 1966, **19** (3), 122.

Viscosity values (at 20°C) of individual and herd buffalo's milk were 2.3156 C.P. and 2.352 C.P. respectively and were higher than for cow's milk (2.0114 C.P. and 1.9280 C.P.). A mean viscosity value of 2.2392 C.P. for market buffalo milk was lower than for that of individual and herd cow's milk. Both sterilization and boiling yielded higher values for viscosity of milk for both these species.

B. S. N.

10.47 *Studies on some physical and physico-chemical properties of Egyptian buffalo's and cow's milk. V. Acidity and hydrogen-ion concentration*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHID, *Indian J. Dairy Sci.*, 1966, **19** (3), 158.

Mean acidity and pH values obtained in this study were: buffalo-individual, 0.186 and 6.60; bulk 0.175 per cent and 6.58 and cow individual, 0.178 per cent, and 6.59; and herd bulk 0.172 per cent and 6.53 respectively. Market milk samples had 0.153 per cent and 6.65 as corresponding values. A significant lowering of pH of buffalo and cow milk samples on sterilization (at 120°C for 20 min.) and a slight increase in buffalo milk on pasteurization were observed. Pasteurization and boiling had very little influence in decreasing acidity of both cow and buffalo herd bulk milk, whereas sterilization resulted in significant increase in acidity in both species.

B. S. N.

10.48 *Nutritional evaluation of milk processed for removal of cationic radionuclides. Chemical analyses*, R. E. ISACKS, D. G. HAZZARD, JULIUS BARTH, J. H. FOOKS AND L. F. EDMONDSON, *J. agric. Fd Chem.*, 1967, **15** (2), 295.

10.49 *Relation between xanthine dehydrase and oxidation taste in milk*, F. KIERMEIER & E. GRASSMANN, *Z. Lebensmittelunters. u. Forsch.*, 1967, **133** (5), 310.

The role of xanthine dehydrase in producing the oxidation taste in milk is disputed. Experiments on the oxidation of xanthine and adenine in the presence of this enzyme showed that the velocity of the reaction is increased by the addition of linoleic acid emulsion. These observations give rise to a discussion of the possible influence of reactions catalysed by xanthine dehydrase on the production of the taste defect in milk.

10.50 *Influence of enhanced leucocyte precipitation on the chemical and technical properties of milk. V. Influence on heat stability*, F. KIERMEIER, M. DJAFARIAN AND O. KIRCHMEIER, *Z. Lebensmittelunters. u. Forsch.*, 1967, **133** (4), 208.

As leucocyte precipitation increases, the heat stability of milk decreases. In the production of condensed milk, it is important

that the coagulation time become shorter with increasing concentration. In mixed milk, heat stability varies with the percentage of milk from udders whose secretion is seriously disturbed.

K. M. D.

- 10.51 *Influence of enhanced leucocyte precipitation on the chemical and technical properties of milk. VII. Influence on the suitability of milk for cheese making*, F. KIERMEIER, E. RENNER AND M. DJAFARIAN, *Z. Lebensmittelunters. u. Forsch.*, 1967, **132** (6), 352-358.

Enhanced leucocyte precipitation has the following characteristic effects: (1) yield of whey from curdled milk decreases as the California Mastitis (CM) reaction increases.

(2) There is a definite relation between the CM reaction of the milk and the consistency of rennet jelly made from it. When there is a distinct or strongly positive reaction, formation of jelly is scarcely noticeable.

(3) When Camembert cheese is made from the milk of animals with diseased udders, the cheese has a distinctly lesser consistency than the cheese made from the milk of healthy animals.

K. M. D.

- 10.52 *Efficiency of different mechanical milk can washing procedures*, J. FOLEY, T. P. WHELTON, AND M. O'SE', *Irish J. agric. Res.*, 1967, **6** (1), 15.

When rotary intermittent jet-type can washer was employed, the plate counts of 10-gallon milk cans after washing did not exceed 25,000 colonies/can and the cans were free from milky residues. Satisfactory results (<50,000 colonies/can) were also obtained from milk-soiled cans which had been held for 16 hr at ambient temperatures (12°-16°C) before washing. Cans soiled with butter milk film were not always free from milky residues. Various 3-stage mechanical can washing treatments gave satisfactory cleaning and sterilisation of freshly tipped 10-gallon cans.

A. A.

- 10.53 *New automated methods of milk analysis for fat and protein*, M. G. O'KEEFFE, *Aust. J. Dairy Technol.*, 1967, **22** (2), 64.

The Milko Tester Mark III for fat is the well known Mark II instrument with the versene added before homogenisation and the sample volume is reduced to 1.5 ml. The instrument tests about 180 samples per hour and allows the data to be presented in punched card or on tape for modern processing. The Pro-Milk Tester is for protein and is based on the well known amido black method. It can test 200 samples per hour and requires 2 ml. of sample and 10 ml. of dye.

K. A. R.

- 10.54 *Studies on some physico-chemical properties of Egyptian buffalo's and cow's milk. VI. Gross composition*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHID, *Indian J. Dairy Sci.*, 1966, **19** (4), 195.

Values for density (g/ml), S.N.F. (per cent) and fat (per cent) in case of buffalo's milk, cow's milk and market samples for both individual and herd bulk types from Cairo area are presented.

B. S. N.

- 10.55 *Studies of some physical and physico-chemical properties of Egyptian buffalo's and cow's milk. VI. Inter-relationship between examined properties*, A. A. HOFI, I. D. RIFAAT AND M. A. KHORSHID, *Indian J. Dairy Sci.*, 1966, **19** (4), 198.

- 10.56 *The release of free and bound sialic acid from casein by rennet and trypsin*, S. K. GUPTA AND N. C. GANGULI, *Indian J. Dairy Sci.*, 1966, **19** (4), 220.

A proteolytic enzyme releases more of sialic acid in free form than in bound form in casein, while sialic acid in bound form is

released by rennet. An unknown rennet preparation may probably be characterised on this basis by testing for its sialidase activity and sialic acid release.

B. S. N.

11. Coffee, Tea and Cocoa

- 11.5 *Occurrence of milk coagulating and proteolytic enzymes in cacao*, F. KIERMEIER, AND M. SCHMID, *Z. Lebensmittelunters. u. Forsch.*, 1967, **133** (4), 217.

The presence of a vegetable rennet and a proteolytic enzyme in cacao was demonstrated. The content of these enzymes depends very much on the origin of the beans. Partial inactivation of the enzymes during the processing of beans could be proved by taking samples at different stages of manufacture of cocoa powder. Temperature stability of the proteolytic enzyme was particularly noteworthy. Residues of milk-coagulating and proteolytic enzymes could be detected in six commercial samples of cocoa powder.

K. M. D.

- 11.6 *Protein hydrolysis during cacao fermentation and its dependence on interactions with polyphenols under anaerobic and aerobic conditions*, BIEHL, *Z. Lebensmittelunters. u. Forsch.*, 1967, **133** (3), 145-158.

Fermentation tests conducted *in vitro* with freeze-dried and acetone-dried powders of unfermented cacao beans showed that, under anaerobic conditions and in the presence of polyphenols, the solubility in water and hydrolysis of the cocoa protein are reduced by oxygen-independent tannins (flavotannins) but not completely suppressed. Interactions with polyphenols under aerobic conditions (quinone tannin), however, render the protein almost completely insoluble in water and hydrolysis is totally suppressed.

K. M. D.

12. Food Additives

- 12.19 *Use of potassium sorbate and sodium benzoate in salted and sun-dried mackerel (*Rastrelliger canagurta*)*, D. P. SEN AND J. R. RANGASWAMY, *J. Fd Sci. Technol.*, 1967, **3** (4), 159.

- 12.20 *Orange oil as a preservative for fish sausage*, M. A. KRISHNASWAMY AND T. M. RUDRA SETTY, *Bull. J. soc. Sci. Fish.*, 1966, **32** (11), 972.

Orange oil compared well with sorbic acid and tylosin as preservatives for fish sausage. It is likely that oxygenated derivatives of D-limonene act as antimicrobial agents.

J. V. S.

- 12.21 *The multi-determination of antioxidants in lard*, DONALD F. MCCULLLEY, THOMAS FAZIO, JOHN W. HOWARD, FRANCES M. DICURIOR AND JULIAN IVES, *J. Ass. off. anal. Chem.*, 1967, **50** (2), 243.

The procedure consists of vacuum sublimation of the antioxidants (BHA, BHT, Ionex-100, PF, THBP and TDPA) and determination by GC, UV, IR and mass spectrometry were used for identification and confirmation. Average recovery of the antioxidants added to 4 g. lard at 100 p.p.m., was 91 to 96 per cent.

A. A.

- 12.22 *Effect of natural and synthetic antioxidants on the incidence of muscle dystrophy of carp induced by oxidised saury oil*, TAKESHI WATANABE, YASUNOBU MATSUURA AND YOSHIRO HASHIMOTO, *Bull. J. Soc. sci. Fish.*, 1966, **32** (10), 887.

Muscle dystrophy of carp (sekoke disease) is due to oxidised oil. Methylene blue, BHA and ethyl gallate were ineffective for preventing this disorder while DL- α tocopheryl acetate was effective.

Muscle dystrophy was induced by oxidised saury oil of very low peroxide value and also by acetone-soluble liquids from dried silk worm pupae.

J. V. S.

12.23 *Thin-layer chromatography of some preservatives*, H. WOIDICH, H. GNADER, AND E. GALINOVSKY, *Z. Lebensmittelunters. u. Forsch.*, 1967, 133 (5), 317.

A simple method, suitable for examination of foods, is described whereby sorbic acid, benzoic acid, p-chlorobenzoic acid, p-hydroxybenzoic acid and its esters can be separated. After shaking the samples with ether-petroleum ether (1:1) and evaporating the solvents, the preservatives were separated by chromatography on a thin layer of polyamide containing a fluorescing substance and made visible by UV light.

K. M. D.

13. Food Analysis

13.32 *Collaborative study of a method for multiple organophosphorus pesticide residues in non-fatty foods*, JOHN R. WESSEL, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 430.

A multiple detection gas chromatographic method (potassium chloride thermionic plus electron capture) was tested for ronnel, ethion, trithion, diazinon, methyl parathion, and malathion in leafy vegetables (lettuce) and fruits (apples). Residues were present at the 0.5 and 5.0 p.p.m. levels. Average recoveries for the 7 residues at the 0.5 p.p.m., level, were 88.7 per cent (by thermionic) and 91.2 per cent (by electron capture) from apples. At the 5.0 p.p.m., level average recoveries were 89.0 per cent (thermionic) and 89.4 per cent (by electron capture) from lettuce. Residues in most instances were confirmed by TLC.

A. A.

13.33 *Quantitative determination of benzaldehyde in flavours and cordials by ultra violet spectrophotometry and 2, 4-dinitrophenylhydrazine precipitation*, RICHARD L. BRUNELLE, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 319.

The UV spectrophotometric method (this journal, 1966, 49, 215) with a modification (described in this paper) and also the 2,4-dinitrophenylhydrazine precipitation method (this journal 1966, 49, 504) after modification (described here) are recommended for adoption as official final action as alternative methods.

J. V. S.

13.34 *Determination of Potassium in food using the Technicon auto analyzer flame photometer and solid prep sampler*, R. V. SMITH L. L. CIACCIO AND R. L. LIPCHUS, *J. agric. Fd Chem.*, 1967, 15 (3), 408.

By using the modified stirrer in the homogenizer of the apparatus, complete extraction of potassium is feasible in 1 minute and 20 seconds by using warm (50°C) 0.5 N ammonium acetate. The analytical data in case of tea for potassium as compared with conventional techniques is 1.51 ± 0.03 per cent.

B. S. N.

13.35 *A refractometric method for the estimation of fat in cookies and bakery products*, L. COURLIOS-SALVI AND D. G. WEEDEN *Chemistry Ind.*, 1967, No. 13, 544.

The refractometer estimates unbound lipid and yields identical results with those obtained by direct light petroleum extraction.

K. A. R.

13.36 *Methods employed by the citrus concentrate industry for detecting diacetyl and acetyl methyl carbinol (AMC)*, D. I., MURDOCK, *Fd Technol. Champaign*, 1967, 21 (4), 643.

Quality and stability of chemicals and reagents for Voges-Proskauer reaction were examined. A method is suggested for estimating diacetyl in frozen concentrated orange juice.

13.37 *Protein analysis of meat products*, K. MOHLER AND W. VOLLEY, *Z. Lebensmittelunters. u. Forsch.*, 1967, 133 (3), 179.

Use of sulphuric acid instead of hydrochloric acid for the preparation of the hydrolysate required for hydroxyproline estimation makes it simpler to estimate enzymatically the L-glutamate in the hydrolysate also. The maximum error is ± 4 per cent and other amino acids do not interfere in this estimation.

13.38 *Microbiological estimation of biological values of proteins*, N. G. DOIPHODE AND D. B. DESAI, *Indian J. med. Res.*, 1967, 55 (5), 443.

A method for estimating biological values of proteins of cereals and pulses, with the use of *Leuconostoc mesenteroides* showed general agreement with conventional methods.

K. A. R.

13.39 *Gas chromatographic determinations of B-alanylhistidine dipeptides in soup preparations*, A. CARISAMO, *J. Chromatog.*, 1967, 27 (1), 259.

The spectrophotometric determination of B-alanylhistidine dipeptides in soup preparations is hindered by certain difficulties which cause an error of over 10 per cent. This method based on GC is suitable for determining B-alanylhistidine dipeptides in soup preparations and enables the calculation of meat extract content of these products.

J. V. S.

13.40 *Rapid methods for determining copper content of milk*, SMITH A. C., *J. Dairy Sci.*, 1967, 50 (5), 664.

Two rapid methods of precipitation involving the use of zinc dibenzyl dithiocarbamate (Arazate), which eliminates the need for pH adjustment, have been compared with a dry-ashing procedure.

K. A. R.

13.41 *Micro sedimentation test for wheat*, W. T. GREENAWAY N. S. HURST, M. H. NEUSTADT AND LAWRENCE ZELENY, *Cereal Sci. Today*, 1967, 11 (5), 197.

A scaled-down version of the standard sedimentation test given in Cereal Laboratory Methods (7th Edition, Method 56-66), with some differences. It has been applied to 40 samples of wheat ranging in sedimentation value from 10 to 72 and in protein content from 8.4 to 17.5 per cent.

J. V. S.

13.42 *Estimation of residual carbohydrate in brewers' spent grains by acid hydrolysis a rapid process control measure*, C. MACFARLANE, *J. Inst. Brew.*, 1967, 73 (2), 175.

A straight borne correlation is shown between the results obtained by the proposed method and by the mashing method described by Lloyd-Lind. The relationship of the residual carbohydrate in the spent grains to the weight of malt soluble solids obtained in the wort is deduced theoretically.

A. A.

13.43 *Analytical methods for the determination of physical properties of dried milk*, J. HEJL and others, *Prumysl Potravin*, 1967, 18 (3), 168.

The work covers the following methods for the detn of physical properties of dried milk, determination of bulk density, indirect method of determining the specific weight of particles by means of organic solvents, and microscopic method studying the percentage of various fractions of particles.

A. A.

13.44 *Development of citrus colorimeter*, RICHARD S. HUNTER, *Fd Technol. Champaign*, 1967, 21 (6), 906.

An instrument has been developed for measuring the colour quality of orange and other citrus juices. For orange juices, the

new instrument measures citrus redness. A scale can be added to measure the citrus yellow colour also. The new USDA plastic cylindrical standards for orange juice colour are used to standardise the instrument.

J. V. S.

14. Food Microbiology and Fermentation

14.40 *Leaker spoilage in canned foods and its prevention*, K. C. DE, *Indian Fd Packer*, 1967, 21 (1), 24.

General article.

14.41 *Incidence of Salmonella and Shigella in samples of raw milk*, R. S. SINGH AND I. P. SINGH, *Indian J. Dairy Sci.*, 1966, 19 (3), 149.

About 205 pooled samples of raw buffalo milk were analysed. Two Salmonella and Shigella strains were isolated. *Salmonella* strains were typed as *S. paratyphi A.*, (1, 2, 12:a:—) and *S. newport* (6, 8:e, h: 1, 2) one of Shigella strains was identified as *S. flexeneri* and the other remained untyped due to roughness of its colonies.

B. S. N.

14.42 *Simultaneous determination of volatile acids and sulfur dioxide in alcoholic beverages by microdiffusion*, JOSEPH L. OWADES AND JOSEPH M. DONO, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 307.

This method avoids the troublesome distillation. Only small samples are required and many replicates can be analysed in one day.

J. V. S.

14.43 *A rapid routine test for coliform contamination in food*, I. FARRELL, G. G. JAYSON, L. C. MCCONLOUGH AND D. G. PIRIE, *J. Sci. Fd Agric.*, 1967, 18 (4), 138.

The new method makes use of radio active tracers and requires less time to confirm the presence of coliform contamination. The relationship has been established between the number of organisms originally present and the time required for their detection.

A. A.

14.44 *Manufacturing digestible protein foods from oilseeds and pulses by enzyme treatment*, H. EBINE, *Japan agric. Res. Quart.*, 1966, 1 (1), 21.

Review. Improvements needed during *miso* manufacture; production of new type *miso* of low salt and high protein, fermentation of pulses and the applications of enzyme production. Three references.

J. V. S.

14.45 *Biological value of the protein of the dried yeast powder*, SURAZYNSKI A., CHUDY J. AND ALEKSIEJEZYK Z., *J. Nutr. Dietet.*, 1967, 4 (2), 118.

The production of yeast protein preparation on an industrial scale employing method of Janicki and Collaborators.

14.46 *Study of the prevention of swelling miso. 3. Swelling caused by Clostridium*, HIROSHI ITO AND HIDEO EBINE, *Rep. Fd Res. Inst. Japan*, 1967, 22, 53.

The number of Clostridia in different types of *miso* which swell during storage at 30°C were 10² to 10⁴/g. Sorbic acid or DHA could prevent swelling due to yeast but not swelling due to Clostridium. A strain isolated from white *miso* was classified as *Cl. perfringens*, a strain from barley *miso* as a variety of *Cl. multifementus*, a strain from yellow *miso* as a variety of *Cl. toanum* and a strain from light yellow *miso* and red sweet *miso* as a variety of *Cl. tertium*.

J. V. S.

14.47 *Milk clotting enzyme from microorganisms. I. Screening test and identification of the potent fungus*, KEI ARIMA, SHINJIRO IWASAKI AND GAKUZO TAMURA, *Agric. biol. Chem. Japan*, 1967, 31 (5), 540.

Out of some 800 strains of microorganisms, a potent fungus for milk clotting enzyme was isolated from soil and identified as a strain of *Mucor pusillulus* Lindt. Satisfactory results were obtained in cheese making experiments with this enzyme which could be produced effectively by solid culture on wheat bran at 30°C for 70 hr. The balance between milk clotting activity and proteolytic activity of this enzyme resembled very much to that of rennet.

A. A.

14.48 *Milk clotting enzyme from microorganisms. II. The enzyme production and the properties of crude enzyme*, SHINJIRO IWASAKI, GAKUZOTAMURA AND KEI ARIMA, *Agric. biol. Chem. Japan*, 1967, 31 (5), 546.

From *Mucor pusillus* F 27, a microbial rennet (an acid protease) was obtained with high productivity by solid culture followed by water extraction. On salting out with ammonium sulphate or mixing with water miscible organic solvents like ethanol, methanol or acetone, the enzyme may be precipitated. Its milk clotting activity is similar to that of calf rennet.

B. S. N.

15. Toxicology

15.32 *Report on mycotoxins*, A. D. CAMPBELL, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 343.

Covers the aflatoxin method with reference to peanut and peanut products, cottonseed products, corn and corn products, cocoa, coffee and tea. Other aspects relate to aflatoxin M₁, confirmative methods for mycotoxin, estrogenic factor from *Gibberella zeae* and ochratoxins. Recommendations are given.

J. V. S.

15.33 *Fungistatic action of aflatoxin B₁*, E. B. LILLEHOJ, A. CIEGLER AND H. H. HALL, *Experientia*, 1967, 23 (3), 187.

Growth of several species of *Aspergillus* and *Penicillium* was inhibited by aflatoxin B₁ when grown in a medium (described in the paper); growth of some strains of *A. terreus*, *A. ochraceus*, *A. niger* and *A. clavatus* was not inhibited.

J. V. S.

15.34 *Limiting temperature and relative humidity for growth and production of aflatoxin and free fatty acids by A. flavus in sterile peanuts*, URBAN L. DIENER AND NORMAN D. DAVIS, *J. Am. Oil Chem. Soc.*, 1967, 44 (4), 259.

The limiting R. H. for aflatoxin production by *A. flavus* was 85±1 per cent for 21 days at 30°C. The limiting low temperature for visible growth and aflatoxin production by *A. flavus* was 13±1°C for 21 days at 97-99 per cent R.H. Damaged kernels however, developed some aflatoxin in 21 days at 12°C. The maximum temperature for aflatoxin production was 41.5±1.5°C for 21 days at 97-99 per cent R.H. Fungus growth and sporulation at 43°C were equal to that at 40°C but no aflatoxin was produced.

A. A.

15.35 *Collaborative study of a method for the identification of the aflatoxin B₁ by derivative formation*, LEONARD STOLOFF, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 354.

Collaborative study by 19 laboratories. The procedure based on the altered chromatographic behaviour of the aflatoxin after reactions with trifluoroacetic acid, formic acid/thionyl chloride, and glacial acetic acid/thionyl chloride was modified by an

improved silica gel column clean up and a clearer definition of sources of difficulty.

A. A.

15.36 *Estimation of aflatoxin M in milk*, I. F. H. PURCHASE AND M. STEYN, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 363.

15.37 *Detoxification of aflatoxin in peanut meal by hydrogen peroxide*, V. SREENIVASAMURTHY, H. A. B. PARPIA, S. SRIKANTA AND A. SHANKAR MURTHY, *J. Ass. off. anal. Chem.*, 1967, 50 (2), 350.

A new approach to destroy aflatoxin in toxic peanut meal. It involves heat treatment of the meal at 80°C for ½ hour with H₂O₂ at pH 9.5. The destruction of aflatoxin is confirmed by biological tests, using Duckling and Duck embryos.

A. A.

15.38 *Survival of Pathogens in Dahi*, N. P. TIWARI AND I. P. SINGH, *Indian J. Dairy Sci.*, 1966, 19, (3), 162.

The pathogens differed in their rate of destruction; *Salm. paratyphi* and *Sh. dysenteriae* were more susceptible than *Staph. aureus* and *E. coli*. In view of the long survival of pathogens at 3-5°C and 22-25°C, *dahi* cannot be considered safe from the standpoint of transmitting infection.

B. S. N.

15.39 *Studies on yellow Pseudomonas infecting newly cropped rice. 4. Fluorescent pigments produced by P. trifolii P. straminea, and P. alba nov. species*, MORIO MATSUNO, *Rep. Fd Res. Inst. Japan*, 1967, 22, 1.

P. trifolii produced invisible fluorescent pigment (maximum absorption, 410 m μ ; maximum fluorescence, pH 3. *P. straminea* and *P. alba* produced yellow or yellow green pigments (maximum absorption, 460-470 m μ maximum fluorescence pH, 7-9). The effects of compositions and conditions of the growth media on the abilities of the organisms to produce the fluorescent pigment have also been investigated.

A. A.

15.40 *Toxicity of Aspergilli isolated from groundnuts and groundnut cakes*, P. G. CHOUDHARY AND S. L. MANJREKAR, *Indian Vet. J.*, 1967, 44 (5), 359.

Of the 150 samples of groundnut cake in Bombay dock, 13 per cent was infested by *A. flavus* and 20 per cent with *A. flavus oryzae*, *A. fumigatus*, *A. niger*, *Penicillium*, *Rhizopus* etc. The infestation of *A. flavus* and other fungi in white, injured and healthy nuts was 5 per cent whereas in damaged, discoloured nuts it was 57.5 per cent. Infestation of *A. flavus* in white nuts was nil whereas in discoloured it was 26.25 per cent.

A. A.

15.41 *Examination of prepared foods in plastic package for Cl. botulinum*, C. TACHINDO JR, T. MIDHRA, G. S. NYGAARD AND H. L. BODITY, *Appl. Microbiol.*, 1967, 15 (2), 426.

Low incidence of *Cl. botulinum* was noticed in a survey of 113 plastic packaged foods which required little or no heating before consumption. Among several materials tested, only soybean cake and Turkey roll, supported growth and toxinogenesis in *Cl. botulinum* type E.

B. S. N.

15.42 *Toxicological studies with a hydrocarbon solvent SBP 62/82*, A. I. T. WALKER AND D. E. STEVENSON, *Fd Cosmet. Toxicol.*, 1967, 5 (1), 19.

Acute and subacute toxicity studies of the hydrocarbon solvent SBP 62/82 derived from petroleum have been carried out in rats and dogs. The acute oral LD₅₀ in rats exceeded 20 ml./kg.

No adverse effects attributable to the solvent were noted after thrice weekly 1 or 5 ml./kg. of SBP to rats for 13 weeks, once weekly oral doses of 0.5 or 2.5 ml./kg. of a 20 per cent emulsion of SBP to rats for 26 weeks, or daily graded oral doses of 0-0.5 ml/kg. of SBP to dogs for 24 weeks.

A. A.

15.43 *Enterococci in the atmosphere of two plants making dried milk*, H. JARCHOVSKA, *Prumysl Potravin*, 1967, 18 (1), 33.

The environment conditions and atmosphere in two plants manufacturing dried milk products have been checked for 10 months for the presence of enterococci. The Chirana 'S' Aeroskop and Petri dishes with selective culture medium have been employed for sampling. The results are presented in six tables covering 102 analyses, and evaluated mathematically by applying statistical methods.

A. A.

16. Infestation, Pesticides and Fungicides

16.56 *Evaluation of some repellent cream formulations against housefly and mosquito*, S. H. QUADRI, J. K. KRISHNA RAO AND S. K. MAJUMDER, *Int. Pest Contr.*, 1967, 9 (2), 25.

Composition B consisting of petroleum base, 84 per cent, citral 10 per cent, clove oil, 5 per cent and *Keamferia galanga* rhizome powder (Kaehura) 1 per cent was superior to composition A consisting petroleum base, 77 per cent oil citronella 18 per cent, clove oil, 4 per cent and *Keamferia galanga* rhizome powder, 1 per cent, against house flies and mosquitoes. However it was less effective against house flies as compared to standard cream C consisting petroleum jelly, 89 per cent and dimethyl phthalate, 11 per cent. The formulations A and B were shown to be very pleasant in smell, without any discomfort or irritation. No toxic symptoms were observed while testing these creams against house flies on treated papers and against mosquitoes on human volunteers.

K. A. R.

16.57 *On the identification of Khapra beetle, Trogoderma granarium*, EIZO MITSUI, *Rep. Fd Res. Inst. Japan*, 1967, 22 (8).

The position of *Tr. varium* and *Tr. inclusum* has been clarified by morphological studies. A key for the identification of *Trogoderma* for plant quarantine purposes is provided.

J. V. S.

16.58 *Studies on the application of rodent repellent to storage warehouse. 3. Tests on Efficiency of paper grain bag treated with rodent repellent*, TOYOAKI HARADA, *Rep. Fd Res. Inst. Japan*, 1967, 22 (33).

Paper bags treated with rodent repellent Lamtarin (2-4 g./m² per bag) containing the antibiotic cycloheximide were tested in six warehouses. The treated bags were mixed in 3 separate stacks. The stacks mixed with treated bags were uneffected by rats while ordinary bag stacks showed rodent damage. The success achieved was 100 per cent.

J. V. S.

16.59 *Studies on fumigant ethylene oxide. VII. Sterilization of mould injurious to the stored cereals and influence on germination of plant seeds*, OSAMU TSURUTA AND AKIKO ISHIHARA, *Rep. Fd Res. Inst. Japan*, 1967, No. 22, 147 (*Food Sanitarian*, 1966, 7, (4), 298).

The maximum efficiency of fumigant against parasitic moulds of stored cereals was found when fumigation was done for 2 hours with an ethylene concentration of 30 per cent in the chamber; and for 48 hours and 72 hours respectively with ethylene concentrations of 0.8 per cent and 0.7 per cent. Seed germination was effected by fumigation in different ways with species.

J. V. S.

- 16.60 *Retention of vaporized lindane by plants and animals*, DAVID M. WHITEACRE AND GEORGE W. WARE, *J. agric. Fd Chem.*, 1967, 15 (3), 492.
Chicken, rats, mice, frogs, fish and plants were exposed to vapourized lindane for 7 to 46 days. Nearly all animal tissues and plants showed significant storage of lindane, including egg yolk from test chicken. All the test fish died during exposure.
B. S. N.
- 16.61 *Toxicity of six organophosphorus insecticides to fish*, A. SREENIVASAN AND G. K. SWAMINATHAN, *Curr. Sci.*, 1967, 36 (15), 397.
Review. 15 references and 3 tables.
- 16.62 *A review of the problem of the toxicity of the pesticidal chemicals in food in India*, S. K. MAJUMDER, *Indian Fd Packer*, 1967, 21 (2), 54.
Review. 20 references.
- 16.63 *Rodent control of stored grains*, T. HARADA, *Japan agric. Res. Quart.*, 1 (3), 22.
The chemicals used in Japan for rodent control and the degree of their success.
- 16.64 *Moisture content, its significance and measurement in stored products*, S. W. PIXTON, *J. Stored Prod. Res.*, 1967, 3 (1), 35.
Review. 18 references.
- 17. Nutrition and Biochemistry**
- 17.42 *Symposium on dietary carbohydrates in man*, *Am. J. clin. Nutr.*, 1967, 20 (2), 65.
Contains 19 papers.
- 17.43 *Feeding of infants with full fat soyabean—rice diets*, PO-CHAO HUANG, TA CHENG TUNG, HUNG-CHI LUE, CHIN-YUN LEE & HUOYAO WEI, *J. trop. Pediatr. & Afr. Child Hlth*, 1967, 13 (1), 27.
Using a toasted and an extruded full fat soya bean flour, 2 kinds of protein rich soyabean rice-diets, ADM and Wenger formulae were prepared. These formulae, together with an American commercial full-fat soya product, Sobee and a cow's milk formula were fed to infants (1-6½ month old) for 6 months. Protein intake was 3.5 g/kg. body weight/day.
- 17.44 *Feeding studies in low-birth weight (LBW) infants. I. Relationships of dietary protein fat, and electrolyte to rates of weight gain, clinical courses and serum chemical concentrations*, M. DAVIDSON, S. Z. LEVINE, C. H. BAUER AND M. DANN, *J. Pediatr.*, 1967, 70 (5), 695.
Isocaloric formula (cow's milk protein, corn oil, and dextrin-maltose) were adjusted so that 6, 4, 3 and 2 g/kg./day of respective proteins were fed to infants (LBW). The minimum intake of protein which was associated with consistently high rates of gain in weight (RGW) was 4 g/kg./day. Observations on two different dietary intakes of fat and minerals were also made in a limited number of infants. Within the range of variations in the daily intake of either fat or minerals there were no effects on gain in weight among the infants studied.
A. A.
- 17.45 *Approaches to village level infant feeding. I. Multi mixes as general foods*, D. B. JELLIFFE, *J. trop. Pediatr. & Afr. Child Hlth*, 1967, 13 (1), 47.
Principles and types of multi mixes.
- 17.46 *Vitamin A therapy in children with Kwashiorkor*, SHEILA M. PEREIRA, ALMAN BEGUM, THILAKAVATHY ISAAC AND MARY E. DUMM, *Am. J. clin. Nutr.*, 1967, 20 (4), 297.
Single intra muscular injection of 100,000 I.U. of water miscible palmitate effected significant improvement in children suffering from kwashiorkor and severe vitamin A deficiency.
B. S. N.
- 17.47 *Vitamin E content of infant formulas and cereals*, MARTHA W. DICKS-BUSHNELL & KAREN C. DAVIS, *Am. J. clin. Nutr.*, 1967, 20 (3), 262.
Six infant formulae and 10 infant cereals analysed respectively contained: 0.08-3.86 and 0.03-1.8 mg/100 g. of tocopherol: and 0.08-1.06 and 0.03-0.49 mg/100 g. of alphatocopherol. Destruction of tocopherol during processing was indicated. These low levels indicate the need of supplementation with tocopherol.
B. S. N.
- 17.48 *A study of the diet pattern of the Sindhi community in Bombay*, MAYA ADVANEY, ALAMELA VENKATARAMAN AND N. RAJESWARA RAO, *J. Nutr. Dietet.*, 1967, 4 (2), 110.
Survey Report.
- 17.49 *Patterns and trends in food consumption in India*, K. VISWESWARA RAO, *J. Nutr. Dietet.*, 1967, 4 (2), 79.
Review. 19 references. 8 tables.
- 17.50 *Association of growth status and the prevalence of nutritional deficiency signs among pre-school children*, SHANTHA MAHADEVAN, T. P. SUSHEELA AND M. C. SWAMINATHAN, *Indian J. med. Res.*, 1967, 55 (5), 497.
A report of survey conducted in twenty six villages covering 1809 children between the ages of 1 to 5 years.
K. A. R.
- 17.51 *Influence of Socio-economic factors on the nutritional status and food intake of pre-school children in a rural community*, RAJAMMAL P. DEVADAS AND PARVATHY P. EASWARAN, *J. Nutr. Dietet.*, 1967, 4 (2), 156.
Survey report. 6 references and 8 tables.
- 17.52 *The nutrition and feeding of industrial workers in developing countries*, M. SWAMINATHAN, *J. Nutr. Dietet.*, 1967, 4 (2), 131.
Review. 42 references and 11 tables.
- 17.53 *Non enzymatic browning reactions in smoked foods*, ZENON ZIEMBA, *J. Nutr. Dietet.*, 1967, 4 (2), 122.
Non enzymatic browning in smoked foods is mainly due to carbonyl-amino reactions although the smoke carbonyls undergo caramelization in non-amino systems. Oxidative browning due to limited supply of air may also occur.
B. S. N.
- 17.54 *Chemical and biological evaluation of the effect of fermentation on the nutritive value of foods prepared from rice and gram*, R. RAJALAKSHMI AND K. VANAJA, *Brit. J. Nutr.*, 1967, 21 (1), 467.
Idli, prepared from milled rice, dehusked black gram and *Khaman* from dehusked and milled Bengal gram showed increased thiamine and riboflavine levels and a lower phytate content as a result of fermentation during their processing. Rats fed on both these products showed an increase in weight gain, nitrogen retention, thiamine and riboflavin levels of liver, haemoglobin content of blood and liver xanthine oxidase and succinic dehydrogenase activities in comparison with control group of rats.
B. S. N.
- 17.55 *Protein quality of feeding stuffs. 4. Progress report on collaborative studies on the microbiological assay of available amino acids*, A. W. BOYNE, S. A. PRICE, G. D. ROSEN AND J. A. STOTT, *Brit. J. Nutr.*, 1967, 21 (1), 181.
Available methionine and lysine in samples of whale, meat, fish, groundnut and soya bean meals and skim milk powder were

assayed microbiologically with *Tetrahymena pyriformis* and *Streptococcus zymogens*. Dry grinding of the meal and predigestion with specific levels of papain have been suggested as provisional methods for protein quality on the basis of these studies.

B. S. N.

17.56 *The digestion of heat-damaged protein*, M. C. NESHEIM AND K. J. CARPENTER, *Brit. J. Nutr.*, 1967, 21 (2), 399.

Chicks killed and examined 3 hours after being fed a test meal containing heat-damaged cod flour (C₃₅) showed much more nitrogen in gut; those fed freeze dried cod muscle showed little more nitrogen in intestine than those subsisting on N-free diet. It is probable that large quantities of heat damaged protein may remain undigested in small intestine, which may then get deaminated by fermentation in caecum so that values for digestibility of nitrogen and of individual amino acids appear to be higher than the real level.

B. S. N.

17.57 *The short term prognosis of severe primary infantile malnutrition*, J. S. GARROW AND M. C. PIKE, *Brit. J. Nutr.*, 1967, 21 (1), 155.

17.58 *The concentration of copper in the liver of African children with Marasmus*, L. GODETTE AND P. J. WARREN, *Brit. J. Nutr.*, 1967, 21 (2), 419.

The copper content of African children suffering from marasmus was not different from those suffering from other diseases. Only children suffering from Kwashiorkor had high copper content.

B. S. N.

17.59 *Distribution of carotene and fat in liver, pancreas and body fat of Ghanians*, MAND DAGADU, *Brit. J. Nutr.*, 1967, 21 (1), 453.

General.

17.60 *Symposium proceedings—absorption of nutrients from the intestine*, *Proc. Nutr. Soc.*, 1967, 26 (1), 1-67.

18. Food Processing, Packaging and Engineering

18.41 *Continuous quality control in grain processing*, Y. PAMERANZ AND A. B. WARD, *Cereal Sci. Today*, 1967, 12 (4), 159.
Review. 83 references.

18.42 *Hydrogenation and bleaching control procedures*, E. G. LANTONDRESS, *J. Am. Oil Chem. Soc.*, 1967, 44 (4), 154 A.

Brief description of various hydrogenation control tests, refractive index, congeal points, and Wiley melting point and their use in the quality control of hydrogenated oil.

J. V. S.

18.43 *Refinements in control viscometry*, R. W. GOETZ, T. D. WHELOCK, H. F. CONWAY AND E. B. LANCASTER, *Cereal Sci. Today*, 1967, 12 (4), 151.

A simple cooking viscometer developed at Northren Laboratory utilises a pin mixer driven by electric motor to stir a slurry or liquid sample in a brass cup placed in a water bath for temperature control or for cooking starch and flour pastes. The viscosity of a sample is determined in effect by measuring changes in mixer torque through an appropriate electronic circuit and recording instrument. Improvement made in this instrument have been reported here.

A. A.

18.44 *Application of freeze drying technique in the development of service rations*, B. S. BHATIA AND P. K. VIJAYARAGHAVAN, *Indian Fd Packer*, 1967, 21 (1), 10.

Review. 21 references.

18.45 *Spray drying dairy and food products*, C. H. AMUNDSON, *Ashrae J.*, 1967, 9 (3), 70.

Efficacy and advantages of spray drying dairy and food products.

18.46 *Indigenous substitutes of palm oil in tin plate process*, K. VENKATESWARA RAO, G. SIVA RAMI REDDY, B. PANDURANGA RAO, B. A. R. SOMAYAJULU AND S. D. THIRUMALA RAO, *Indian Fd Packer*, 1967, 21 (1), 20.

Crude rice bran oil and mahua fat are found to be satisfactory substitutes to oil in hot dip tinning.

A. A.

18.47 *The packaging of fish meal*, R. J. NACHENIUS, *Fish. News Internat.* 1967, 6 (2), 20.

General.

18.48 *Bubble formation in polystyrene containers filled with jam*, E. G. DAVIS, *Fd Preserv. Q.*, 1967, 27 (1), 19.

No bubbles were observed in containers with polyethylene closures, but containers with tin plate closures developed bubbles. There were no bubbles in packs with tin plate closures filled at 140°F and stored at room conditions, or evacuated to 10 in. Hg and stored under a vacuum of 9 in. Hg. Pretreatment of containers in either live steam or hot detergent solutions failed to remove the bubbles, but their character was altered.

K. A. R.

18.49 *Design features of peeler centrifuges*, STOHLMEIER, *Chem. Engng Progr.*, 1967, 48 (3), 65.

Besides the peeler type of centrifuges wherein the solids are discharged from the bowl by a ploughing or peeling device in an essentially batchwise operation, other types of centrifuges like Pusher, Helical conveyor, Vibratory and conical screw slide are also dealt in brief.

M. C. B.

18.50 *Gas fired plant in the food factory*, ANTHONY J. BURTON, *Fd Mf.*, 1967, 42 (5), 48.

General.

18.51 *Present status and future prospects of food irradiation*, E. M. SOUTHERN, *Fd Mf.*, 1967, 42 (1), 19.

Review. 38 references.

18.52 *Preservation of fresh white fish with gamma radiation*, K. OSTOVAR AND M. SLUSAL, *J. Fish Res. Bd Canada*, 1967, 24 (1), 9.

Fresh white fish (*Coreyonus clupeiformis*) irradiated with 150,000 rads judged acceptable up to 29 days of storage in ice. Fish treated with 75,000 rads were acceptable up to 22 days, those treated with 300,000 rads though bacteriologically acceptable received lower sensory scores. Unirradiated samples were dominated by gram-negative micro-organisms belonging to the genera *Pseudomonas*, *Achromobacter*, and *Flavobacterium*. Samples treated with 150,000 rads showed survival of gram positive micro-organisms belonging to the genera *Corynebacterium* and *Micrococcus* which were replaced by gram-negative micro-organisms after 29 days of storage.

K. A. R.

18.53 *Some recent developments in the canning of foods*, V. K. MATHUR, K. R. DWARAKANATH AND B. S. BHATIA, *Indian Fd Packer*, 1967, 21 (2), 37.

Review. 26 references.

18.54 *Hydrocolloid rheology in the formulation of convenience foods*, ELISABETH FARKAS AND MARTIN GLICKSMAN, *Fd Technol. Champaign*, 1967, 21 (4), 535.

Mouth-feel imparted by gums (hydrocolloids) is directly related to their rheological properties. Viscosity and shear can

be used effectively to characterise mouth-feel of food products and to duplicate the texture of original food product by use of gums. Developmental work for matching texture is described for orange beverage and chocolate milk shake.

A. A.

18.55 *Trends in paper board packaging*, C. W. ENGSTER, *Fd Mf.*, 1967, 42 (1), 30.

The use of coated, laminated, and varnish coated paper boards for packaging of food products are discussed.

B. S. N.

18.56 *Fundamentals in fruit juice concentration*, H. A. C. THIJSSSEN, AND L. R. W. A. MIDDELBERG, *I.I.R. Transaction (Delft)*, 1966, 113.

The various methods of concentrating the fruit juice like evaporation combined with distillation, crystallisation and the membrane processes of pre-evaporation, direct osmosis and reverse osmosis have been elaborated. The relative merits of the various methods are also indicated.

M. C. B.

18.57 *Effect of different methods of cooking and storage on the ascorbic acid content of vegetables*, SWARAN PASRICHA, *Indian J. med. Res.*, 1967, 55 (7), 779.

18.58 *Effects of agitation and temperature in deep fat frying of potatoes. II. Determination of efficiency of the deep fat-fryer*, H. STROCK, C. O. BALL AND S. S. CHANG, *Fd Technol. Champaign*, 1967, 21 (4), 649.

Efficiency of the fryer in deep frying of potatoes. was tested by 2 methods. Both methods showed that throughout the frying medium at a controlled temperature, agitation by releasing steam into hot fat resulted in a more uniform distribution of heat than did non-agitation. This method of distribution, however, was not as efficient as agitation by circulation.

J. V. S.

18.59 *Effect of freeze-drying on the quality of longissimus dorsi muscle of pork*, J. M. TOUMY AND R. L. HELMER, *Fd Technol. Champaign*, 1967, 21 (4), 653.

Freeze-drying of raw chops caused toughening with individual variations. Both heavy and light loins appeared satisfactory for freeze-drying. Since all chops were cooked rapidly in a way not promoting tenderness, it is believed that revised cooking procedure could be used to offset the toughening effect of freeze-drying.

J. V. S.

18.60 *Factors affecting film thickness and uniformity on double-drum during dehydration of sweet potato flakes*, J. J. WADSWORTH, G. M. ZIEGLER JR., A. S. GALLO AND J. J. SPADARO, *Fd Technol. Champaign*, 1967, 21 (4), 668.

It is hypothesised that the film of sweet potato puree adhering to the surface of double drum-dryer is formed by two mechanisms and the film is described in terms of two layers. The first layer adheres to the drum, by a 'burn on' effect while the hot drum surface is in contact with the liquid puree. The second layer is formed by puree which is forced through the spacing between the drums by the shearing force of the revolving drums and by the hydrostatic force of the puree in the dryer. The thickness of the puree film is effected significantly by changes in drum spacing, drum velocity, puree viscosity and level of puree in the dryer.

A. A.

18.61 *Assessing suitability of plastic films for pre-packaging fruits and vegetables*, TOMPKINS R. G., *Fd Mf.*, 1967, 42 (4), 34.

The advantages, disadvantages and problems involved are discussed; the need for avoiding hazards arising out of restricting ventilation is emphasised.

B. S. N.

18.62 *Total extraction by solvent of oil-bearing raw materials: a new continuous process*, G. B. MARTINENGI, *Oleagineux*, 1967, 22 (5), 317.

The new Donini-Garigoli method for the continuous extraction by solvent of all oily substances, notably from seeds, without the intervention of a continuous press and without the formation of fines. The new counter current method has the following characteristics: (1) high extraction ratio due to the continuous rotary movement of the seeds in the solvent; (2) the movement of the seeds, at once vertical, rotative and oblique, rising in the apparatus and meeting the inverse movement of the current of solvent, which gives transversal extraction; (3) and continuous filtration of the miscella at different levels of the column, the formation of feed-back of fines being avoided.

A. A.

18.63 *Solvent extraction milling*, *Cereal Sci. Today*, 1967, 12 (6), 219.

The new method gives; up to 10 per cent higher yields of whole grains of superior quality than conventional milling methods. It also provides in one process, rice oil and valuable proteins, not available till now by conventional milling. The flow chart for the process has been given.

J. V. S.

18.64 *Business potential of R and D projects*, G. TEPLITZKY, *Chem. Engng*, 1967, 74 (11), 136.

The steps and procedure adopted for estimation of commercial economic worth of projects are described. Some of the aspects considered are cost estimates, feasibility analysis, market competitiveness situation, product performance, patent situation, etc.

M. C. B.

18.65 *Relative permeabilities of plastic films to water and carbon-dioxide*, JOSEPH T. WOOLLEY, *Pl. Physiol. Wash.*, 1967, 42 (5), 641.

Materials tested were teflon, polyethylene, rubber dental dam, paraffine and rubber, oriented styrene, polycarbonate, polyvinylidene chloride, cellulose acetate, regenerated cellulose and polyethylene glycol, and no materials was found to have a CO₂ permeability as great as its water permeability.

J. V. S.

19. Food Texture and Flavour

19.22 *Fish odours and the problems of their removal*, D. P. SEN, *J. Fd Sci. Technol.*, 1967, 3 (4), 142.

Review. References 103.

19.23 *Fruit aromas: A survey of components identified*, H. E. NURSTEN AND A. A. WILLIAMS, *Chem. Ind.*, 1967, No. 12, 486.

Review. 75 references.

19.24 *Evaluating flavour and aroma*, *Fd Mf.*, 1967, 42 (1), 29.

Describes the need and method employed for 'assessing flavour profile' of food, pharmaceutical and cosmetic products.

B. S. N.

19.25 *Volatiles from grapes, Vitis vinifera (Linn). Cultivar Grenache*, K. L. STEVENS, J. L. BOMBEN AND W. H. MCFADDEN, *J. agric. Fd Chem.*, 1967, 15 (3), 378.

A large number of compounds have been identified, the most abundant being 1-hexanol, 3-methyl-1-butanol, trans-2 hexanol, hexanol and 1-heptanol.

A. A.

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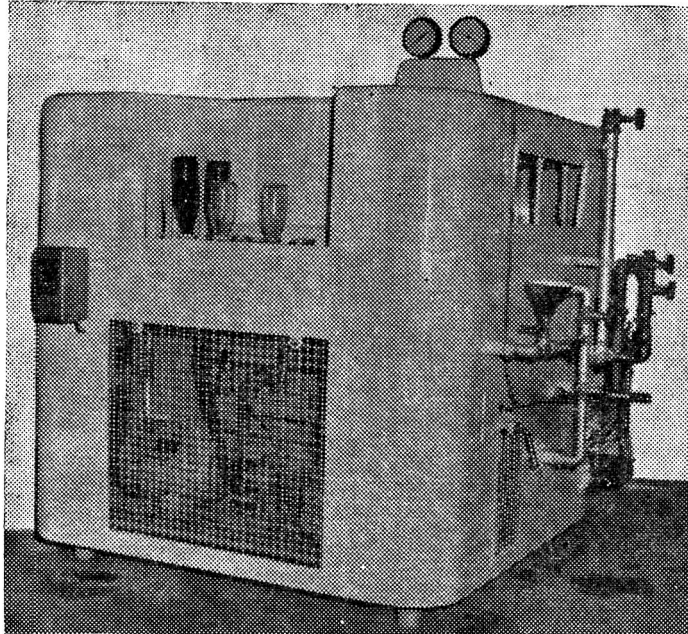
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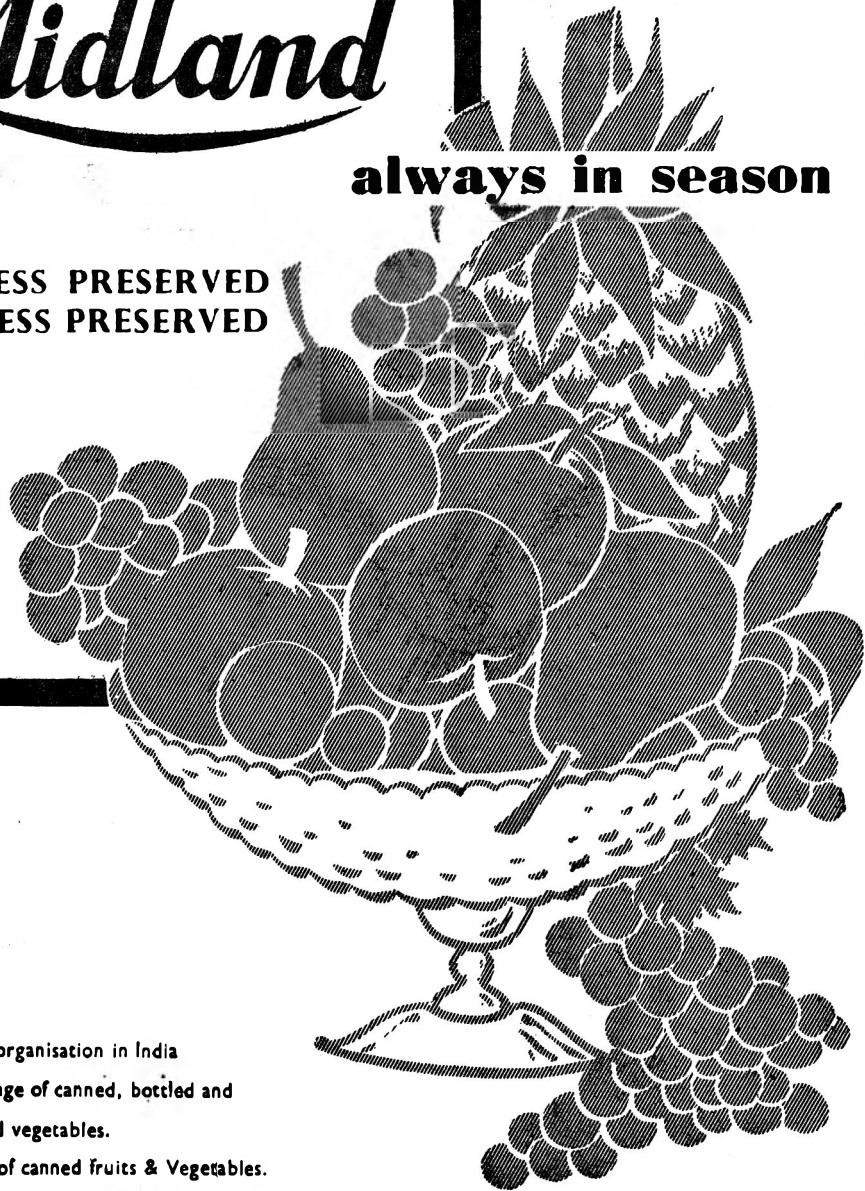
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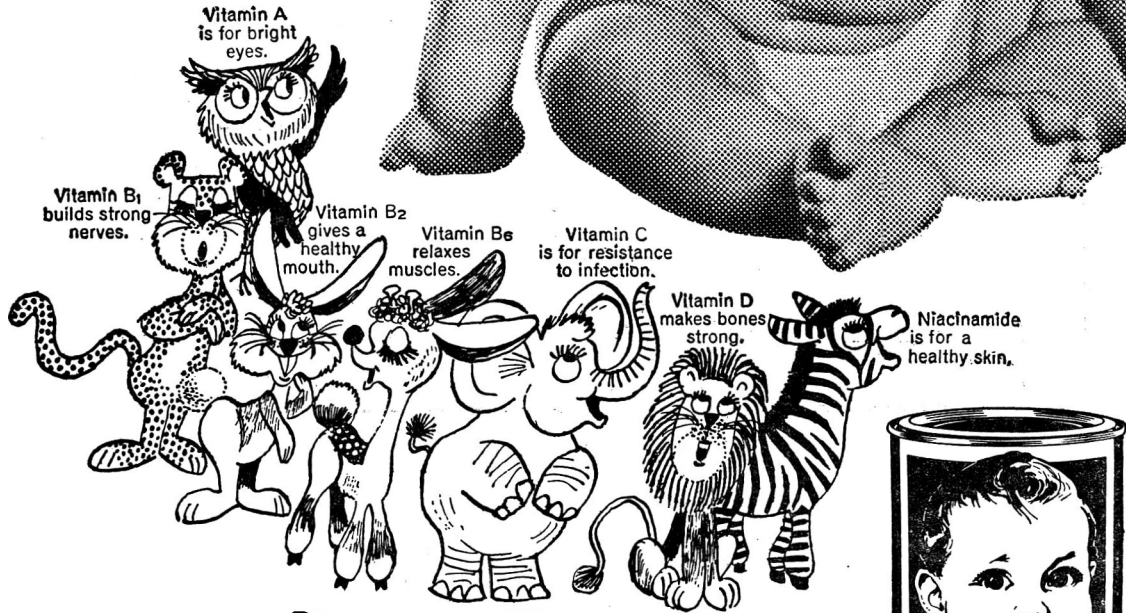
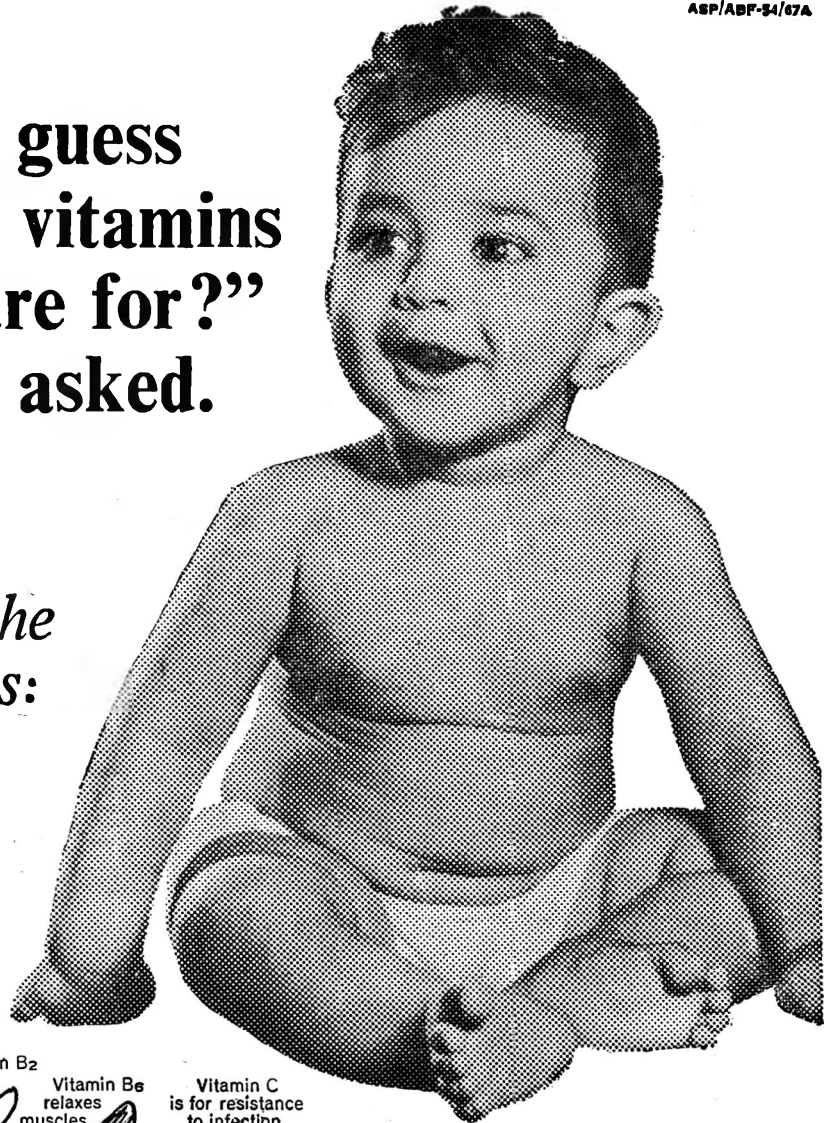
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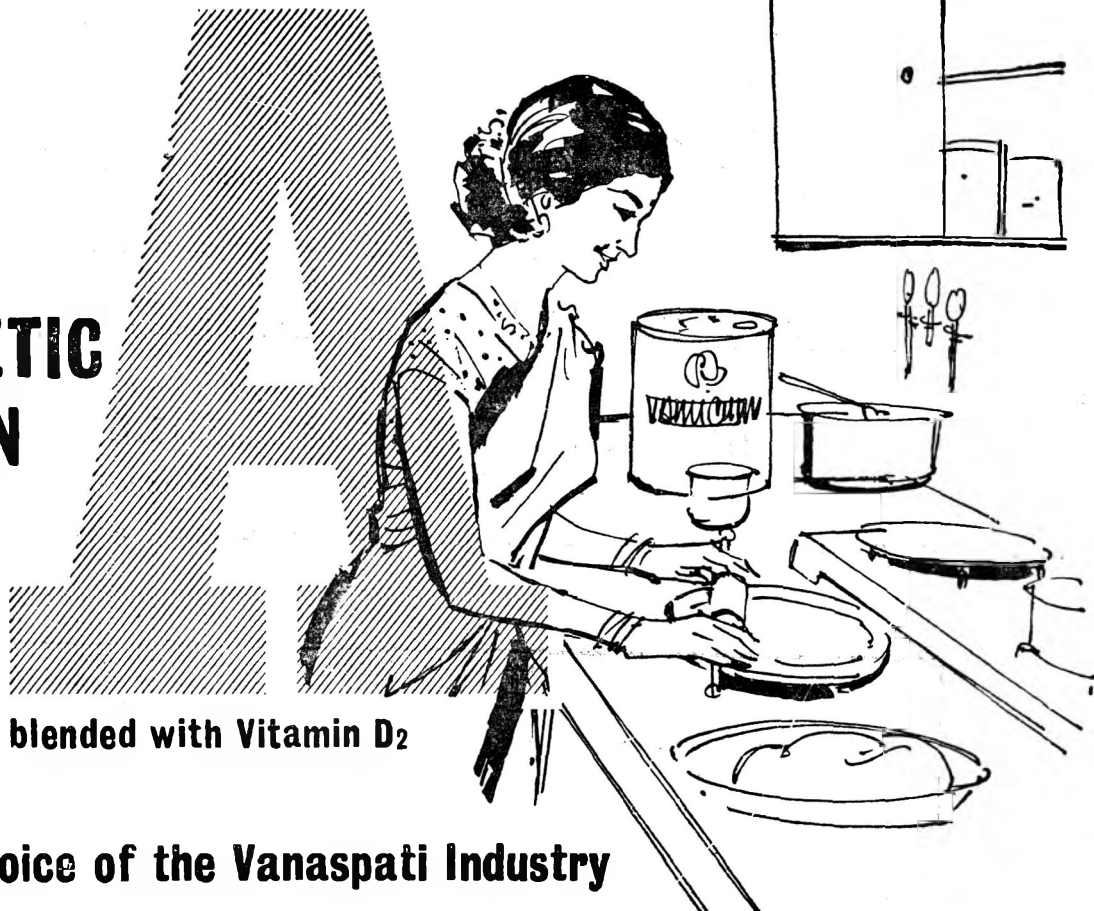


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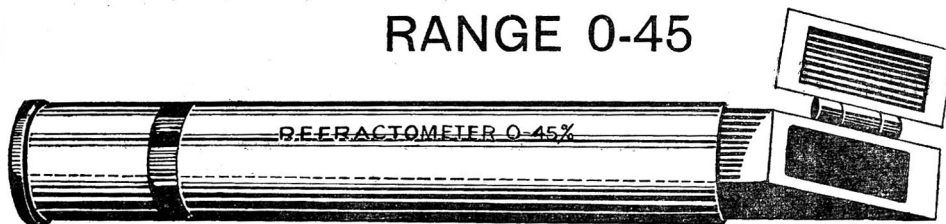
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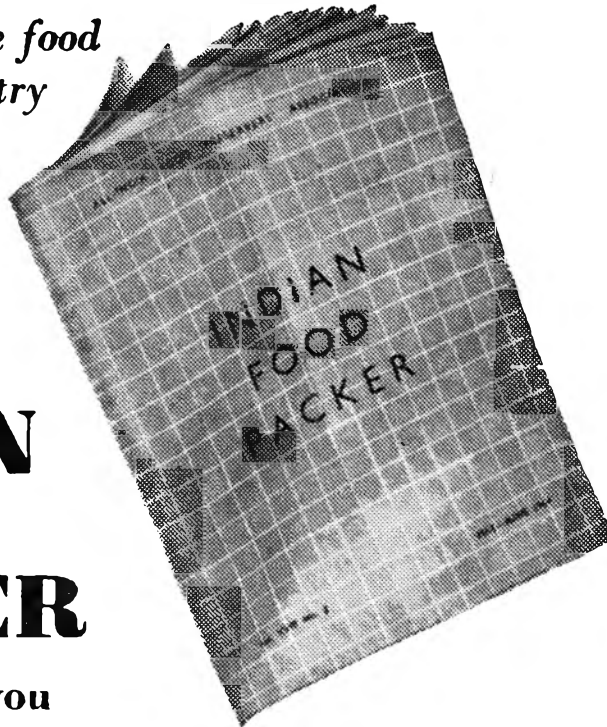


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