

THE ANALYST

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS.

The Hon. Secretary wishes to direct special attention to the notice
on page 556.

Obituary.

OTTO HEHNER.

It is difficult to realise that Hehner is gone from us. He was so long and so intimately connected with our Society that it is only gradually we shall come to know the full extent of our loss. The blow is all the more severe because so unexpected. Only a few days before his death he had written to say that the end of his work in South Africa was in sight, and that he was intending shortly to return to London. It was not to be, for he was attacked by malaria and died on September 9th.

Otto Hehner was born on November 25th, 1853, at Marienberg, in Nassau. His father was a judge of the High Court of Appeal in Wiesbaden, and it was doubtless this legal strain in his blood which gave him that intuitive grasp of the legal aspects of a case, which was freely acknowledged by the leaders of the English Bar, who so often met him in consultation. He was educated at Wiesbaden and studied chemistry under Fresenius, whose laboratory was already recognised as the leading training ground in Germany for the profession of analytical chemistry. He was for a time assistant to Fresenius, until, in 1873, he came to this country to become assistant to Professor Bischof at the Andersonian College in Glasgow. At about the same time Ramsay was also starting his professional career as assistant to Bischof, and the association between the two young men ripened into a close friendship which only closed with Ramsay's life.

Only a few months ago Hehner gave the writer a humorous description of his early experiences in Glasgow and of his ineffectual attempts to adapt himself to the requirements of a Scottish Sabbath, more stringent then than now.

From the very outset he had been attracted to the chemistry of food and the problems of preventing its adulteration. The Act of 1872, which led to the appointment of Public Analysts, had only recently come into force, and Hassall, to whose labours this Act was largely due, was accepted as the principal authority on the subject. He invited Hehner to join him as one of his chemical assistants, and early in 1874 Hehner left Glasgow for Ventnor, where Hassall had established

his laboratory. Here he had as fellow assistant Mr. Arthur Angell, who is still with us. In addition to carrying out the chemical routine work of the laboratory, the two young assistants engaged in research work, and it was then that Hehner discovered the essential difference between butter fat and the animal body fats, and devised that process which will always be associated with his name—the determination of the *Hehner value*.

The same year Dr. Hassall, giving evidence before a Parliamentary Commission to enquire into the working of the Act of 1872, admitted that he did not know of any method of detecting foreign fat in butter, but stated that his assistant, Mr. Otto Hehner, claimed to have discovered a method.

The findings of this Commission led to the passing of the Sale of Food and Drugs Act of 1875, which made the appointment of Public Analysts no longer permissive, as in the 1872 Act, but compulsory. The various counties and boroughs then had to discover suitable men for the purpose, and many solved the difficulty by appointing their medical officers, most of whom knew but little chemistry.

In 1877 Hehner came to London, and shortly after started in practice as an analytical and consulting chemist, and the reputation which he had already gained as a scientific authority on butter helped him in establishing this.

In 1878 he was appointed Public Analyst for the Isle of Wight, an appointment which he retained until 1909. The same year he received the appointment for Ryde, which he only resigned three years ago.

A few years later other public appointments followed:—Derbyshire (1881–1893); Derby Borough (1881–1916); Nottinghamshire (1885–1921); and West Sussex (1890–1921); and, after the passing of the Fertilisers and Feeding Stuffs Act, he became Agricultural Analyst for the Isle of Wight (1893–1909) and for West Sussex (1893–1921).

The Society of Public Analysts was founded in 1874, and Hehner joined it in 1876 while still at Ventnor. After coming to London, he took an active part in the work of our Society. He was first elected a member of the Council in 1880, and two years later became one of the Secretaries, which office he resigned on his election as President in 1891. Since then he was continuously on the Council as Past President, and, until the war, seldom missed a meeting.

He was an abstractor of *THE ANALYST* for some years, and edited the journal for a month after the sudden death of Dr. Sykes, in 1907, and he continued to be a member of the Publication Committee until the present year.

Most of his original work was concerned with the composition and analysis of food and drugs, and was mainly read before this Society and published in our journal. A reference to the decennial indexes will show the wide scope of this work, which included researches into the chemistry of fats, methods for the examination of meat extracts, the analysis of honey, experiments on the action of preservatives, the adulteration of beer, the analysis of vinegar, various contributions to the analysis of milk and butter, water analysis, etc., etc. His first paper published in *THE ANALYST* was, appropriately, one on butter analysis in

collaboration with Angell (*ANALYST*, 1877, **1**; 147); his last paper was one on the estimation of pentosans in collaboration with W. P. Skertchly (*ANALYST*, 1899, **24**, 178), but he continued to take an active part in the discussions at our meetings until 1914. His alcohol tables, first published in the fifth volume of *THE ANALYST*, and afterwards produced in book form, supplied a great want and are still used. He was also responsible for the article on "Adulteration" in the ninth edition of the *Encyclopædia Britannica*—an admirable digest of the subject, in which, again, his legal acumen is clearly shown.

Among the outstanding investigations associated with his name it may be recalled that the method of analysing beeswax, based upon the constant ratio of free cerotic acid to myricin, was first devised by Hehner in 1881 (*ANALYST*, 1881, **8**, 16), and that Hübl, whose name is associated with the method, did not publish the same discovery until a few months later. The dichromate method of estimating glycerol in fats was another contribution to analytical chemistry and has long been accepted as a standard process (*ANALYST*, 1888, **12**, 44), and the Hehner method of estimating the hardness in water without the use of soap solution is almost as widely known (*ANALYST*, 1884, **8**, 77).

Hehner was an original member of the Society of Chemical Industry, and subsequently became Chairman of the London Section. In 1878 he was elected a Fellow of the Institute of Chemistry, and he served as Vice-President on three occasions, the last being 1915–1918; he was an examiner from 1895 to 1899, and a Censor from 1901 to 1903.

Within a few years he had come to be generally accepted as one of the leading authorities on all chemical questions affecting the public health, and his help was sought by many public authorities in getting their water bills passed through Parliament. In 1901 he acted as Chairman of the Joint Committee of our Society and the Society of Chemical Industry on the methods of estimating arsenic, and he was also Chairman of the Expert Committee of 1909 to 1911 and that of 1919 to 1921, called together to standardise the methods of glycerin analysis.

In 1901 a Parliamentary Committee was set up to inquire into the use of preservatives and colouring matters in foods, and he was one of the most important witnesses at that abortive inquiry.

The busy years swept on, their days filled with a never-ending round of consultations, legal cases, committee meetings and meetings of scientific societies, not to mention the constant supervision of his extensive routine laboratory practice and the investigation of chemical problems requiring experimental solution, until, in 1913, he was at the summit of a successful professional career. In November of that year he invited his past and present assistants to a dinner to celebrate his sixtieth birthday. He was in one of his gayest and happiest moods, full of plans for the future, and the prospect for his remaining years seemed unclouded. And then, within a year, came the war.

His was one of the great personal tragedies of that catastrophe. Over and over again he had impressed upon his friends in Germany that the spirit of domination which had developed there since his boyhood was essentially parochialism,

and was leading that country straight to disaster. When the inevitable crash came he at once ranged himself actively on the side of his adopted country, where he had long been naturalised, and he could not understand why the average Englishmen should have hesitated to accept him as one of themselves.

Those who knew him never wavered in their attitude of friendship and trust towards him throughout that trying time, and it is significant of the esteem in which he was held throughout the country that he was unanimously chosen as the official referee for glycerin contracts between the War Office and the soap manufacturers. He also worked continually in connection with the control of foods, serving as the Chairman of two Committees on the standardisation of the methods of analysing oils and fats, and he was one of the first to make experiments to discover the best type of mask to afford protection against poison gas.

He never spared himself in his efforts to help this country, and for all this work he refused to accept any remuneration whatsoever. The special letter of thanks for his services during the war, sent to him by Lord Moulton, brought some comfort to him, but he was deeply hurt by the attitude taken up by certain sections of the press and some public authorities. He failed to make allowance for the loss of a sense of proportion in those who, egged on by the sensation-sowing papers and eager to express their active detestation of the methods of atrocity introduced into the war, often became unjust to the individual of German antecedents.

And thus it was that after the war, while he was even more busy than before, he had lost some of that joyous zest in his work which was so characteristic of the man. He could not altogether shake off the memories of those four years, and he, therefore, in 1921, welcomed the chance of visiting South Africa. When he returned last year he actively resumed his professional work, and later in the year was chosen as the representative of our Society on the new Parliamentary Committee on Preservatives. Being obliged to return to South Africa for a time, he resigned from this Committee, but his public work continued, for his help had been welcomed by the South African Government, and he had been chosen a member of a Committee appointed to consider the question of power alcohol (1922-1924).

The characteristics which must have struck everyone first in dealing with Hehner were his straightforwardness, his love of justice, and the simplicity of his nature. To those who did not know him well his manner might seem brusque at times, and he was inclined to be impatient with those whose brains moved more slowly than his. Yet these were only surface faults, and beneath was a deep vein of genuine sympathy. None of his friends ever turned to him in vain for counsel or help, and only those who were closely associated with him know of his many acts of kindness and generosity even to complete strangers. His outlook on life was shrewd, but never cynical, and was always instinct with a broad humanity. When the writer first knew him he was inclined to be dogmatic in the expression of his views, but time softened this, and in his later years he showed a kindly tolerance of the opinions of those from whom he differed.

In his chemical work he showed that gift which is akin to genius, of seeing instinctively the crux of a problem, and he would eagerly devise ingenious methods of testing the truth of his hypothesis. At the same time he had the drawback, which is frequently part of such a temperament, of being too readily discouraged if his first efforts were unsuccessful.

Much of his time was spent in the Law Courts, and he was never happier than when he was working up the chemical side of a case and devising experiments which could be shown in Court to convince judge and jury of the truth of his contention. He was an excellent witness, clear and concise in his evidence, and always ready with a humorous answer for a cross-examining counsel.

A keen lover of nature, Hehner delighted in long country tramps with one or more intimate friends, and in the interludes of conversation, which would range over an infinity of topics from the trivial to the profound, he would be on the alert for familiar plants, and would note the habits of each wild animal or bird met with on the way. On one of his last walks with the writer he raised the question of how long a soaring lark could remain in the air, and with characteristic eagerness at once put the matter to the test.

Although in the later years of his life he was denied the happiness of the home life for which he was so well fitted, he remained unsoured, and was always ready to join in any piece of boyish fun on hand. In one of his letters to the writer he mentioned how happy he had been in his friendships throughout life. He was a lovable man, and his death makes a great and lasting gap in the lives of all of us who loved him.

C. A. MITCHELL.

The Quantitative Estimation of the Degree of Hydrolysis of Gallotannin by Tannase.

By WINIFRED NELLIE NICHOLSON, B.Sc., AND DONALD RHIND, B.Sc.

(Read at the Meeting, October 1, 1924.)

THE main function of tannase is the disintegration of the gallotannin molecule, gallic acid being produced. With the view of measuring the activity of tannase a quantitative method was elaborated in this laboratory by Rhind and Smith (*Biochem. J.*, 1922, 16, 1), which gives the amount of unchanged gallotannin left after hydrolysis by tannase. The gallotannin is estimated by the caseinogen absorption method (Nierenstein, *Chem. Zeit.*, 1911, 36, 31), as modified by Spiers (*J. Agric. Sci.*, 1914, 6, 77) in this laboratory for the estimation of small quantities of gallotannin.

During the course of our work on tannase, however, it became necessary also to estimate the amount of gallic acid produced by the tannase. Such a

method has been described by Freudenberg and Vollbrecht (*Zeitsch. physiol. Chem.*, 1921, 116, 277). In this method the gallic acid formed by the action of tannase on gallotannin or methyl gallate is estimated by titration with sodium hydroxide, litmus paper being used as an indicator. It is assumed by Freudenberg and Vollbrecht that, under the conditions chosen by them, only the carboxyl group in gallic acid reacts with sodium hydroxide. This method has been investigated by one of us (D.R.), but has been found unreliable.

On the other hand, concordant results have been obtained by one of us (W.N.N.) when using Mitchell's colorimetric method for the estimation of small quantities of gallic acid. (*ANALYST*, 1923, 48, 2.) This method, slightly modified so as to adjust it to our requirements, has been in constant use in this laboratory for the last eighteen months, and has been found to be trustworthy.

In the present communication we give our results with (1) the method of Freudenberg and Vollbrecht, and (2) the modification of Mitchell's method, as applied to the hydrolysis of gallotannin by tannase.

I. THE METHOD OF FREUDENBERG AND VOLLBRECHT.—The following is a brief summary of the results obtained:—(1) Under the exact conditions laid down by Freudenberg and Vollbrecht, namely: (a) solutions of the same strengths as theirs, *i.e.* *N*/40 sodium hydroxide solution and 0.333 per cent. gallic acid, (b) Freudenberg and Vollbrecht's correction for gallic acid, and (c) their correction for distilled water, there were errors varying from +2.8 to -3.8 per cent. In view of the fact that always the same amount of gallic acid was used for these experiments, this error, which varied in both directions, is obviously too great. (2) The use of litmus paper as an indicator, as recommended by Freudenberg and Vollbrecht, was found to have the disadvantages that the end-point is difficult to see, and that its appearance depends upon the size of the drops of solution placed upon the paper, the rate of absorption of the solution, the light, and the depth of colour of the paper used. (3) Experiments using bromthymol blue and phenol red as internal indicators gave the following results:—(i) *Bromthymol Blue*.—The bluish-green colour was taken as the end-point, although it gave uniformly high results. The correction required is 0.45 c.c. of *N*/40 sodium hydroxide solution for 20 c.c. of a 0.333 per cent. solution of gallic acid. By using three drops of the indicator and titrating in good daylight (electric light was found to be unsuitable) the errors lay between +0.4 and -1.7 per cent. Although bromthymol blue is an improvement on litmus paper, when titrating gallic acid by itself, the method fails in the presence of tannase, as errors of +3.8 to -1.4 per cent. were obtained. "Killing" the tannase by boiling the solution does not reduce the error. (ii) *Phenol Red*.—A correction of 0.92 c.c. of *N*/40 NaOH was required. The errors varied between +0.3 and -0.4 per cent., and this error remained the same in the presence of tannase. Diastase* and emulsin increase the error to -2.6 per cent. Phenol red fails, however, entirely when gallotannin

* From an investigation carried out by Mr. C. J. Pool in this laboratory it appears that diastase and invertase, in addition to other enzymes, are present in the mycelium of *Aspergillus niger*, which was the source of the tannase used in our work.

is replaced by methyl gallate and ethyl gallate, as used by Freudenberg and Vollbrecht, the average error then rising to +50 per cent.

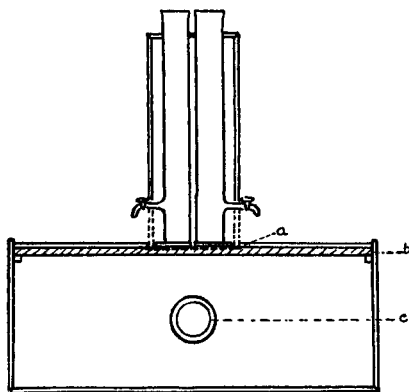
We therefore discarded the Freudenberg and Vollbrecht method and the attempted modifications of it.

II. MITCHELL'S METHOD.—The method described by Mitchell for the estimation of gallic acid, is a colorimetric one, based on the fact that the acid gives a bluish violet-colour with iron salts. Mitchell found that the most stable colour is produced if a mixture of ferrous sulphate (0.1 per cent.) and Rochelle salt (0.5 per cent.) is used as the reagent. The estimation is carried out by means of a colour comparison in Nessler tubes in the usual way.

In using Mitchell's method in this work, slight modifications were introduced. In preliminary experiments it was found that the error, when comparisons were made in daylight, lay between -2.59 per cent. and $+4.85$ per cent. and other estimations were therefore carried out by artificial light. When ordinary electric light, shaded by white paper, was used, the errors were between -1.81 and $+4.06$ per cent.; electric light shaded by light blue paper gave errors of -4.31 to $+7.97$ per cent.; when the light was shaded by dark blue crinkled paper, the errors were reduced to between -1.33 and $+2.90$ per cent., the average of seven readings being $+0.83$ per cent. The last modification was therefore adopted.

In order to facilitate the making of colour comparisons by artificial light during the day, the apparatus shown in the diagram, was designed:

An oblong wooden box (18 in. by 7 in. by 7 in.), painted black inside, and having a plate-glass lid, was fitted with an electric bulb as near the centre as possible. On this, in the centre, was placed a second box (5 in. by 7 in. by 10 in.), into which were fitted two Nessler tubes, their taps projecting through a slit in each side, and the tubes themselves extending about 1 in. above the lid through two holes in the top. This box had no base, so that, when in position, the tubes stood on the plate glass, immediately above the light. The remainder of the plate glass was covered with two movable pieces of wood, whilst the part in the centre, beneath the tubes, was covered with dark blue crinkled paper. The whole of the inner surface of both boxes was blackened, so as to prevent reflection as far as possible. The taps were connected by rubber tubing with a sink, so that it was impossible to tell how much solution was being run out. The use of this apparatus thus tends to eliminate personal error.



a Blue. *b* Plate glass. *c* Electric bulb.

The unchanged gallotannin was precipitated with quinine hydrochloride, as recommended by Mitchell. The small quantities of quinine tannate thus obtained were colloidal and difficult to filter. Sodium chloride was therefore added, and

the solution then yielded a clear filtrate on shaking or centrifuging. It was, therefore, essential to find how far the presence of an excess of quinine hydrochloride or of sodium chloride affected the colour comparisons. It was found that, whereas quinine hydrochloride has no effect, the presence of salt introduces a constant plus error, and in order to eliminate this error, the same amount of salt was added to the standard tube in each estimation.

Finally the following technique was adopted:—The hydrolyses were carried out in a series of test tubes, into each of which were put 10 c.c. of a gallotannin solution (containing about 3 grms. per litre). To this was added 1 c.c. of mycelium extract (prepared by shaking 1 gm. of mycelium powder with 50 c.c. of distilled water for 3 hours, allowing this to stand for 21 hours, and filtering). A layer of benzene was poured on the surface to prevent the growth of fungi. The test tubes were corked tightly and placed in an incubator at 25° C., one being used for a gallic acid estimation every twenty-four hours. To precipitate the unchanged gallotannin, 4.5 c.c. of a 1 per cent. solution of quinine hydrochloride were added (this being an excess), and 0.5 c.c. of a 16 per cent. solution of sodium chloride, to coagulate the precipitate. One c.c. of this mixture was added to one of the Nessler tubes, and 1 c.c. of standard gallic acid, and 1 c.c. of a 0.5 per cent. solution of sodium chloride to the other. To each tube 2 c.c. of Mitchell's reagent were added, the volume in each case made up to 100 c.c. and the liquid stirred. (It was found convenient to use a glass rod with a flattened knob at the base for stirring.) The darker liquid was then run out until the colours approximately matched, and a sufficient quantity of Mitchell's reagent was added to make up for the amount run out, as unless the concentration of the reagent was the same in both tubes, different colours were produced. The volume was again made up to 100 c.c., the liquid stirred, and the colours now matched as accurately as possible.

We wish to thank the Department of Scientific and Industrial Research for grants which have enabled us to carry out this investigation. Our thanks are also due to Dr. Nierenstein for the interest he has shown in the work and the advice he has given.

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DISCUSSION.

Dr. M. NIERENSTEIN, who communicated the paper in the absence of the authors, said that Mitchell's method had not only proved of help in connection with the work on tannase, but had also been of the greatest value in other work on the tannins which was in progress in his laboratory. Thus it seemed to offer a means to the solution of the vexed question whether glucose was an essential part of the gallotannin molecule. From a series of experiments which were in progress in his (Dr. Nierenstein's) laboratory it was evident that yeast decreased the glucose content of gallotannin which had been purified by Fischer's method. This decrease in glucose, however, was *not* accompanied by an increase of free gallic acid, as was to be expected from the Fischer formula of gallotannin. This type of work could only be carried out with the aid of Mitchell's method. It must

be emphasised that these observations confirmed the views held by him during the last 20 years, namely, that glucose was not an essential part of gallotannin. In this connection it must be remembered that Mitchell had described a gallotannin which was practically free from glucose, and that this had also been confirmed by him (the speaker).

Mr. C. A. MITCHELL said that he was pleased to have the value of his method confirmed by independent workers. He had sent to Bristol a specimen of that remarkable glucose-free tannin in which he had found 10.5 per cent. of gallic acid (ANALYST, 1923, 48, 9), and Miss Nicholson, working under her own conditions, had found it to contain 10.7 per cent. An objection urged against the method was that the comparison ought to be made under definite hydrogen ion concentrations. So far as his experience went a good deal of latitude was permissible in this respect; all that was necessary was to neutralise the acidity of the ferrous sulphate. The point was now under investigation at University College, Exeter, and he hoped that, before long, standard conditions for the test might be established. He, too, had experienced the difficulty of filtering the colloidal solutions, but had overcome it by adding a little Spanish clay to the liquid. This avoided the introduction of a soluble salt which had some effect upon the reaction.

Mr. A. CHASTON CHAPMAN remarked that the subject of the constitution of gallotannic acid was in the nature of a hardy perennial, and stated that although gallotannic acid might possibly—as was sometimes asserted—be an anhydride of di-gallic acid, yet he thought that the authors' results need not necessarily be regarded as entirely disproving its glucosidal character. The action of tannase was apparently different in some respects from that of dilute acids, and in the attack by yeast it was quite possible, having regard to the large number of enzymes secreted by that organism, that the gallic acid might itself be decomposed. It might very well be that the true gallotannin was, in fact, a glucoside, and that the product which did not yield glucose was a simpler derivative of it. It might, in other words, perhaps be, after all, a question of definition. They were very greatly indebted to the authors and to Dr. Nierenstein, under whose direction the work had been carried out, but he thought that they would agree with him that the last word had not yet been said on this subject.

Preliminary Notes on the Composition of the Fat of Goats' Butter.

BY FRANK KNOWLES AND JOHN C. URQUHART.

(Read at the Meeting, October 1, 1924.)

At the present time goat-keeping in this country appears to be increasing and, with a vigorous movement being carried on to popularise it, may become an industry of some importance. As is well known, this "poor man's cow" is a very hardy animal, and under reasonable conditions will produce milk as economically as the average cow; and, generally speaking, the milk is of richer quality both in fat and solids-not-fat. There are to-day in Essex herds of goats which yield, on the average, approximately a gallon of milk per day per head, and this figure is

often exceeded. A considerable amount of this milk is churned into butter which is sold as "butter"; the owner of quite a small herd of goats recently informed us that he was selling a surplus over his own requirements of 10 lbs. of "butter" per week.

The prejudice against goats' milk or butter on account of alleged objectionable taste is rapidly disappearing, there being no real grounds for this prejudice if the goats are kept under proper conditions. Certainly, those goat-keepers making butter have no difficulty in disposing of their product.

The important question may be asked: Is it legal to sell this product as butter? If answered in the affirmative the point could be raised: Do the analytical standards of purity which are in use for butter apply? If a negative reply be given, what standards should be fixed for goats' butter?

The definition of "butter" in the Margarine Act 1887 (50 & 51 c. 29) is as follows:—"The word 'butter' shall mean the substance usually known as butter, made exclusively from milk or cream, or both, with or without salt or other preservative, and with or without the addition of colouring matter."

The Butter and Margarine Act, 1907 (7 Edw. 7, c. 2), describes milk-blended butter as "any mixture produced by mixing or blending butter with milk or cream (other than condensed milk or cream)." Obviously this definition of butter and also, presumably, of cream depends upon the interpretation which is put upon the word milk.

In this connection an extract may be quoted from *The Law Relating to the Sale of Milk*, published by Messrs. Bibby & Sons:—"So far as we know, there is no exact definition of milk on our statute book, but the Congress of Geneva framed the following: 'Milk is the integral product of the entire and uninterrupted milking of a female cow in good health, and well nourished and not overworked. It ought to be collected in a proper manner and contain no colostrum.'"

That this is the generally accepted definition of milk is supported by the Milk and Dairies Act of 1915 and that of 1922, which will come into operation in September, 1925, which ignores the existence of any milk other than that of the cow. Paragraph 5 of the Act of 1922 prohibits the sale of milk of a cow suffering from tuberculosis of the udder, but it will presumably be quite lawful to sell the milk of goats where such animals are similarly infected.

If this definition be accepted, it is clear that the milk or butter obtained from the goat is not correctly named if sold, respectively, as "milk" or "butter." As, however, goats' milk and cows' milk are not easily distinguishable, this misnaming may occur, either through ignorance of the law, or for the purpose of effecting a sale of goats' milk to persons who might, conceivably, be chary of purchasing it if it were so named. The possibility of cows' milk and goats' milk being mixed and sold to dairies for butter and cheese-making must also not be overlooked. It is, therefore, very desirable to ascertain if differences exist between the customary analytical standards for cows' butter and the values obtained by using the same methods of analysis on a large number of samples of butter which are known to have been made from goats' milk only. Further, if differences are found consideration could be given to the desirability of setting up similar standards

for goats' butter to which such butter should comply if adulteration is not to be considered established or to be presumed.

The mean analytical values from closely agreeing duplicates obtained by us when working with the fat of genuine goats' butter obtained direct from owners of herds are given below. The methods of analysis used are the usual ones; care being taken to follow closely the details in the case of such conventional methods as the Reichert-Wollny and Polenske values, etc.

ANALYSES OF FAT OF GOATS' BUTTERS.

Sample Ref.	Reichert-Wollny value.	Polenske value.	Kirchner value.	Refractive index.	Iodine value.	Sp. Gr. at 100° F.
1	27.66	8.65	—	1.4554	24.73	0.9326
2	25.08	7.50	—	1.4554	28.92	0.9209
3	27.77	7.85	16.82	1.4554	33.56	—
4	27.22	7.00	18.56	1.4547	27.92	—
5	25.96	8.70	17.20	1.4547	34.84	0.9346
6	24.47	5.30	17.12	1.4554	34.03	0.9218
7	26.07	7.6	18.04	1.4552	30.77	0.9215
8	26.89	4.9	18.96	1.4559	36.96	0.9187
9	26.87	8.3	18.00	1.4541	28.2	0.9169
*A.	20.8	6.5	—	—	—	—
*B.	22.9	4.9	—	—	—	—

It can safely be assumed from these results that the usual presumptive limits for purity of the fat of butter do not apply to the fat of goats' butter; particularly is this the case with the Polenske value. This might perhaps be inferred if it is considered that the fatty acids obtained by the Polenske method may contain, in addition to lauric acid, lower members of the series which are also insoluble and which would be expected to be present from the following passage in an old edition of Allen's Commercial Organic Analysis: "The fat from the butter of ewes and goats' milk is very similar to that from cows' milk, but the esters of caproic and capric acids bear a larger proportion to the butyric present than is the case of cows' butter."

The high Polenske figure obtainable with goats' butter is indicated in *König's Chemie der Menschlichen Nahrungs- und Genussmittel* (4th Edition *Nachtrag Zu Band, 1, 1919*, pp. 479-481), where the results of about 40 analyses of Danish, German and Russian samples are recorded. The Reichert-Wollny figures of these samples varied from 17 to 29, and the Polenske values from 4.15 (one sample 3.15) to 9.8. Two results recorded by Trimen for Egyptian goats' butter (*ANALYST, 1913, 38, 242*) are included in the preceding table for the purpose of ready comparison with our results.

It is not intended at this stage to discuss these figures in detail, beyond drawing attention to the inference an analyst might at present attach to the Reichert-Wollny, Polenske and Kirchner values if he received similar samples described as butter.

The formula given by Richmond (*Dairy Chemistry, 3rd Edition*), to express

* Analyses by Trimen of Egyptian goats' butter.

the usual relationship between the Reichert-Wollny and Polenske figures is

$$R.W. \times 0.033 - 0.6155 = \log_{10} (P - 0.48).$$

From this is deduced a formula by means of which the maximum allowable Polenske value may be calculated, *viz.* $R.W. \times 0.033 - 0.6155 = \log_{10} (P - 1)$.

Our Polenske values for goats' butter are compared with the maximum allowable for the various Reichert-Wollny values in the following table.

Reichert-Wollny value.	Polenske values.						
	Mean.	Maximum allowable.	Found in goats' butter.				
28	2.6	3.1	} 8.65	7.0	7.85	8.3	4.9
27	2.4	2.9					
26	2.3	2.8	} 8.7	7.6			
25	2.1	2.6					
24	2.0	2.5	} 7.5	5.3			
23	1.9	2.4					

Richmond further states that "should the Polenske figure exceed the maximum given in the table, the amount of coconut oil present may be deduced from the formula $C = \frac{P - P'}{14.4} \times 100$."

where C = percentage of coconut oil; P = Polenske figure; P' = Mean Polenske figure from the table equal to the Reichert-Wollny No. found + half the Polenske figure.

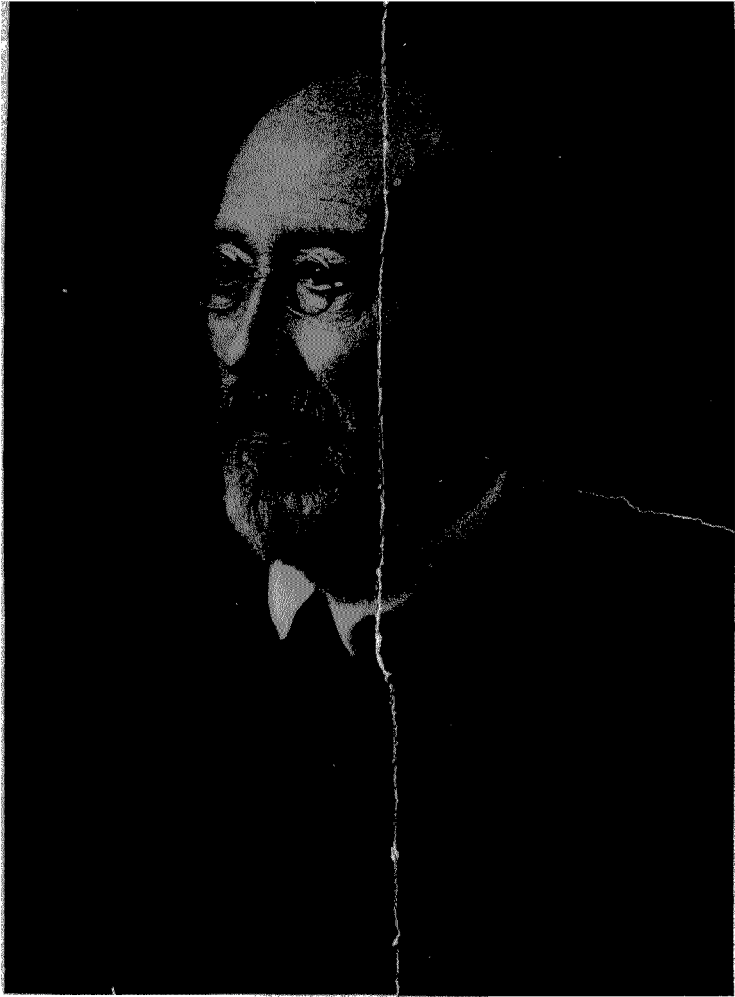
"Should palm-kernel oil be known to be present or detected by the test of Burnett and Revis, the figure 8.5 may be substituted for 14.4."

If the first formula were to be applied to our results, it might, erroneously, be inferred that our samples of genuine goats' butter contained the following percentages of coconut oil.

Sample ref.	1	2	3	4	5	6	7	8	9
Coconut oil, per cent.	12.64	11.46	9.51	7.64	14.24	4.17	10.42	0.35	10.78

The relationship between the Kirschner and Polenske values for cows' butter is expressed by Richmond as $P = (K - 14) \times .26$, and he states that "it may be safely assumed that if the Polenske figure is higher than $(K - 10) \times .26$, the presence of coconut or palm-kernel oil is established." That this formula could not apply to the samples of goats' butter we have analysed is shown.

Sample Ref.	Polenske value.	$(K - 10 \times .26)$.
3	7.85	1.77
4	7.00	2.23
5	8.70	1.87
6	5.30	1.85
7	7.6	2.09
8	4.9	2.33
9	8.3	2.08



Otto Steiner

In every case the Polenske value is higher than that given by the formula, from which the same erroneous conclusion might be drawn, namely, that the samples contained a high percentage of coconut oil. The iodine values and refractive indices of the fat appear to correspond fairly well with those given by cows' butter, but the specific gravities appear to be distinctly higher and more variable. Determinations on many more samples would, however, be necessary before this could be asserted as being universally true. We had no information as to the diet or stage in the lactation period of the animals at the time our samples were taken, but we propose to study their effects on the composition of goats' butter in a further paper.

In conclusion, we would suggest that evidence has been produced to show (1) That the present legal interpretation of the words "Milk" and "Butter" should be more clearly defined.

(2) That the usually accepted standards do not hold good for goats' butter, and that an analyst receiving samples of this product designated as "butter," would almost certainly certify them as adulterated.

(3) That it is necessary to enforce that the prefix "goats'" be applied to the milk and butter obtained from goats.

We wish to acknowledge the help given by Mr. R. P. Hawkins, who carried out some of the specific gravity determinations, also assistance given by Mr. T. W. Palmer, Hon. Secretary of the British Goat Society, and those members of that Society who, at his request, kindly supplied the samples.

CHEMICAL DEPARTMENT,
EAST ANGLIAN INSTITUTE OF AGRICULTURE,
CHELMSFORD.

DISCUSSION.

Mr. G. RUDD THOMPSON said that he had gained the impression that the use of artificial feeding stuffs, in which coconut might or might not appear, was indicated by the authors' results. The authors had stated that nothing at all was known of the diet of the goats, but he thought investigation would show the existence of compound feeding cakes for the use of goats. Milk produced by goats kept under hygienic conditions was known to be greatly on the increase, so that there was obviously no reason why goats' butter and milk should not be put upon the market, and anyone taking a case into Court would find it very difficult to prove that it was not "butter" or "milk," according to official standards, had the goat been in the vicinity of a coconut cake.

Mr. E. R. BOLTON said that the Bombay Adulteration of Ghee Act defined "ghee" as made from the butter fat of the cow, buffalo, goat, or sheep; he, therefore, thought that the authors' figures for goats' butter would prove of interest to Indian chemists.

With regard to the question of substituting goats' butter for cows' butter, he thought that if a buyer asked for *butter* he would clearly expect to receive cows' butter. The speaker hoped that the authors would give any information they had about the diet of the animals, in view of the somewhat extraordinary figures, and asked if they had applied the baryta value of Avé-Lallement—a test which had proved useful for sorting purposes, giving a "minus" value for butter fat and a "plus" value for every other fat.

Mr. C. L. CLAREMONT said that he thought that a cow would have to eat a very heavy ration of coconut cake for the analysis of the butter to show a figure like that mentioned by the authors for goats' butter.

Mr. C. A. MITCHELL enquired whether the authors had done any work on determining the composition of the fat; if so, he would like to hear what proportion of stearic acid was present and what were the unsaturated acids.

Mr. G. D. ELSDON said the definition of "butter" was "the substance usually known as butter"; goats' butter was not usually known as butter, and therefore to supply goats' butter as butter would be adulteration. With regard to the constituents of the fat, would it not be advisable to find out the composition of cows' butter with some degree of accuracy before attempting that of goats' butter?

Mr. A. C. BARNES said the subject of the authors' paper was of considerable interest outside England. In West Africa there were no cows, and those fortunate enough to get milk got goats' milk; it was possible that ultimately there would be a large sale for both milk and butter from goats. As it was in these countries that the palm fruit was grown, the chances of adulteration of an animal fat by the natives were enormous, so that the authors' determinations were of great interest to people overseas. In his opinion, the authors should be encouraged to continue their investigations, and he suggested their obtaining samples of milk and butter from goats abroad.

Mr. A. MORE said that sheep' milk fat also gave higher Polenske figures than cows' milk fat, and recently he had examined the fat of a Roquefort cheese, made from sheep's milk, which had a Polenske value of 4.6, and a Reichert-Wollny figure of 27.5.

In reply to the discussion, the authors state that, although the full diets of the goats were unknown, they can assert that no coconut, palm-kernel or compound cake was used as far as eight samples of the butter were concerned.

In their opinion the high Polenske figure is natural to goats' butter. Their view is supported by the previous analyses quoted and by the fact that their samples were drawn from different counties. Feeding of cows on coconut cake has, however, been shown by Cranfield to influence the Polenske figure for the resulting butter, but the effect is comparatively slight.

The chief point in the legal position appears to have been missed by Mr. Elsdon—namely, that the definition of butter depends on the definition of milk. The authors agree that a buyer asking for butter might well expect to receive cows' butter, but are of opinion, that, as the law stands at present, he would have no redress if he received goats' butter.

No Avé-Lallement baryta values or proportions of constituent acids were determined, but it is hoped to make these determinations at a future date.

Notes.

The Editor wishes to point out that the pages of the Journal are open for the inclusion of short notes dealing with analytical practice and kindred matters. Such notes are submitted to the Publication Committee in the usual manner.

DHOLL MIXED WITH DYED TALC.

"DHOLL" is a dried lentil, of which five different types are imported into Natal from India. Recently the Indian Customs Authorities informed the Health

Authorities in this town (Durban) that a consignment of dholl had been sent here which was believed to be coloured with red lead. This material was traced to local Indian stores (we have a large Indian community here), and samples were purchased. No lead could be found in the dholl, but the samples contained from 6 to 22 per cent. of talc coloured with an eosine dye.

Apparently there is no question of adulteration, as the retailers state that certain castes will not purchase dholl unless it is so treated. I should be glad to have any information to explain this peculiar custom.

ALFRED A. KLOOT.

THE STEARIC ACID CONTENT OF BUTTER FAT.

THE method of estimating stearic acid in fats by crystallising the mixed fatty acids from alcohol already saturated at 0° C. with pure stearic acid was first described in a paper read before the Society by Hehner and myself (ANALYST, 1896, 21, 316). In one of the sections in that paper we referred to the behaviour of butter fatty acids in that test, and mentioned that, whilst in many cases little, if any, deposit was obtained from them, in other cases some tendency to supersaturation was noticed.

As reference was made to this question in the discussion on a paper at the October meeting, I have thought it might be of value to place on record the results which, since that time, I have obtained with various samples of butter fat. Supersaturation may be prevented by adding a weighed excess of pure stearic acid to the mixed fatty acids as was suggested by Holland Reed and Buckley (*J. Agric. Res.*, 1916, 6, 105; ANALYST, 1916, 41, 209), but in my experience supersaturation only takes place, in the case of butter fatty acids, when a relatively small amount of stearic acid is present. Supersaturation may also be ended by shaking the flask vigorously after 12 hours and then leaving it for a further 12 hours in the ice-water. Referring to my experimental note-books, I find that the following results (*inter alia*) were obtained with samples of butter fat, which I had every reason to believe to be genuine:

	Reichert- Meissl value.	Stearic acid. Per Cent.		Reichert- Meissl value.	Stearic acid. Per Cent.
I.	23.1	15.7	XIII.	29.7	1.5
II.	—	nil	XIV. (Dutch)	18.6	21.7
III.	—	10.9	XVII. „	20.3	17.9
IV.	—	nil	XVIII. „	21.4	15.5
V.	—	nil	XIX.	—	nil
VI.	—	3.8	XX.	—	0.7
VII.	—	nil	XXI.	22.4	1.2
VIII.	28.8	(a) 4.1; (b) 4.3	XXII.	22.6	15.0
IX.	32.4	14.2	XXIII.	25.7	16.0
X.	30.8	15.2	XXIV. (Australian)	31.6	18.1
XI.	—	nil			
XII.	—	0.8			

In each case the deposit had the appearance of stearic acid crystals and melted between 68° and 69° C. In experiments in which weighed quantities of pure stearic acid were added to butter fatty acids the deposits contained these added amounts. Hence there does not appear to be any constituent in butter fat (analogous to that in Japan wax) which interferes with the crystallisation of stearic acid.

From these results it can hardly be doubted that the stearic acid content of butter fat may range from practically nothing to 22 per cent., at least.

It has been shown that such wide variations do occur in the body fat of different animals of the same species, and so it need not excite surprise that they should also occur in the milk fat. There is quite sufficient of the lower fatty acids in butter fat to form, with the stearic acid and oleic acid, mixed glycerides of relatively low melting point.

C. AINSWORTH MITCHELL.

NOTES ON THE TREATMENT OF PARCHMENTS DAMAGED BY FIRE.

DURING the current year, in two separate instances, we have been asked to deal with legal documents—parchments—which had been contained in a safe during an outbreak of fire. The safe became involved, but showed a reasonable amount of resistance. The great heat, however, had baked the parchments to compact matter of much reduced bulk, and nearly as brittle as biscuit; they also had a rather pronounced burned and scorched appearance. It became necessary to refer to the subject matter of the documents, and the question was how to deal with them. On the first essay they were carefully dipped in warm water for some minutes, then put on cloths and left for some hours. It was found possible to open them out to some extent, but they were so unequally shrunken by the heat that the parts most baked were most contracted, although other portions opened out fairly well. It was then seen that the ink (the documents were of some age) was either faded or reduced by the water treatment, and those places were accordingly brushed over with a solution of gallic acid on a soft camel-hair brush. The documents were thus rendered legible, with the exception of a missing word or two which could be pretty well supplied from the context, and a copy required was made.

Then occurred a mischance with one of the documents which, after treatment with gallic acid, had been put between sheets of clean blotting paper and pressure gradually applied in a copying press. The moisture penetrated the layers of paper and brought away enough iron in solution from the press to stain the document, but fortunately it remained more or less legible, and the copy previously in use was available. It was found that directly the parchment began to dry again, the brittleness of the worst places returned with its accompanying risk of cracking or breaking; this was surmounted by brushing with a solution of about 1 part of glycerin to about 6 parts of distilled water, and thus producing a continuing dampness.

This treatment had a fair amount of success, but a much improved procedure was devised when a further parchment was sent to us some months later.

In this case a large beaker was taken and the bottom covered with cotton wool. The document, which in its shrunken state measured about $5\frac{1}{2}$ in. by 2 in. by $\frac{3}{4}$ in. in thickness, was set upright on the wool, and from a flask provided with a safety tube steam was gently introduced into the beaker at the level of the cotton wool, which acted like a sponge as regards condensed water; the inlet of the delivery tube was at the side of a dial-glass and rested in the spout of the beaker. The operation went on for half an hour, and then the beaker and document in it were left at rest for a few hours. This treatment was quite successful; the ink had not run, and the document (although it would not properly flatten) could be opened without breaking and was manageable, especially after the glycerin treatment, which was applied earlier than in the former case. No gallic acid was

used, nor was it necessary. Of course, there was not a very close resemblance to the original parchment, but it was distinctly legible, including the signature. In all cases the wax of the seals had melted in the first instance, and in one case the seal had been removed to the other side of the document, but any adhesion caused by the wax yielded to the high temperature, and the surfaces could be drawn apart. We were the more satisfied to get a pretty good result, as the case had been regarded as rather hopeless.

C. G. MATTHEWS.

Notes from the Reports of Public Analysts.

The Editor would be glad to receive the Annual or other Reports of Public Analysts containing matter of interest to the Society. Notes made from such Reports would be submitted to the Publication Committee.

BOROUGH OF PORTSMOUTH.

REPORT OF THE PUBLIC ANALYST FOR THE YEAR 1923.

THE total number of samples examined during the year was 1336, of which 1202 were Food and Drug samples, and 46 were samples under the Milk and Dairies Amendment Act. Of the Food and Drug samples, 66 were found to be adulterated, and 9 of inferior quality. Twenty-eight of the 588 samples of milk, examined were adulterated and 5 inferior.

THE MILK AND DAIRIES (AMENDMENT) ACT (1923).—Six samples of “certified milk” were examined, and one was rejected. This sample contained 7300 bacteria per c.c. (standard not more than 30,000), but *B. coli* was detected in 0.1 c.c.

It is reasonable to suppose that in framing the Act, milk of at least average quality was pre-supposed, whereas all the samples of “certified milk” examined have been below the average in fat content (3.0 to 3.3 per cent.). This milk has been sold at an average retail price of 1s. 2½d. per quart.

Grade A Milk.—This milk is to be produced and treated under such conditions that a sample taken at any time between production and delivery to the customer shall not contain “more than 200,000 bacteria per c.c., and *B. coli* shall be absent from 0.01 c.c. of milk.” The average retail price of this milk during the year has been 9d. per quart.

For comparison purposes the results of 20 of the many examinations of *ordinary* milk as supplied to hospitals and other local institutions are given. The numbers of bacteria per c.c. ranged from 1720 to 32,100. Ten of the samples gave negative results in the test for *B. coli* in 0.01 c.c. of milk.

These results indicate that a standard of 200,000 bacteria per c.c. is vastly in excess of what a milk produced under normally sanitary conditions should contain.

It is suggested that the present specifications for hospitals and other municipal institutions should be altered, and that in future only “Grade A” milk be accepted.

PRESERVATIVES.—In three of eleven samples of cream sold as preserved cream no boric acid was present, and the remainder contained from 0.03 to 0.16 per cent.

Boron preservative was found in 55 samples of butter (41 per cent. of those examined), but in no case in greater proportion than 0.29 per cent.

REGINALD P. PAGE.

COUNTY BOROUGH OF SALFORD.

ANNUAL REPORT OF THE BOROUGH ANALYST FOR 1923.

DURING the year 1591 samples were submitted for analysis, of which 1388 were taken under the Sale of Food and Drugs Acts, and 203 were submitted by various Corporation departments. Of the Food and Drugs samples 96 (6.9 per cent.) were returned as adulterated.

MILK.—Of the 779 samples examined, 42 (5.4 per cent.) were returned as adulterated.

Two samples contained 0.01 per cent. of potassium nitrate, and 2 contained 1 part of potassium nitrate in 50,000. Proceedings were taken against the vendor of these samples, and he was fined £3 for deficiency in fat. The Magistrate remarked that he would not, on that occasion, impose a penalty for the presence of the potassium nitrate, but hoped that the case would serve as a warning to others in future.

Dirt in Milk.—Since the year 1915, 2765 average samples of milk coming into the borough have been examined. Of these, 946 have been entirely free from sediment, 1208 contained between 0 and 1 part per 100,000, and 218 have contained between 1 and 2 parts per 100,000. Hence, since 81 per cent. of the samples have contained not more than 1 part per 100,000, it would appear that that would be a fair standard, and that milk containing 2 or more parts per 100,000 should be classified as unsatisfactory. Efforts are being made, by administrative methods, to improve the present condition of the milk supply in this respect, before taking more drastic steps.

BUTTER AND MARGARINE.—Of 53 samples of butter examined, 9 were preserved with boron preservative (=0.3 per cent. of boric acid).

Of 43 samples of margarine none was adulterated. Seventeen were tested for boron preservative, which was present in every case. In nine it amounted to 0.4 per cent. as boric acid.

Legal proceedings were instituted in several cases for the sale of margarine as "butter mixture," one of the samples containing only 0.5 per cent. of butter. Fines were inflicted in 2 cases. (Cf. ANALYST, 1923, 48, 489; 1924, 85).

CHEESE.—Fifteen samples of cheese contained pure milk fat in the proportions of 21.5 to 47.0 per cent.

Eight samples of cream cheese were examined, and, of these, 4 (containing between 5 and 6 per cent. of milk fat) were returned as adulterated. (Cf. ANALYST, 1924, 264).

A few cheeses were sold as "Bondon Cheese," and of these samples, some contained 38 per cent. of fat, whilst others contained only 5 per cent. A special report was made on the subject (see ANALYST, 1924, 267).

BEEF AND MALT WINE.—Proceedings were taken against the vendors of beef and malt wine deficient in both meat extract and malt extract, and the maximum fine, with 20 guineas costs, was inflicted. The analyses were accepted, the amounts of meat and malt extracts actually added being about half the maximum amount mentioned in the certificate ("not more than 0.2 per cent. of a mixture of equal parts of meat and malt extracts"). (ANALYST, 1923, 48, 326; 1924, 210.)

SYRUP TREACLE.—Of 32 samples of golden syrup examined, 22 were found to be genuine golden syrup derived from cane or beet sugar products, but 10 samples (from 3 manufacturers) contained a large percentage of glucose syrup. Proceedings

were instituted in two cases, but both were dismissed, one on the ground that the label (though misleading) afforded some sort of protection, and the other because of evidence that the term "syrup treacle" was not a term usually known in the trade. In the Salford district, however, ample evidence can be found that the term was at one time well known. (Cf. ANALYST, 1923, 48, 599, 600.)

JAM.—Eighteen samples from 13 vendors, out of 26 examined, contained from 8 to 20 per cent. of glucose syrup, and 1 contained 35 per cent. In the case of marmalade it has been held by the High Court (ANALYST, 1901, 26, 329), that there was no evidence to show that a sample which contained 13 per cent. of glucose was not marmalade. This ruling would probably be followed in the case of jam, and those samples, therefore, which contained not more than 15 per cent. of glucose syrup and were not labelled in any objectionable way were passed as genuine.

Sixteen samples, from 11 manufacturers, were labelled in such way as to lead the purchaser to suppose that the jams were free from glucose syrup. The manufacturers were approached in the matter, and agreed either to drop the use of glucose syrup or to modify their labels, by omitting all references to sugar in the case of jams containing about 15 per cent. of glucose syrup, and by adding the words "scientifically preserved" when larger proportions of glucose were present.

ARSENIC IN FOOD WRAPPERS.—Nine of 51 samples examined contained an appreciable quantity of arsenic derived from the printing inks (cf. ANALYST, 1924, 336).

CANNED GOODS.—Of 35 samples examined, 12 of canned fish and 8 of canned tomatoes, were fairly satisfactory, since they contained less than 2 grains of metallic tin per lb. Fifteen samples of canned bristlings were reported to be unsatisfactory, as they contained from 2·7 to 6·7 grains of metallic tin per lb. The owners agreed to withdraw them from sale and destroy them.

G. D. ELSDON.

Legal Notes.

Under this heading will be published notes on cases in which points of special legal or chemical interest arise. The Editor would be glad to receive particulars of such cases.

CHOCOLATE.

ON September 3, a grocer was summoned at Stanley (Co. Durham) for selling as "chocolate" an article not of the nature, substance and quality demanded.

Mr. C. J. H. Stock, Public Analyst, gave evidence to the effect that the sample of "chocolate animals" in question was a sweetmeat not of the composition of chocolate. It consisted of a mixture of chocolate with gelatin, maize starch and ferric oxide, which last substance, in the proportion in which it was present, was not a constituent of genuine chocolate.

For the defence it was contended that the sweet was described by the manufacturers as "Chocolate Mixed Brown Animals," and that this was intended as a description of the colour. The article was not sold as chocolate.

A fine of £2 and costs was imposed.

ARSENIC IN BORAX.

ON September 23rd a firm of druggists was summoned at the Mansion House for having sold as purified borax a sample of borax containing 120 parts of arsenic per million.

Mr. Earle, prosecuting for the Corporation of London, said that, as borax was taken internally as a medicine, it was of the greatest importance that it should be of the highest degree of purity, and that the standard of the British Pharmacopœia (in the case of this drug 5 parts of arsenic per million) should be complied with.

Mr. H. Glyn-Jones, for the defence, said that in this case a good commercial sample of borax had been supplied instead of the B.P. article. Borax might occasionally be used as a medicine; it was sometimes used in mouth-washes; more often in toilet preparations, but mainly for industrial purposes, such as laundering. He submitted that it was inconceivable that borax containing not more than 120 parts of arsenic per million could do harm. One would have to take more than 20 times the average B.P. dose of borax in order to get an average dose of arsenic. To get a really poisonous dose of arsenic about a pound and a half of this borax would have to be swallowed.

The Lord Mayor, on being assured that the consignment of borax had been destroyed, said that he was prepared to deal leniently with the case, and imposed a fine of 40s. with 2 guineas costs.

ADULTERATION OF SHELL EGGS.

THE following case is typical of ten cases reported by the U.S. Department of Agriculture:*—On July 5th, 1923, the United States Attorney for the District of Nebraska, acting upon a report by the Secretary of Agriculture, filed in the District Court of the United States for the said district an information against a firm of traders, of Danbury, Nebr., alleging shipment by said defendants, in violation of the Food and Drugs Act, on or about August 9, 1922, from the State of Nebraska into the State of Colorado, of a quantity of shell eggs which were adulterated.

Examination by the Bureau of Chemistry of 1080 eggs from the consignment showed that 204 or 18·88 per cent. of those examined, were inedible eggs, consisting of "black rots, mixed or white rots, mouldy eggs, spot rots, and blood rings." (Cf. ANALYST, 1924, 279.)

Adulteration of the article was alleged in the information for the reason that it consisted in part of a filthy and decomposed and putrid animal substance.

On March 3, 1924, the defendants entered a plea of guilty to the information, and the Court imposed a fine of \$25.

* Service and Regulatory Announcements, Bureau of Chemistry. Supplement. N.J., 12201-12250. Aug. 1924. (No. 12212, *United States v. W. T. Harris*. F. & D., No. 17419, I.S., No. 7583-v.)

Ministry of Health.

FUR DERMATITIS.*

In this enquiry into the occurrence of dermatitis attributed to the wearing of fur collars the subject has been investigated from all sides. Information as to dyeing process has been obtained from the fur trade associations and from private individuals, and the co-operation of dermatologists, medical officers of health and chemists has been enlisted.

Although cases of dermatitis caused by the wearing of dyed furs have been recorded by dermatologists during the last 20 years, there is no history of any aggregation of cases similar to the "epidemic" of the winter season of 1923-1924, when the total number of cases up to July, 1923 (when complaints ceased), probably ran into hundreds. Only a relatively small number of fur-wearing women and girls were affected, so that personal susceptibility was responsible to a certain extent. In most cases there is a latent interval of 2 to 3 weeks, but sometimes the symptoms appear within a few hours of contact with the fur.

The furs which have been proved to be the cause of the complaints are rabbit skins dyed to resemble beaver; they are exclusively produced and dyed in foreign countries, notably Belgium, France, Germany, and the United States.

Defective or careless technique in the use of potentially dangerous dyes is, in all probability, the cause of the trouble. (*cf.* ANALYST, 1923, 48, 282, 283, 284).

BACTERIOSCOPIC EXAMINATION.—The report contains in an appendix a report by Dr. Eyre of Guy's Hospital on the bacterioscopic examination of a fur collar that had caused dermatitis. The hairs were normal in character, no bacteria or moulds could be demonstrated microscopically, and cultures from the hair and skin failed to yield any micro-organisms which could be associated with dermatitis.

CHEMICAL EXAMINATION.—Appendix 4 contains a report by Professor Perkin on the chemical examination of four samples of suspected furs. The conclusion drawn is that there can be no doubt that the trouble has arisen in connection with the so-called oxidation colours, which are developed on the fibre from colourless substances, probably all of which are of a poisonous or irritating character.

Whereas in (A) no compound of the nature of *p*-phenylene-diamine could be detected, in (B) *p*-phenylene-diamine was actually present; (C), on the other hand, contained traces of a readily crystalline soluble basic aromatic substance, the exact chemical identification of which was not possible, but which, it is reasonably suspected, was allied to *p*-phenylene-diamine itself. Finally, (D) in this respect resembled (A).

All the furs contained a substance or substances, in moderate amount, soluble in alcohol, and from these solutions brown semi-crystalline products were obtained possessing a remarkable similarity to Bandrowski's base, the well-known oxidation product of *p*-phenylene-diamine, which is readily obtained by passing air through an ammoniacal solution of *p*-phenylene-diamine, and is also, without doubt, an oxidising agent.

The colouring matter present in these furs was by no means of a homogeneous character, for although much was insoluble in the usual solvents, some portions were, however, soluble in water, in boiling alcohol, and in cold dilute hydrochloric acid respectively.

* Reports on Public Health and Medical Subjects. No. 27. By Allan C. Parsons, M.R.C.S. H.M. Stationery Office, 1924. Price 9d. net.

The conclusions with regard to these points are given with reserve, as an authentically innocuous dyed fur for purposes of comparison could not be obtained. On the other hand, this lack of homogeneity of colouring matter is likely to have arisen from a faulty application of the dyeing process—in other words, an incomplete oxidation of the developer to the finished dyestuff. Whereas in the case of the furs (A) and (D), *p*-phenylene-diamine or an analogous compound was absent, and these furs had undoubtedly produced dermatitis, it is thus probable that the irritant was a product representing an early stage of colour development that is of the nature of Bandrowski's base. Again, although in fur (B) *p*-phenylene-diamine was found, and in fur (C) there was a crystalline substance of an apparently similar character, there was also present in each immature colouring matter, closely similar to Bandrowski's compound. Finally, all the furs had a faintly acid reaction and showed no sign of the application of mordants.

No information is available as to whether in high-class fur-dyeing the mordanting operation is considered to be essential for a complete development and fixation of the dye. Such an adjunct to the dyeing operation is, however, evidently very usual, and is described in the majority of fur-dyeing recipes. An after-treatment of this character may, on the other hand, be most important. Thus, according to Austin (*Principles and Practice of Fur Dressing and Fur Dyeing*, p. 168), "Some shades, especially black, have a tendency to rub off slightly. To overcome this the dyed furs are treated with a cold solution of one part of copper sulphate in 1000 parts of water, for 3 to 4 hours," and (p. 160), "It was this superficial deposition of minute crystals of the dye, or the only partially oxidised intermediate . . . which was frequently injurious to the health."

Finally, the following note of W. F. Castle (*ANALYST*, 1923, 48, 284), is interesting:—"The furs seem to be innocuous unless the wearer has a greasy skin, when the colouring agent appears to dissolve in the fatty acids."

BIBLIOGRAPHY.—The Report concludes with a bibliography containing 28 references, dating from 1902 to 1924.

FINAL REPORT OF THE DEPARTMENTAL COMMITTEE ON THE USE OF PRESERVATIVES AND COLOURING MATTERS IN FOOD.*

FOLLOWING a summary of the regulations adopted by other countries in the matter of preservatives and colouring matters in food, the effect of various preservatives on the consumer and their relative harmfulness is discussed, and, from a consideration of the evidence, the conclusion is drawn that preservatives may be classified in three groups according to their relative degrees of undesirability, *viz.*: Group I., Formaldehyde and its derivatives; hydrofluoric acid and its derivatives. Group II., Boron preservatives; salicylic acid and its salts. Group III., Benzoic acid, sulphurous acid and their salts.

The existing practice in connection with various foods is next described, and after a general consideration of the evidence of medical men and traders, each group of foods is dealt with in turn.

MILK.—The addition of any preservative in milk is now prohibited by the Milk and Cream Regulations, but antiseptic agents are still advertised and sold

* H.M. Stationery Office. Pamphlet 84. 1924. Price 1s. 6d. net

for sterilising dairy utensils and milk bottles. To prevent possible contamination of milk from this source, the Committee are of opinion that only steam or other suitable source of heat should be permitted for this purpose.

CREAM.—Given appropriate care to preparation and the use of suitable methods of transport, storage and distribution, the Committee see no sufficient reason why the use of preservatives in cream should not be prohibited after a sufficient period of notice to enable the trade to make suitable adjustments.

BUTTER.—The conclusion reached after a consideration of all the evidence is that a period of two years would be sufficient to allow such adjustments of method to be made as would enable all butter to be produced and sold without preservatives. The Australian and New Zealand trade, and possibly that of the Argentine, seemed to be the only cases in which any difficulty was to be apprehended. From both the former countries a considerable quantity of butter is already being sent without preservatives. The requirement of compulsory pasteurisation which has been recently imposed in Australia will, it is believed, help to improve the keeping quality of the butter, and the Committee have little doubt that such a regulation as we suggest would stimulate improvements in other directions.

MARGARINE.—The Committee are of opinion that well-made margarine keeps as well as, or even better than butter, and therefore recommend that the addition of preservatives should be prohibited.

SAUSAGES.—As at present there is a lack of suitable transport and storage accommodation, the conclusion has been reached that, in existing circumstances, some preservative should be permissible (*vide infra*).

BACON AND HAM.—The Committee consider that difficulties of keeping these foods can be satisfactorily met by the provision or extension of suitable storage accommodation on ship and on shore, and therefore advise that, after due notice, the use of preservatives in the preparation, storage or distribution of bacon and ham should be prohibited.

BRAWN, POTTED MEAT AND POTTED FISH.—It is recommended that the use of all preservatives be prohibited in these products, including potted shrimps.

MEAT.—It is recommended that the use of all preservatives should be prohibited, no exception being made in favour of the Bullot process of exposing the freshly-killed carcass to sulphurous fumes derived from a special mixture. After this treatment as much as 2 grains of sulphur dioxide per lb. could be detected throughout the meat.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

1. Preservatives should be prohibited in all articles of food and drink offered or exposed for sale whether manufactured in this country or imported, except that

(A) Sulphur dioxide only should be permitted

(i) in sausages in amounts not exceeding 3 grains per pound; (ii) in jam in amounts not exceeding 0.3 grain per pound; (iii) in dried fruit in amounts not exceeding 7 grains per pound; (iv) in preserved (but not dried) whole fruit or fruit pulp in amounts not exceeding 5 grains per pound; (v) in beer and cider, whether in bottle or in cask, in amounts not exceeding 5 grains per gallon; (vi) in alcoholic wines, non-alcoholic wines and cordials, and fruit juices, sweetened and unsweetened, in amounts not exceeding 3 grains per pint.

(B) Benzoic acid only should be permitted

(i) in coffee extract in amounts not exceeding 3 grains per pound; (ii) in non-alcoholic wines and cordials, and sweetened and unsweetened fruit juices (as an alternative to sulphur dioxide) in amounts not exceeding 5 grains per pint; (iii) in sweetened mineral waters and in brewed ginger beer in amounts not exceeding 1 grain per pint.

The method of estimating the foregoing preservatives should be prescribed by the Minister of Health.

2. The sale of any preparation as a food preservative or for use in such circumstances that it may be introduced into food should be declared illegal unless such preparation

(a) bears a description clearly indicating its composition and strength; (b) is free from impurities and, in particular, contains not more than 1/100th part of 1 grain of arsenic per pound or more than 1/7th part of 1 grain of lead per pound.

3. The use of preservatives, so far as they are permitted, should be upon the condition that the nature and quantity of the preservative present in the article of food should be declared in a manner prescribed by the Minister of Health. In cases in which the declaration of the preservative might be difficult to enforce or might result in undue harm to the industry without compensating advantage to the consumer, exception to this requirement might be made, but the exception should in no circumstances apply to sausages.

4. The employment of a copper salt to colour or preserve the colour of peas and other vegetables should be prohibited.

5. A schedule should be issued by the Minister of Health, after such enquiry as is necessary, of colouring matters the use of which may be considered non-injurious to health, such schedule to be subject to amendment or extension from time to time as occasion may require. Within a suitable period after the publication of this list the use of any other colouring matter should be prohibited, unless and until it shall have been approved by the Minister.

6. Before the prohibition of preservatives or of colouring matters in food (including the use of copper salts for the so-called greening of vegetables) is enforced, a period of grace should be allowed sufficient to enable manufacturers and importers to adjust their methods and processes and to allow stocks to be cleared.

7. Improved methods in the storage and transport of food by rail, road and water, especially as regards the use of refrigeration and cool air storage, are urgently required.

8. It should be provided by law that any Regulations or Statute prohibiting or limiting the use of preservatives and colouring matters should bind the courts in proceedings taken under the Sale of Food and Drugs Acts in respect of their use.

9. An amendment of the law is required to render more expeditious the prosecution of a person actually responsible for offences under these Acts, where a warranty defence is pleaded.

10. Further powers of control by registration, licensing or inspection should be given to Local Authorities in relation to all places concerned in the production, sale, storage, and distribution of food.

Report of the Government Chemist upon the Work of the Government Laboratory.

FOR THE YEAR ENDING MARCH 31ST, 1924.*

THE chemical work of the following Departments is carried out wholly or in part at the Government Laboratories—Admiralty, Ministry of Agriculture and Fisheries, Air Ministry, Colonial Office, Crown Agents for the Colonies, Board of Inland Revenue, Ministry of Pensions, Post Office, Department of Scientific and Industrial Research, Home Office, Board of Trade, War Office, Office of Woods and Forests, Privy Council, and Office of Works. The total number of samples examined during the year, including those dealt with at the chemical stations, was 390,421, an increase of 46,968 over the preceding year. Marked increase is shown in the number of wine, sugar and tea samples, and of wort, exported beer, and spirituous preparations. The number of imported beer samples rose from 1361 to 15,283, those of exported tobacco and snuff doubled, these latter being largely due to the examination necessitated by the establishment of the Irish Free State.

IMPORTED DAIRY PRODUCE AND MARGARINE.—*Butter.*—Of the 867 samples examined, 10 exceeded the 16 per cent. water limit, and 3 “hard butters” were palm-kernel preparations.

Margarines.—Five out of 455 samples exceeded the water limit.

Cheese.—The fat varied in the 138 samples examined from 8·6 to 38·1 per cent., or 21·0 to 56·9 per cent. on the dry matter.

Cream.—The tinned creams contained from 23 to 54 per cent. of fat, and the preserved creams from 51 to 67 per cent.

Milk.—Two out of 6 samples of tinned sterilised milk taken from specimen consignments sent with the object of getting a footing in this country had been deprived of about a quarter of their fat, and another sample was incorrectly labelled.

Condensed Milk.—One hundred and thirty six samples were examined under the old regulations, and 263 under the new regulations which require that the milk should conform to the following standards:

Whole milk, sweetened or unsweetened,	31 per cent. of milk solids, including 9 per cent. fat.
Skimmed milk, sweetened,	26 per cent. milk solids.
Skimmed milk, unsweetened,	20 per cent. milk solids.

Of these, 12 samples were deficient in fat, and 3 of these in milk solids as well; 10 overstated the contents of milk represented, and in 15 the fluid produced by the stated dilution was below the prescribed standard. Labelling errors appeared in 17 samples.

SHEEP DIPS.—Samples of dips are examined for suitability of formula and conformation to formula, and baths for strength. Thirty-six out of 134 samples were reported as defective.

* H.M. Stationery Office, Kingsway, W.C. Price 1s. 6d. net.

WATER AND POLLUTION OF RIVERS.—From the point of view of fish life, 18 samples of river water and effluents were examined; also 32 samples of domestic water, and 12 of road dressings for harmful substances.

SEA WATER.—The salinity of 5757 samples and the amount of dissolved oxygen in 131 samples of sea water was determined, chiefly in connection with the influence of the salt concentration upon fish life.

FERTILISERS AND FEEDING STUFFS ACT.—During the year 10 fertilisers and 13 feeding stuffs were reported upon. Two samples of basic slag contained admixed mineral phosphates, 1 sample was deficient in citric-soluble phosphates, and in 3 the guarantee of citric-soluble phosphates was greatly understated. A sample of bone siftings was deficient in phosphates and contained over 10 per cent. of sand. Of the feeding stuffs, the ground oats were adulterated with from 20 to 80 per cent. of barley meal and oat-shudes, a sample of sharps contained 4 per cent. of rice husks, a sample of pea meal 40 per cent. of wheat, rye and dari, feed and cotton cakes were deficient in oil and albuminoids, and 3 samples of fish meal contained excess of oil. The statements of oil and albuminoid content given with samples of fish, meat and bone meals were too low to represent the composition of any such articles on the market. In only 1 case was there disagreement with the Agricultural Analyst who examined the samples in the first instance.

MERCHANDISE MARKS ACT.—Out of a total of 21 samples examined, 1 sample of ground oats contained 15 per cent. of tapioca flour (conviction and fine), another 85 per cent. of barley and tapioca; 3 samples of pea meal contained 5.25 and 33 per cent. respectively, of maize and barley; 4 samples of barley meal had 25, 30, 40 and 50 per cent. respectively, of oat refuse and weed seeds, and a fish meal contained 10 per cent. of ground cereals and refuse. Two samples of copper sulphate contained 50 per cent. of iron sulphate, and a sample sold as cherry cider was found to be an artificial preparation.

MISCELLANEOUS ARTICLES.—Out of 24 samples of apples examined for evidence of insecticidal sprays, one showed 1/30th of a grain of lead, and arsenic equivalent to 1/50th of a grain per lb. A sample of milk powder contained 25 per cent. of vegetable fat.

CUSTOMS AND EXCISE.—In connection with duty on beer, 47,733 samples were examined, and 385 samples of brewing materials were tested for arsenic, of which 90 slightly exceeded the limit of the Royal Commission of 1/100th of a grain of arsenious oxide per lb. for solids or per gallon for liquids.

Cocoa and Chocolate.—The estimation and detection of cocoa butter substitutes in chocolate has continued to receive attention and 3020 samples of chocolate confections were found to contain spirit.

Dangerous Drugs Act.—Out of 94 samples, 24 were found to contravene the Act. Two samples marked "morphiumpulver" were found to consist of lactose.

Dyestuffs.—Three hundred and fifty-eight samples of imported colours, lakes, and other goods were examined.

Matches.—None of the 153 samples contained white phosphorus.

Safeguarding of Industries Act.—Nearly 8000 samples of medicinal preparations, toilet articles and perfumes were examined, many of the analyses being of an intricate nature.

Spirits.—One sample of wood naphtha out of 787 was not approved for use in the preparation of methylated spirits, and 993 samples of special denaturants were examined. One additional denaturant has been recommended for mixing

with methylated spirits. The strength of spirit or quantity of sugar in gin, brandy, etc., for export was overstated in 360 claims for drawback out of 2490, and the spirit strength in 276 cases out of 17,700 for medicinal spirits, tinctures, etc. Fourteen samples of fusel oil out of 50 contained more than 15 per cent. of proof spirit, and the proportion was allowed to be reduced as an alternative to paying duty.

Sugar, Glucose and Saccharin.—Although fixed rates of duty have been established for a large number of articles containing sugar, many substances have still to be tested on each importation, and 55,887 articles were examined for assessment or drawback, 1831 samples of glucose and 199 of saccharin, or articles containing saccharin, besides 160 articles for the presence of saccharin.

Table Water Duty.—Of the 100 cordials, syrups, etc., 4 contained between 2 and 5 per cent. of proof spirit, and all the non-alcoholic wines less than 2 per cent.

Tea.—Of 42,068 samples examined, 1024 were reported against, representing 4853 packages of tea; 394 on account of the presence of foreign substances, and 630 as unfit for human consumption; 1095 samples of denatured tea were examined.

Tobacco.—Moisture was estimated in 400 samples of imported and home grown tobacco, and in 9833 of manufactured tobacco, and oil in 1313 samples from stocks of manufacturers and retailers. The number of samples of tobacco exported on drawback was 16,662, as against 8262 last year, the increase being largely owing to export to the Irish Free State pending establishment there of branch factories by British manufacturers. This factor was also responsible for the increase in snuff samples from 271 to 1056. During the year 22,764 samples of tobacco stalks for drawback and 6964 for test as to uniformity of condition, together with 6294 samples of offal snuff, shorts and smalls, were examined. One sample of commercial snuff contained prohibited ingredients, as did 19 out of 128 samples of essential oils, whilst 1 of tobacco contained formaldehyde. Aluminium foil was found to be more satisfactory than lead foil for enclosing tobacco submitted for moisture tests. Experimental research into the composition of British-grown tobacco at various stages is being undertaken with regard to the quantities of nicotine and sugar present.

Wines.—In all, 92,319 samples were tested.

HOME OFFICE.—The usual examinations were continued and an explosion in an oxygen compressor was traced to the lubricant of soap water. Copper and lead soaps were formed and these split off their fatty acids owing to the local heating, and exploded in the air. A case of hydrogen arsenide poisoning was found to be due to dross from a metal foundry in bags becoming saturated with rain water.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.—A series of experiments was carried out on the recovery of formaldehyde by means of water. The results obtained on the investigation of the ammonium sulphate nitrate involved in the explosion at Oppau were described at a meeting of the Faraday Society on the 14th April, 1924.

BOARD OF TRADE.—The quantity of lime and lemon juice approved for the Mercantile Marine was 24,376 gallons.

CORPORATION OF TRINITY HOUSE.—The cause of sediments in oil storage tanks and the effect of certain grades of oil on lead pipes was enquired into.

OFFICE OF WORKS.—The examination of samples of materials purchased for the Public Services was continued, and also the enquiry into the decay of stone in

town atmospheres. Chlorinated hydrocarbons used in charging certain types of fire extinguishers were found liable to cause corrosion of the metal, particularly in the presence of moisture.

SALE OF FOODS AND DRUGS ACT.—Thirty samples of food (including 29 of milk) and 5 samples of drugs were examined. There were four cases of disagreement with the results put forward by the prosecution; two samples of medicine alleged to contain excess of quinine sulphate were found deficient in that substance, 2 samples of milk alleged to be deficient in non-fatty solids were found to contain 8.50 and 8.54 per cent., respectively, whilst there was partial disagreement in the case of a sample of milk alleged to be deficient in fat and in non-fatty-solids, which was found to be deficient in fat but to contain 8.61 per cent. of non-fatty-solids.

D. G. H.

Methods for the Determination of Sulphur and Moisture in Pyrites Ores.

AS APPROVED BY THE SWEDISH GOVERNMENT TESTING INSTITUTE
AND BY THE NORWEGIAN GOVERNMENT ANALYSIS COMMITTEE.

I. INTRODUCTION.

THE method here described contains detailed instructions for the preparation of the general sample for analysis after its arrival at the laboratory and for the method employed in the analysis. In regard to sampling, the following general information and hints, only, will be given.

In order that the chemical analysis shall give reliable values for the composition of a certain lot of pyrites ore, the samples analysed must be correct average samples (general samples) of the lot in question.

The sampling is usually carried out by taking from various portions of the lot in question a larger rough sample, which is then repeatedly ground, mixed and subdivided until a certain sample quantity, having the desired fineness, is obtained, from which eventually one or *simultaneously* a number of *identical* samples are taken for subsequent analysis at various laboratories. The samples taken for the determination of moisture are called *moisture samples*, and those taken for the determination of sulphur are called *quality samples*.

Moisture samples may be suitably taken after the general sample has been reduced to particles not exceeding 10 mm. in size. At this size of grain at least 2.5 kg. should be taken for each moisture sample. The samples are immediately packed as described below.

During the taking of the general sample and during its preparation for a moisture sample, care must be taken that the moisture contents remain unchanged.

Quality samples may suitably be taken after continued repeated subdivision and crushing of the general sample down to a size of 1 or 2 mm. Where the particles do not exceed 2 mm. in size, each quality sample taken should weigh not less than 1.2 kg., and when the largest particle has 1 mm. diameter, each quality sample should weigh at least 0.3 kg.

The samples are immediately hermetically enclosed (in, for instance, a glass bottle with a tight-fitting cork, or tin vessel closed by soldering) and given a label with the necessary information, of which a copy is laid on the top of the sample inside each packing and sealed with the seal of the sampler.

II. PREPARATION OF SAMPLE FOR ANALYSIS.

The *moisture sample* is subjected to no special preparation and is used in its original condition for the determination of moisture (see below).

The *quality sample* is dried, if necessary, at normal room temperature (spread on a suitable surface) or else in a drying cupboard at a temperature not exceeding 40° C. The sample is then

crushed and subdivided into two analysis samples with a maximum particle size of about 0.1 mm. according to the following scheme:

Weight of sample.	Crush to maximum particle.	
2.5 to 10 kg.	abt. 2 mm.	After crushing, the sample is mixed and halved repeatedly until a quantity of not less than 1.2 kg. is obtained.
0.3 to 2.5 kg.	abt. 1 mm.*	After crushing, mix and halve repeatedly until a quantity of not less than 0.3 kg. is obtained.
0.3 kg.	abt. 0.25 mm.	After crushing and mixing, 2 ultimate samples, each of at least 10 grms., are taken and ground in an agate mortar down to a size of about 0.1 mm.† The samples are kept after subdivision in closed weighing bottles.

Crushing down to 2 mm. and 1 mm. generally takes place in a rolling mill or on a steel plate with the use of a sledge-hammer. In the latter case great care must be taken that the crushing is done by careful blows with the hammer and not by grinding, as pyrites ore, on account of its hardness, will be contaminated with iron from the plate and the hammer. Crushing from 1 mm. down to 0.25 mm. is done in a small ball mill with steel balls (for instance, the model of the Government Testing Institute) or on a steel plate with a sledge-hammer as before.

The utility of special crushing tools should be separately investigated, for instance by comparative analysis of two identical samples, of which one has been crushed on a steel plate as described above.

III. THE ANALYSIS.

Determination of Moisture.

After careful mixing of the moisture sample (but without crushing) two samples of 0.1 to 1 kg., depending on the size of particles, are taken and dried in a drying cupboard at 105° C. until a constant weight is observed. As a result the average value of the two tests is given.

Determination of Sulphur.

Analyses are carried out on both the ultimate samples ground in the agate mortar according to one of the following two methods.

As certain ores after grinding rapidly increase in weight on account of oxidation, one should not wait more than 24 hours before weighing in the analysis, and for the same reason the subdivision† of the sample should not be carried too far.

METHOD A: SWEDISH-NORWEGIAN METHOD ACCORDING TO LUNGE.

1. Weigh in 0.5 gm. of the finely pulverised ore sample and transfer the weighed quantity to a glass beaker of 250 to 300 c.c. (low model).

2. Add 20 c.c. newly mixed nitric-hydrochloric acid (3 parts nitric sp. gr. 1.40 + 1 part hydrochloric sp. gr. 1.19) and let the beaker stand, with a watch glass cover, without warming or shaking, until the ore appears to be completely dissolved, preferably until the following day.

Nitric acid of a lower sp. gr. than 1.40 should not be used for this purpose. A somewhat stronger acid may, however, advantageously be employed. In the case of some ores a small quantity of sulphur separates during solution, but it dissolves completely when the sample is left at room temperature or during the succeeding heating.

3. Warm the sample on a boiling water bath for about $\frac{3}{4}$ hour. Remove the watch glass (do not swirl) and evaporate to dryness on the water bath.

The beaker should not be sunk in the water bath. After about $\frac{3}{4}$ hour's heating there will be no appreciable traces of sulphuric acid on the watch glass, for which reason the acid mixture should not be unduly diluted by swirling the cover.

During crushing, the fine material may with advantage be sifted off repeatedly through a sieve with 1 mm. mesh, after which the remnant on the sieve is again crushed.

† If the sample is shaken through a sieve with 140 mesh per inch (0.12 mm. free opening) the remainder on the sieve should amount to 2 or 3 per cent. When grinding is carried too far the sample is considerably altered either by oxidation or by admixture of silica from the agate mortar.

4. Dissolve the residue in 5 c.c. diluted hydrochloric acid, sp. gr. 1.12, while heating with a cover over the beaker. Swill the glass cover and evaporate again to dryness on water bath.

In employing dilute hydrochloric acid, sp. gr. 1.12, no evanescence occurs with the attending spitting, as when conc. hydrochloric acid is used. Any nitric acid remaining in the residue is, however, completely driven off by evaporation with 5 c.c. dilute hydrochloric acid.

5. Moisten the evaporation residue with 2 c.c. hydrochloric acid, sp. gr. 1.19, and heat until all except the insoluble residue (gangue, silica, etc.) is dissolved. Swill the covering glass and dilute to about 100 c.c. with warm water. Filter off the insoluble residue and wash the same with about 50 c.c. warm water. Let the filtrate pass into a beaker of 250 c.c. capacity.

In adding hydrochloric acid a dropping-bottle may be used with advantage, the number of drops of hydrochloric acid per c.c. having been determined.

6. Precipitate in the warm solution the ferric hydroxide with 20 c.c. ammonia, sp. gr. 0.96 (or 15 c.c. sp. gr. 0.95), heat to 60 or 70° C. for 15 minutes, filter and wash the precipitate on a 10 cm. filter. Filtrate and washing water should not exceed a total volume of 350 c.c. and may run into a Jena beaker (low model) of 600 c.c. capacity.

The quantity of ammonia added corresponds in part to that necessary to precipitate the iron, and in part to the surplus recommended by Lunge. The washing of the ferric hydroxide precipitate is suitably carried out firstly twice on the filter with about 25 c.c. of warm water each time; thereafter the precipitate is transferred back to the beaker with about 50 c.c. water. After boiling with the water a couple of minutes, the precipitate is filtered upon the same filter, as before and finally washed with a further quantity of about 75 c.c. warm water.

7. Wash the ferric hydroxide precipitate into the precipitation beaker and dissolve by the addition of 5 c.c. hydrochloric acid, sp. gr. 1.12. Dilute the solution to about 100 c.c. and add, while warm, 5 c.c. barium chloride solution (110 grms./litre). If, after 24 hours, a weighable precipitate is deposited in the beaker, this should be separated by filtration and weighed separately or together with the barium sulphate precipitate in the filtrate from the iron precipitation.

If the washing of the iron precipitate is carried out as above described under 6, it is generally free from sulphuric acid.

8. Add to the filtrate from the ferric hydroxide precipitate a few drops of methyl-orange solution (0.1 gm./litre) and neutralise by adding hydrochloric acid sp. gr. 1.19 drop by drop. Add an excess of 1 c.c. of this hydrochloric acid and dilute to about 350 c.c.

About 2.5 c.c. hydrochloric acid are required for the neutralisation. This may suitably be added by means of a dropping-bottle as mentioned under 5.

9. Heat the solution to boiling, remove the burner and add at once while rapidly stirring 20 c.c. of a boiling barium chloride solution (110 grms./litre $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$).

The barium chloride solution is added from a large test tube, bearing a mark for the exact measurement of 20 c.c. The solution in the beaker is firstly given a rapid rotary movement by quickly stirring three or four revolutions per sec, with a glass rod about 5 mm. thick, after which the barium chloride solution is added during continued stirring, as rapidly as possible, near the edge of the beaker and in the direction of the stirring.

10. Let the sample stand without heating until the precipitate has settled (at least $\frac{1}{2}$ hour), and afterwards decant the clear solution through a close 9 cm. filter.—Test the filtrate with barium chloride to see that all sulphuric acid is removed.—Pour over the precipitate in the beaker 100 c.c. boiling water, stir rapidly, let the precipitate sink for about 5 minutes, and again decant the solution. Repeat this treatment twice again and then wash the precipitate on to the filter, where it is washed until the washings do not give any reaction for chlorine with silver nitrate.

If the filtrate from the barium sulphate precipitate is not completely clear, and if, after a few hours, a weighable deposit is found, a closer filter paper should be used, or else the sample should stand a longer time before filtering.

11. Transfer the filter paper with the precipitate, without previous drying, into a weighed platinum crucible (together with any filter and barium sulphate precipitate from the iron solution) laying the filter with its point upwards. Place the crucible upright on a triangle and carbonise the filter paper at so low a heat that the gases issuing from the crucible do not ignite. Then lay the crucible inclined upon the triangle and burn off the carbon. Bring to red heat with the lid on until constant weight is obtained, using a Teclu or Meker burner (No. 2). A blast flame must not be used.

Barium sulphate \times 0.1373 = sulphur.

12. The purity of the reagents is controlled by carrying out a special blank analysis, and the analysis results are corrected in regard to any sulphur found in the reagents.

METHOD B: SWEDISH-NORWEGIAN METHOD ACCORDING TO GYZANDER.

Method A is followed as far as point 4 inclusive and from point 9 onwards inclusive. Intermediate operations are carried out according to the following instructions.

5. Moisten the evaporation residue with 2 c.c. of hydrochloric acid (sp. gr. 1.19), and heat until all except the insoluble residue (gangue, silica, etc.) is dissolved. Wash the glass cover and dilute to about 100 c.c. with warm water. Filter off the insoluble residue and wash same with about 50 c.c. warm water. Let the filtrate run into a beaker of 600 c.c. capacity (low model).

In adding the hydrochloric acid a dropping-bottle may suitably be used, for which the number of drops of hydrochloric acid per c.c. has been determined.

6. Add to the beaker 20 c.c. solution containing 20 grms. hydroxylamine hydrochloride and 100 grms. ammonium chloride per litre and dilute to about 350 c.c.

The hydroxylamine hydrochloride reduces, upon subsequently bringing to boiling, any ferric salts to ferrous salts which are not occluded by the barium sulphate precipitate. The solution then becomes colourless.

The addition of ammonium chloride makes it possible to employ Lunge's method for the precipitation of the barium sulphate. In the absence of ammonium chloride a result about 0.2 per cent. too high is obtained upon precipitating according to Lunge's method, and upon precipitation by the addition, drop by drop, of barium chloride solution according to Gyzander's method, the results are 0.3 per cent. too low.

IV. THE CALCULATION OF THE SULPHUR ANALYSIS.

Upon each of the two ultimate samples, in addition to the determination of the sulphur content, a separate moisture analysis is made. For this 5 grms. are weighed into a weighing glass with a glass stopper (dimensions about 30 × 30 mm.) and dried for one hour at 105° C. The loss in weight is regarded as moisture.

After calculating the average values of sulphur and moisture analyses upon the ultimate samples the sulphur is then calculated upon the sample dried at 105° C. The result is given with one decimal.

The sulphur analysis must never be made upon samples which have been dried at a higher temperature than about 40° C.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Acid-soluble Phosphoric Acid in Eggs. L. Pine. (*J. Assoc. Off. Agric. Chemists*, 1924, 8, 57-70.)—For estimating the acid-soluble phosphoric acid in liquid whole egg and yolk, the following modification of the Chapin and Powick method (*J. Biol. Chem.*, 1915, 20, 97) is recommended. Fifty grms. of whole egg (or 25 grms. of yolk) are shaken vigorously at least every 10 minutes for 1 hour with 200 c.c. of hydrochloric acid solution containing 1 c.c. of the concentrated acid and 8 grms. of picric acid, in a 500 c.c. Erlenmeyer flask closed with a rubber stopper. The mixture is then filtered through a pleated filter paper, No. 24 (18.5) cm. in diameter, the filtration occupying not more than 45 minutes. From 125 to 150 c.c. of the filtrate are boiled with 10 c.c. of concentrated sulphuric acid and 10 c.c. of concentrated nitric acid in a 500 c.c. Kjeldahl flask, containing four glass beads, until white fumes appear; about 2 c.c. of concentrated nitric acid are then added, drop by drop, and the liquid again boiled until white fumes are evolved, this procedure being repeated four times and the final boiling continued for 10 minutes longer. The cold liquid is now boiled with about 25 c.c. of water until

the brown fumes are expelled. While still hot, the solution is transferred to a 400 c.c. beaker, and the flask is washed with small quantities of hot water until the liquid in the beaker measures about 100 c.c. The phosphoric acid is then estimated by the official gravimetric method.

The total volume of solution in the extraction mixture is found by adding together 200 c.c., the volume of water contained in 50 grms. of whole egg or 25 grms. of yolk, and in 8 grms. of picric acid. Water is estimated in eggs in a vacuum at 55° C., and in picric acid in a vacuum over sulphuric acid. The percentage of water is, for whole eggs, between 75.4 and 63.19; for one-day old eggs, 73.57 on the average; for eggs kept for 11 months in cold store, 71.45 on the average; for yolk, between 47.16 and 54.55; for yolks from one-day old eggs, 47.56, and for yolks from eggs kept in cold storage for 11 months, 53.74, both on the average. The number of mgrms. of acid-soluble phosphorus pentoxide per 100 grms. of dry material is: (1) for one-day old eggs, from 76.9 to 95.5, the average being 83.4; (2) for market fresh eggs, from 72.0 to 93.6, the average being 83.3; (3) for eggs kept till the yolks stick to the shells, but are detachable by a rapid twist, the values are from 89.6 to 102.5, and 94.2; (4) for eggs kept in cold storage for 11 months, from 92.1 to 112.9, and 100.5; (5) for eggs kept until the yolks stick to the shells, but are detachable by several quick twists, from 88.2 to 114.8, and 101.2; for eggs with yolks non-detachable from the shells by twisting, from 97.8 to 127.5, and 108.0; for eggs showing "white rots," from 123.6 to 295.2, and 224.6, and for those showing "black rots," from 468.6 to 721.9, and 624.5. For the yolks of eggs of these classes, the values are: (1) From 93.9 to 111.9, and 100.5; (2) from 89.7 to 118.3, and 105.8; (3) from 97.2 to 122.6, and 110.6; (4) from 117.7 to 141.2, and 127.2; (5) from 106.6 to 120.4, and 114.1.

T. H. P.

Rate of Disappearance of Sulphites in Raw Meat. F. H. Campbell. (*J. Soc. Chem. Ind.*, 1924, 43, 297-298T.)—Sulphite was estimated in meat to which it had been added, and which was kept in hermetically sealed bottles, some at room temperature and others in a refrigerator, and the loss determined after varying periods of time. The greatest loss occurred during the first 7 days, but provided the temperature does not exceed 50° F. the loss is not sufficient to form a serious source of disagreement between analysts working on portions of the same sealed sample kept for varying periods up to 6 weeks, or even longer if the temperature is sufficiently low, but specific directions for the conditions of storing of such samples are needed.

D. G. H.

The Bleaching of Pickled Herrings with Hydrogen Peroxide. O. Luning. (*Zeitsch. Unters. Nahr. Genussm.*, 1924, 48, 120-122.)—The peculiar bright colour of the flesh in many samples of pickled herrings is due to the presence of hydrogen peroxide in the pickling fluid. One such fluid, sold under the name of "Blankalit," was found to contain 30 per cent. of hydrogen peroxide. Experiment has shown that it is often not possible subsequently to detect this preservative in the pickle after a time owing to the decomposition of the peroxide. Stale herrings, which are often used for pickling, have a peculiar oily flavour, probably

due to atmospheric oxidation, and this is not removed by hydrogen peroxide. It is suggested that fat-soluble vitamin *A*, in which herrings are particularly rich, may be wholly or partly destroyed by the oxidising action of the peroxide.

H. E. C.

The Hydrocyanic Acid Fumigation of Ships and its effect on Food Material. P. Buttenberg and H. Weiss. (*Zeitsch. Unters. Nahr. Genussm.*, 1924, 48, 104-119.)—The various methods of production of hydrogen cyanide for fumigating ships are described and discussed. The volume percentage used varies from 0.2 to 1.0, and the time of application is about 4 hours, followed by 12 to 18 hours' aeration. Great care is, of course, needed to avoid accidents. Experiments on cargoes of mixed foodstuffs, including cereals, fats, tea, coffee, chocolate, meat, tobacco and drugs, show that a minute quantity of hydrogen cyanide is actually retained by most substances, the amounts varying up to 2 mgrms. per 100 grms. for most commodities and up to 3 mgrms. in the case of raw coffee. It is concluded that there is no permanent deleterious effect on the foodstuffs, and that no perceptible odour or flavour is imparted thereto, except in the case of bulk tea, coffee and raw tobacco, and in the two latter the condition is readily restored by aeration. Only tea appears to be permanently, though slightly, injured, and on this point further investigation is needed.

A simple test for hydrocyanic acid vapour in air is made by suspending therein a filter paper impregnated with a mixed solution of benzidine and copper acetate. A blue colour is developed in the presence of prussic acid. H. E. C.

Composition of Soya Bean Oil. E. S. Wallis and G. H. Burrows. (*J. Amer. Chem. Soc.*, 1924, 46, 1949-1953.)—The insoluble fatty acids of soya bean oil were analysed by the melting point method described by Twitchell (*ANALYST*, 1914, 39, 448), and found to have the following composition:—Myristic acid, none; palmitic acid, 10 per cent.; stearic acid, 2 per cent.; arachidic acid, 1 per cent.; lignoceric, linolenic, linolic and oleic acids, 88 per cent.

W. P. S.

Marine Animal Oils. Identity of Phocœnic Acid with Valeric Acid. E. André. (*Bull. Soc. Chim.*, 1924, 35, 857-868.)—The acid prepared in 1817 by Chevreul from dolphin and porpoise oils and named phocœnic acid, is shown to consist, not of a mixture of butyric and caproic acids, as suggested by Lewkowsitch (*Chemical Technology and Analysis of Oils, Fats and Waxes*, 5th edition, 152) and by Fryer and Weston (*Technical Handbook of Oils, Fats and Waxes*, 1920, I., 37), but of isopropylacetic acid.

T. H. P.

Chemistry of Grape Pigments. Anthocyanins in Clinton Grapes. R. J. Anderson and F. P. Nabenhauer. (*J. Biol. Chem.*, 1924, 61, 97-107.)—The colouring matter occurring in Clinton grapes has been examined. Clinton is said to be the first cultivated variety of *Vitis riparia*, but it is believed that it also contains a derivative of *Vitis labrusca*. The pigment in Clinton grapes consists principally of a monoglucoside, anthocyanin, and is identical with the anthocyanins isolated from Norton and Concord grapes. The anthocyanin chloride, $C_{23}H_{25}O_{12}Cl$,

did not separate in definitely crystalline form, but the picrate, $C_{23}H_{24}O_{12} \cdot C_6H_2(NO_2)_3OH$, crystallised in beautiful bright red prisms or needles. The glucoside is easily hydrolysed by boiling with 20 per cent. hydrochloric acid, yielding 1 molecule each of glucose and anthocyanidin chloride, $C_{17}H_{15}O_7Cl$, the latter crystallising from the hot solution in well-formed prisms. The anthocyanidin chloride has the same percentage composition as oenidin chloride, but it differs from this substance in that it contains a lower percentage of methoxyl. It consists largely of a monomethyl ether of delphinidin, but the values for methoxyl were too high, indicating that it contained some of the dimethyl ether of that substance. It differs in its colour reaction with ferric chloride from the anthocyanidin from Norton and Concord grapes, probably owing to a difference in position of the methoxyl groups in the gallic acid part of the molecule. Results indicate that the methyl groups are attached to the gallic acid part of the molecule and not to the phloroglucinol. The absorption spectra of anthocyanin chloride and anthocyanidin chloride consist of one broad band extending from the yellow into the blue (*cf.* ANALYST, 1924, 39).

P. H. P.

Lead Number of Vanilla Extracts. C. A. Clemens. (*J. Assoc. Off. Agric. Chemists*, 1924, 8, 79–82.)—Comparison is made of the estimation of lead as sulphate and as chromate in the determination of the lead numbers of 36 samples of vanilla extract by the official Winton method and by the Wichmann modification (ANALYST, 1921, 46, 333). With the former method, the values obtained ranged from 0.28 to 0.71 or from 0.27 to 0.73, according to whether the sulphate or chromate method was used; after elimination of the only two values below 0.40, which resulted from incomplete extraction of the beans, the mean values became 0.53 and 0.55 respectively. The Wichmann lead numbers ranged from 0.46 to 0.98, or from 0.47 to 1.06 for the sulphate and chromate methods, respectively, the average values being 0.78 and 0.83; the excellent coagulation of the colloidal lead precipitate effected by this method is due to the combined effects of the temperature, dilution and alcohol employed. When the lead is estimated as chromate, the procedure is as follows: Ten c.c. of the filtrate (*loc. cit.*) are heated in a 400 c.c. beaker with 2 c.c. of glacial acetic acid, 25 c.c. of water, and 25 c.c. of approximately 0.1 N potassium dichromate solution until the precipitate becomes orange-red; the heating should commence immediately the dichromate has been added, and a stirring rod should not be put into the liquid while this is boiling. The precipitate is transferred to a weighed Gooch crucible by means of hot water, and washed thoroughly, first with hot water and then with a little alcohol and a little ether; after being dried in a vacuum oven at 100° C. for 30 minutes, the lead chromate is weighed; multiplication of the weight by 12.82 gives the lead number. If this procedure is coupled with the Wichmann method, the lead number may be determined in 1½ hours, at most.

T. H. P.

Detection of Extract of *Atractylis gummifera* in Liquorice Extract. U. Giuffrè. (*Giorn. Chim. Ind. Appl.*, 1924, 6, 375–377.)—If 100 grms. of the suspected liquorice extract are treated by the author's method (ANALYST, 1923,

48, 30), the presence of 1 per cent. of the extract of *Atractylis gummifera* is sufficient to show clearly the colour reaction of the atractyligenin. Bertolo's method (*Giorn. Chim. Ind. Appl.*, 1923, 5, 391), based on extraction of the potassium atractylate by means of absolute alcohol and subsequent precipitation of the sulphonic sulphur as barium sulphate, involves more manipulation than the above method and is less sensitive and less certain.

T. H. P.

Certain Reactions of Carrageen (*Chondrus crispus*). E. Justin-Mueller. (*J. Pharm. Chim.*, 1924, 30, 154-161.)—Ten grms. of the seaweed were boiled for 2 hours with 1000 c.c. of water, and the solution brought to its original volume, strained through linen and left to cool. The clear supernatant liquid was gummy, limpid and neutral, and gelatinised on removal of 15 to 20 c.c. of water per litre. This liquid was used cold with the various reagents and colouring matters, a sample of untreated liquid being taken for comparison. With methyl violet, magenta, malachite green, picric acid, no change occurs, whilst a marked flocculation takes place with methylene blue and safranin, even although these, together with all the colouring matters tried (except picric acid) were of basic nature. The flocculating action of a decoction of this seaweed thus serves as a differentiating reagent for organic compounds.

D. G. H.

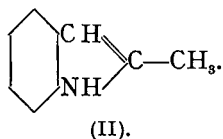
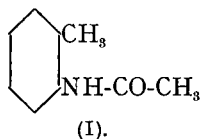
Biochemical, Bacteriological, etc.

Catalytic Action of Copper in the Destruction of Anti-scorbutic Vitamin.

A. F. Hess and M. Weinstock (*J. Amer. Med. Assoc.*, 1924, 82, 952-956; *Chem. Abstr.*, 1924, 18, 1690-1691.)—Experiments with guinea pigs showed that the anti-scorbutic vitamin is readily destroyed by oxidation, especially when the oxidation process takes place in association with heat. This sensitiveness leads to a partial loss of this factor in the pasteurisation of milk. The gradual decrease of vitamin in the ageing of foods, such as vegetables, is to be interpreted in this way. Catalysis greatly increases the velocity of oxidation and furthers the destruction of this vitamin. It was found that when as little as 2.5 mgrms. of copper per litre were added to milk, the anti-scorbutic vitamin was appreciably diminished in the course of heating. Although copper does not dissolve to this extent in properly supervised pasteurisation, such contamination readily occurs when proper care is not taken of the plant. The risk is still greater in the process of condensing milk. A similar danger exists with regard to the contamination of butter and cream, as vitamin A, is highly sensitive to the destructive action of oxidation. At present, contaminations of foods with copper or other metals are judged by the standards of toxicology. This criterion is inadequate, for even non-toxic traces of these substances are sufficient to bring about the catalytic destruction of vitamins.

Sodamide as a Dehydrating Agent. Preparation of Indol, Methyl-Indol and its Homologues. M. A. Verley. (*Bull. Soc. Chim.*, 1924, 35, 1039-1040.)—To remove one molecule of water from acetyl-ortho-toluidine, (I) and

obtain methyl-indol (II) appears simple but all the usual dehydrating agents give entirely negative results. Sodamide, however, in sufficient excess, gives the desired



result. One part of acetyl-*o*-toluidine and $2\frac{1}{2}$ parts of roughly ground sodamide are placed in a metal apparatus and gently warmed, when the mixture begins to melt with a rather violent evolution of ammonia. The temperature of the semi-liquid mass is then raised to 250° C. and heating is continued until the evolution ceases. After being left to cool the product is taken up with water and steam-distilled. An oil collects which forms two portions, one of regenerated *o*-toluidine and the other of methyl-indol, which crystallises immediately. After recrystallisation from petroleum spirit it melts at 59° C. The *o*-toluidine is formed by saponification. The higher homologues of methyl-indol are formed similarly. Indol can be obtained in this way from formyl-*o*-toluidine, but certain precautions are necessary, since the reaction takes place with explosive violence.

P. H. P.

Preparation of Yeast Nucleic Acid as a Magnesium Compound. E. J. Baumann. (*J. Biol. Chem.*, 1924, **61**, 1-4.)—Other methods for the preparation of large quantities of yeast nucleic acid are either laborious or yield products contaminated with protein. Steudel and Peiser (*Z. physiol. Chem.*, 1922, **120**, 292) showed that 3 per cent. sodium hydroxide splits off guanylic acid from yeast nucleic acid at room temperature. The author gives details of a simple, inexpensive method of preparation for which only a very mild and brief treatment of the yeast with weak alkali is used. The crude product contains no protein. The process depends upon: (1) The concept that nucleic acid exists in yeast as a nucleoprotein, and that nucleoprotein is a type of acid protein which is easily separated into its components, nucleic acid and protein, by alkali, forming the alkali salt of the nucleic acid and meta-protein; (2) the solubility of sodium nucleate in dilute acetic acid; (3) the precipitation of nucleic acid as a magnesium salt by magnesium sulphate and hydrochloric acid. The ratio of phosphorus to magnesium indicates that the acid is precipitated as a mixture of the mono- and di-magnesium salts. Attempts at purification have not yielded very satisfactory analytical results. A table is given of analyses of different air-dried unpurified preparations.

P. H. P.

Estimation of Phenols in Blood. R. C. Theis and S. R. Benedict. (*J. Biol. Chem.*, 1924, **61**, 67-71.)—A method is described by which phenols can be estimated directly on the Folin-Wu filtrate. Diazotised *p*-nitraniline base as described by Moir in his phenol test (*J. South African Inst.*, 1922, **5**, 8) is the reagent used as it is more specific for phenols than is the phosphotungstic-molybdic reagent. It is prepared as follows: *p*-Nitraniline base (1.5 grms.) is dissolved in

500 c.c. of water with 40 c.c. of concentrated hydrochloric acid. Twenty-five c.c. of this solution are diazotised by 0.75 c.c. of 10 per cent. sodium nitrite solution. The diazotised solution only keeps for 1 day. This reagent is sufficiently delicate for phenol estimations in blood filtrates, yielding an orange to red coloration with phenols. It is necessary to dilute the blood only 1 to 5, instead of 1 to 10, as in the regular Folin-Wu procedure. The addition of a colloid (gum arabic) prevents turbidity of the reagent with blood filtrates. The reaction takes place in solutions of very weak acidity. Uric acid reacts so feebly with the nitraniline reagent that its removal is unnecessary. Details of the method and tables of results are given. Figures for free phenols in the blood were obtained ranging from 1 to 2 mgrms. per 100 c.c. Conjugated phenols probably occur in small quantity in some bloods, but are not demonstrable in all bloods. Pelkan's criticism of this is discussed. The figures obtained by this method on 20 bloods average 0.4 mgrm. per 100 c.c. lower than the figures of the Rakestraw method on the same bloods. The application of the nitraniline method to urine is being studied. P. H. P.

Method for Cholesterol Estimation in Blood. S. L. Leiboff. (*J. Biol. Chem.*, 1924, **61**, 177-180.)—A new rapid and accurate method is described for estimating cholesterol in blood. A filter paper disc is dropped into an extraction tube so that it lies above the constricted portion of the tube, which contains about 5 c.c. of chloroform. Diagrams of the disc and tube are given. By means of a pipette 0.25 c.c. of oxalated blood are placed on the disc and absorbed, then the tube is attached to a reflux condenser and immersed in hot water and extracted for 30 minutes. The tube is next detached from the condenser and, after the removal of the disc, is cooled by immersion in cold water. Chloroform is added exactly to the 5 c.c. mark. In a similar extraction tube are placed 5 c.c. of a standard solution containing 0.4 mgrm. of cholesterol per 5 c.c., made by dissolving 40 mgrms. of pure dry cholesterol in 500 c.c. of pure dry chloroform. To each tube are added 2 c.c. of pure anhydrous acetic anhydride and 0.1 c.c. of concentrated sulphuric acid. The tubes are inverted twice to mix the contents and then, stoppered, are placed in cold water for half a minute. After being left in a dark place for 10 minutes the readings are taken in a colorimeter. $S/R \times 160 = \text{mgrm. per 100 c.c. of blood}$ where S = reading of standard, and R = reading of unknown. Experiments described and tables given show that the extraction is complete in 30 minutes. Results showed slightly higher figures than by the method of Myers and Wardell (*J. Biol. Chem.*, 1918, **36**, 147), where losses are incurred by the transfer of material. P. H. P.

Modification of Molybdic Method for the Estimation of inorganic Phosphorus in Serum. S. R. Benedict and R. C. Theis. (*J. Biol. Chem.*, 1924, **61**, 63-66.)—A modification of the molybdic method for the estimation of inorganic phosphorus in serum has been devised in an attempt to avoid turbid solutions, and to obtain a more intense and stable colour. The colour produced is about three times as intense as that obtained by the method of Briggs (*J. Biol. Chem.*, 1922, **53**, 13), and the colour of a standard solution has remained unchanged.

for several days. If the blood available is limited, less than stated may be used. In 12 cases where phosphates were added to serum an average of 103 per cent. was recovered. A table shows that the results obtained by this method compare favourably with those by Briggs' method. The method is not applicable to whole blood or to the serum or plasma from badly haemolysed blood, since the heating and strong acid will cause hydrolysis of the organic phosphorus compounds contained in the corpuscles. Estimations in blood serum are carried out as follows:— To 2 c.c. of serum, diluted with a little water in a volumetric flask, 4 c.c. of 20 per cent. trichloroacetic acid are added, and the whole is diluted to 10 c.c., left for 10 minutes and filtered through ashless filter paper. Five c.c. of the filtrate are placed in a tube and 3 c.c. of water added, then 1 c.c. of diluted molybdic acid reagent (to 20 grms. of pure molybdic acid (MoO_3) in a flask add 25 c.c. of 20 per cent. sodium hydroxide solution and warm gently to dissolve the acid, cool and dilute to 250 c.c., filter if necessary and dilute a small quantity of this reagent 1:1 with concentrated sulphuric acid as needed), and 1 c.c. of a solution containing 15 grms. of sodium bisulphite and 0.5 gm. of hydroquinone in 100 c.c. This is mixed, loosely stoppered, and placed in a boiling water bath with a simultaneously prepared standard solution of potassium biphosphate containing 0.025 mgrm. of phosphorus in 5 c.c. which has been treated similarly to the blood filtrate. The standard is prepared from a stock solution (containing 0.4394 gm. of dry potassium biphosphate in 1 litre of water and preserved with chloroform) by diluting 5 c.c. of stock solution to 100 c.c. with water and preserving with chloroform. By this standard a satisfactory degree of accuracy for phosphorus contents between 0.05 and 0.0125 mgrm. is shown. It is noted that no acid-soluble organic phosphorus is found in serum after hydrolysis with concentrated sulphuric acid.

P. H. P.

Toxicological, Forensic, etc.

Case of Poisoning by Fluosilicic Acid. Lührig. (*Chem. Zeit.*, 1924, 48, 613–614.)—Attention is drawn to the highly toxic nature of fluosilicic acid, and a fresh case of fatal poisoning is described, in which, through an error in dispensing, a beetle powder containing this acid was given to a boy in mistake for powdered senna. *Post-mortem* examination showed the presence of the acid in the blood, stomach, intestines, kidneys, and liver; the acid was identified by igniting the tissues, after drying, with lime water, and then observing the etching of glass in the usual way, after adding sulphuric acid to the ash.

H. E. C.

Case of Acetanilide Poisoning. Estève. (*Bull. Soc. Pharm. Bordeaux*, 1923, No. 4; *Ann. Chim. anal.*, 1924, 6, 272–274.)—After taking 0.5 gm. of acetanilide a day for about a month the patient became comatose, with pale face, cold extremities and cyanosed lips. Acetanilide passes into the urine as para-aminophenol sulphate and in this case was present 8 days after the patient had stopped taking the drug. It was identified by evaporating to dryness the ethereal extract of the urine acidified with phosphoric acid, treating the residue with hydrochloric

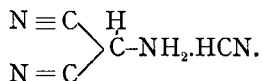
acid, boiling, and, after cooling, adding 1 c.c. of water saturated with phenol, and a few drops of a saturated solution of calcium hypochlorite, shaking after the addition of each drop. A red colour was produced, changing to blue with ammonia. The accumulation of the drug was probably due, in part, to some failure of the excretory organs. It was conclusively shown that cyanosis was not due to the presence of methaemoglobin and haematin in the blood, or the general poisoning to the presence of aniline as an impurity in the acetanilide.

D. G. H.

Fate of Morphine in the Organism. R. Fabre. (*J. Pharm. Chim.*, 1924, 30, 183-187.)—Morphine was found to be unaltered by blood or during the course of pancreatic and peptic digestion, but appeared to be changed in the liver. Twenty c.c. of a 1 per thousand morphine hydrochloride solution was injected into a rabbit's liver under physiological conditions, left for 5 minutes; replaced by a further 20 c.c., which was again left for 5 minutes; the operation repeated with the first 20 c.c., and so on. The proportion of morphine in the solution steadily diminished until at the 6th circulation it was found to be absent from the solution and also from the liver itself.

D. G. H.

Toxicity of a Polymer of Hydrocyanic Acid. C. Bedel. (*J. Pharm. Chim.*, 1924, 30, 189-193.)—A crystalline substance was isolated from azulmic acid representing 2 per cent. of its total weight, and agreeing with the formula



When this substance was administered to female guinea pigs by mouth the fatal dose was found to be as much as 0.75 gm. per kilo. of animal. *Post-mortem* analysis showed that free hydrocyanic acid was absent from the intestines, liver and heart, and only a very small quantity was detected in the stomach, whilst the kidneys gave a positive reaction. The symptoms of poisoning were similar to those recorded for hydrocyanic acid, but more delayed, and it is probable that slow depolymerisation occurs. Sodium hyposulphite appears to exercise no antidotal action on the polymer of cyanic acid.

D. G. H.

Water Analysis.

Estimation of Nitrate in Water by the Frerichs' Method. A. Massink. (*Chem. Weekblad*, 1924, 21, 421.)—Frerichs' method of estimating nitrates in water (*Arch. Pharm.*, 1903, 241, 47) has been found to be inaccurate, the results being too high when alkali carbonates are present. During the neutralisation of the water with sulphuric acid, alkali sulphates are formed and these, on evaporation of the solution to dryness with hydrochloric acid, form bisulphates according to the equation $\text{Na}_2\text{SO}_4 + \text{HCl} \rightarrow \text{NaHSO}_4 + \text{NaCl}$. Thus there would be an increase in the chlorine ions and also in the acidity, both factors contributing to an increase of the titre of the standard silver nitrate.

W. S. S.

Agricultural Analysis.

Toxicity of Cotton-Seed and its Gossypol Content. E. W. Schwartz and C. L. Alsberg. (*J. Agric. Res.*, 1924, 28, 173-189.)—A comparison of the toxicity of pure gossypol with that of Trice, Lone Star, Durango, and Egyptian cotton-seeds has been made. The samples contained 0.41, 0.52, 0.98, and 1.12 per cent. of gossypol respectively, and it is found that injection of the gossypol in arachis oil solution showed a toxicity corresponding with the gossypol content of the different varieties of kernels which shows that the poisonous quality of cotton-seed is due to the gossypol content. The variation in the amount of gossypol in cotton-seed from different producing regions explains the variation in the incidence of cotton-seed poisoning in cattle. Details are given of various adequate diets given to the rats and the physiological effects of the gossypol. The analyses of the cotton-seed kernels show the gossypol to be approximately proportional to the ether extract and inversely proportional to the nitrogen content. For the method of isolation see ANALYST, 1924, 47.

H. E. C.

Pharmacology of Gossypol. E. W. Schwartz and C. L. Alsberg. (*J. Agric. Res.*, 1924, 28, 191-197.)—Administration of gossypol over long periods to cats and rabbits in small doses produces chronic poisoning, the principal symptoms of which are paralysis, with nerve degeneration, shortness of breath, cardiac hypertrophy, oedema of the lungs and effusion into the serous cavities. Pure gossypol is capable of producing all the manifestations characteristic of the cotton-seed poisoning of farm animals, so that the conclusion is warranted that gossypol is the principal causative agent. The only other possible toxic substance in cotton seed kernels could be some decomposition product of gossypol.

H. E. C.

Significance of Urea in Shark Meal. D. B. Dill. (*J. Assoc. Off. Agric. Chemists*, 1924, 8, 70-75.)—A sample of shark meal sold with a guarantee of 70 per cent. of protein was found to contain 11.28 per cent. of total nitrogen and 1.93 per cent. of nitrogen in the form of urea. The discrimination between protein nitrogen and urea nitrogen is probably of no significance if the meal is to be used as fertiliser, but, as a food, urea nitrogen is of less value than protein nitrogen for ruminants, and probably of no value for other animals.

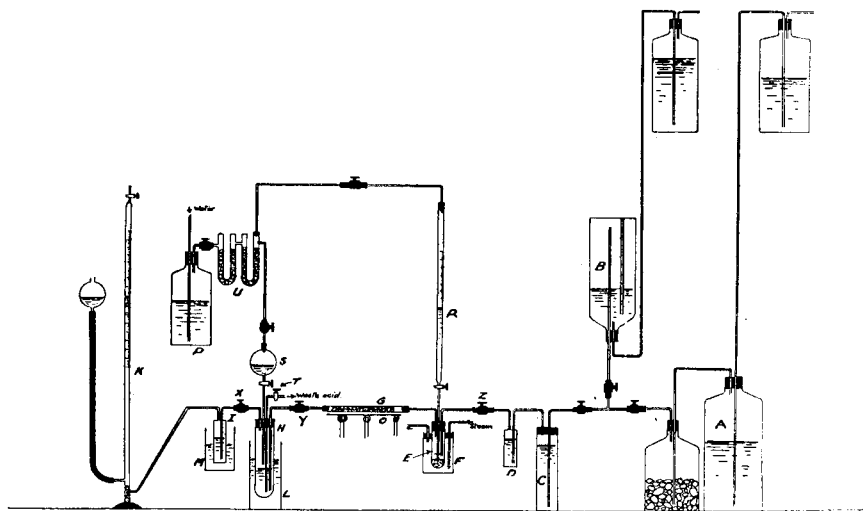
T. H. P.

Organic Analysis.

Bromimetric Estimation of Thiocyanate. A. Kurtenacker and H. Kubina. (*Zeitsch. anal. Chem.*, 1924, 64, 442-444.)—Titration with bromine water (König, *J. prakt. Chem.*, 1911, 84, 558), as well as with bromate—with and without addition of bromide—gave variable results. The estimation of thiocyanate by these methods is unreliable.

W. R. S.

Estimation of Water in Mixtures of Ether, Alcohol and Water. R. K. Newman. (*J. Soc. Chem. Ind.*, 1924, 43, 285T.)—The principle of the method described depends on the fact that the acetylene produced by the action of calcium carbide on such mixtures is not absorbed by 98 per cent. sulphuric acid to any appreciable extent, whereas both ether and alcohol are readily absorbed. The estimation is carried out in the apparatus shown in the diagram all air being



previously replaced by carbon dioxide. The mixture to be examined is run from the burette R into the boiling-tube E, the prolonged end of the burette dipping under mercury at the bottom of E and thus preventing the escape of ether vapour during the estimation. Tube E is heated gradually by introducing steam into the jacket F, and the vapours are led over the calcium carbide in the combustion-tube G, which can be warmed if necessary. The mixed gases are then made to bubble through two gas-washing bottles containing 98 per cent. sulphuric acid, which absorb all ether and alcohol. The unabsorbed acetylene and carbonic acid are then passed into the nitrometer K, which contains strong aqueous potassium hydroxide solution, and the volume of acetylene can then be read off. A correction has to be applied, since carbonic acid, either from cylinders or from marble and acid, gives a small amount of a gas not absorbed by potassium hydroxide. The apparatus is designed so as to allow of a steady pressure of carbonic acid being maintained, and also so that for successive estimations the spent sulphuric acid can be replaced without admitting air into the apparatus. In testing made-up mixtures of known composition it was found that ether dried over sodium for 6 months still contained small amounts of water (about 0.0120 gm. of water per 10 c.c. of ether). After allowing for this and plotting a curve for c.c. of acetylene evolved with definite amounts of added water, it is seen that when the water content is very low the test appears to lose sensitiveness, owing probably to the difficulty of bringing all the water vapour into contact with the calcium carbide.

R. F. I.

Fixed Oil of Orris. P. Langlais and J. Goby. (*Perfumery and Essential Oil Rec.*, 1924, 15, 311.)—During the preparation of some absolute oil of Florentine orris, the authors obtained a portion entirely soluble in sodium carbonate solution and composed of organic acids with a boiling-point below that of myristic acid and a melting point below 28° C. Distillation of these acids at 40 mm. pressure showed them to consist of a very complex mixture, the first fraction passing over at 130° C. and the last at 215° C., with no distinct steps between these points. The last of four fractional distillations was again distilled in six fractions at 40 mm. pressure. No. 1 (150°–151° C.) consisted of a small quantity of liquid; No. 2 (162°–163° C.), small quantity of liquid; No. 3 (174°–175° C.), important quantity of solid; No. 4 (185°–186° C.), small quantity of liquid; No. 5 (198°–200° C.), important quantity of solid; and No. 6 (210°–212° C.), small quantity of solid. This method of separation revealed the presence of the six saturated aliphatic acids: caprylic, pelargonic, capric, undecylic, lauric, and tridecylic, and also of benzoic acid. These were all identified by such methods as the preparation of the silver salts, with subsequent determination of the combining weight and m.pt. of the purified fatty acids and also the m.pt. of their anilides. The authors point out that the acids with 9, 11, and 13 carbon atoms, respectively, have not before been found in nature, and have up to now only been prepared synthetically. R. F. I.

Characteristics of Japanese Tung Oil. I. Miura. (*J. Chem. Ind. (Japan)*, 1923, 26, 316–321; *Chem. Abstr.*, 1924, 18, 1398.)—There are four species of tung oil trees in Japan, viz. (a) Japanese tung oil tree, *Aleurites cordata*, (b) Chinese tung oil tree, *A. Fordii*, (c) Kangtong tung oil tree, *A. montana*, and (d) Bakoly (or tropical) tung oil tree, *A. moluccana*. Of these, (a) is grown all over the interior of the country, and the others in Formosa. The following results were obtained:

	a.	b.	c.	d.
Oil contents, in seeds, per cent. . .	37.8	44.1	37.4	23.6
„ in endosperm, per cent. . .	59.1	66.3	59.8	70.7
Time for drying at 95° C., minutes . . .	65	55	60	270
Specific gravity at 15° C.	0.9340	0.9488	0.9372	0.9267
Acid value	0.47	1.52	0.59	0.80
Saponification value	194.8	196.7	194.3	195.1
Iodine value (Wijs)	151.4	157.2	154.8	146.3
Refractive index, n_D^{25}	1.5065	1.5210	1.5147	1.4785
Reichert-Meissl value	0.39	1.10	0.35	0.71
Unsaponifiable matter, per cent.	0.41	0.59	0.99	0.97

Lignoceric Acid. P. A. Levene, F. A. Taylor and H. L. Haller. (*J. Biol. Chem.*, 1924, 61, 157–161.)—Lignoceric acid is a constituent of cerebrosides and of sphingomyelin. Samples of it freshly prepared from two different sources, viz. from arachis oil and from cerebrosides isolated from the brains of cattle, had exactly the same melting point of 80.5–81° C. and a mixture of the two substances also melted at the same temperature. Thus there is no reason to revise the older

conclusions that lignoceric acid is not identical with the normal tetracosanic acid, although Brigl and Fuchs (*Z. physiol. Chem.*, 1922, **119**, 280) stated it to be a mixture of normal tetracosanic acid melting at 85° C. and a second tetracosanic acid melting at 75° C. Possibly beechwood tar is not a satisfactory material for the preparation of unaltered lignoceric acid. The acid from arachis oil was crystallised three times from pyridine, melted over dilute hydrochloric acid on a water bath and crystallised from acetone. It then melted at 78.5–79.5° C. Four crystallisations of this product from ether gave the pure acid melting at 80–81° C. The pure acid was then fractionated and re-crystallised several times from ether, benzene, ethyl alcohol, toluene and pyridine without any change in the melting or solidification point. The acid from the cerebroside, "cerasin," after many recrystallisations from pyridine and other solvents, gave a m.pt. of 81° C, and then did not change. Finally samples of each acid were converted into the ethyl esters and saponified back again. After recrystallisations the melting points were again 81° C. and did not change.

P. H. P.

Separation of Unsaturated from Saturated Sterols. R. J. Anderson and F. P. Nabenhauer. (*J. Amer. Chem. Soc.*, 1924, **46**, 1957–1960.)—The mixed sterols contained in the endosperm of wheat and maize may be separated from each other by dissolving the mixture in carbon tetrachloride and treating the solution with acetic anhydride and sulphuric acid; the unsaturated sitosterol combines with the sulphuric acid forming a stable soluble compound having a bluish or purple-green colour. The organic solvent is separated from the acid layer, washed with a small quantity of water, and evaporated. The residue is saponified and crystallised from alcohol in order to obtain the saturated dihydrositosterol.

W. P. S.

Quantitative Estimation of Lignin in Wood Pulp. H. Wenzl. (*Papier fabr.*, 1924, **22**, 101–106; *Chem. Abstr.*, 1924, **18**, 1749.)—A new method is described based on the use of a mixture of phosphoric anhydride and hydrochloric acid as reagent. Thirty grms. of phosphoric anhydride are added to 100 c.c. of concentrated hydrochloric acid (sp. gr. 1.19) contained in a beaker immersed in cold water. Twenty-five c.c. of this reagent are added to 1 gm. of the air-dry pulp (without previous extraction), and the mixture stirred, put into a stoppered bottle, which is then kept for 30 minutes in a water bath at 30° C. As a rule, after this time, the cellulose is completely hydrolysed. The reaction mixture is diluted with hydrochloric acid (sp. gr. 1.19), which has previously been heated at 30° C. for an hour, and filtered on to a Gooch crucible containing an asbestos mat, which has been moistened with acid. The residue is washed, first with hydrochloric acid, and then with hot water until free from acid, and dried at 110°–115° C. It may then be calcined in the same crucible. The results (obtained in 4 to 5 hours) agree closely with those given by the Krull modification of the hydrochloric acid method.

Inorganic Analysis.

2-4-Dinitrosoresorcinol as a Sensitive Reagent for Ferrous Salts.

M. Goldstück. (*Chem. Zeit.*, 1924, 108, 629.)—A solution of 2-4-dinitrosoresorcinol in boiling water is prepared, of a concentration sufficient to give a brown colour. A few drops of this are added to the solution to be tested, which may be slightly acid or slightly alkaline. The formation of a greenish-blue precipitate indicates the presence of ferrous salts. If only traces of these are present a green colour is produced. The presence of free mineral acid or strong alkali interferes with the test, although the precipitate once formed is insoluble in these. Tartaric and acetic acids may be present, but not oxidising agents such as nitric acid or hydrogen peroxide. Copper salts must be absent. The delicacy of the reaction is such that the presence of 0.00002 gm. of ferrous iron in 10 c.c. can be detected, thus showing this reagent to be more delicate than potassium ferricyanide.

R. F. I.

Ferric Oxalate. Application to the Separation of Iron and Calcium.

J. Barlot. (*Bull. Soc. Chim.*, 1924, 35, 1026-1030.)—The difficulty of obtaining precipitated ferric hydroxide free from entangled calcium carbonate may be avoided if the calcium alone is first precipitated, the iron and aluminium being left in solution. Aluminium oxalate is soluble in acetic acid, and the double ferric calcium oxalate is decomposed by acetic acid in presence of ammonium oxalate, with formation of a soluble double oxalate of iron and ammonium, the precipitate then containing only the whole of the calcium as oxalate.

The hydrochloric acid containing the aluminium, iron, calcium, and magnesium, is boiled with a little nitric acid to oxidise the iron, neutralised as exactly as possible with ammonia, and treated with a few drops of ammonium chloride solution and with ammonium oxalate. Acetic acid is then added in such quantity that the yellowish-brown precipitate becomes perfectly white and is composed solely of calcium oxalate; the calcium is estimated in the usual way. Addition of ammonia solution to the liquid at 80-90° C. now precipitates the iron and aluminium hydroxides in a pulverulent, non-gelatinous form. The magnesium is precipitated in the usual way.

T. H. P.

Gravimetric Estimation of Copper. E. Wilke-Dörfurt and U. Rhein.

(*Zeitsch. anal. Chem.*, 1924, 64, 380-388.)—Precipitated cuprous sulphide may be weighed as such (Rose's method) or roasted to oxide. The latter procedure is more convenient for technical purposes, but it generally gives a slightly high result. This is not necessarily due to an admixture of sulphate, but to carbon derived from the charred filter paper, which becomes firmly coated with copper oxide. The positive error disappeared when the cuprous sulphide was collected on a porous porcelain crucible (*ANALYST*, 1924, 454) and ignited to oxide. The use of the porous crucible also simplifies and shortens the estimation. W. R. S.

Separation of Copper from the Platinum Metals. W. H. Swanger and E. Wichers. (*J. Amer. Chem. Soc.*, 1924, 46, 1814–1818.)—Copper may be separated quantitatively from platinum, palladium, iridium, and rhodium by means of ammonium thiocyanate if the solution contains sulphur dioxide in quantity sufficient to prevent the platinum metals from forming thiocyanates, and if the solution is sufficiently acid to prevent precipitation of the rhodium double sulphite. The procedure recommended is as follows:—The solution, which should measure about 200 c.c., may contain several grms. of the platinum metals, but not more than 0.1 gm. of copper; it is treated with successive 20 c.c. portions of saturated sulphur dioxide solution until, after being digested for thirty minutes on a water-bath, the mixture still smells strongly of sulphur dioxide and has a yellow colour. After cooling, the mixture is nearly neutralised with sodium hydroxide solution, and 10 drops of concentrated hydrochloric acid are added. Ammonium thiocyanate solution (2 grms. of the salt dissolved in saturated sulphur dioxide solution) is then added, drop by drop, 10 cc. being required for each 0.05 gm. of copper present. After eighteen hours the precipitate is collected on a filter, washed with dilute sodium chloride solution, and the filter and precipitate are digested on a water-bath with dilute nitric acid, the filter-paper pulp is separated by filtration, and the copper in the filtrate is re-precipitated as described above. The paper pulp retains the platinum metals which contaminated the first copper precipitate; these metals may be recovered by digesting the pulp with *aqua regia* and adding the solution to the main filtrate. The filtrate from the second copper precipitate also contains a small amount of platinum metals. The final precipitate of cuprous thiocyanate is collected on a filter, washed with very dilute ammonium chloride solution, ignited, reduced in an atmosphere of hydrogen, and the resulting metallic copper is weighed. W. P. S.

Separation of Rhodium from Platinum. E. Wichers. (*J. Amer. Chem. Soc.*, 1924, 46, 1818–1833.)—The following method is recommended for the separation of rhodium from platinum in hydrochloric acid solution from which other heavy metals have been removed and which does not contain ammonium salts, alkali sulphates or acetates. The solution is treated with sodium hydroxide solution until yellow rhodium hydroxide begins to precipitate, and the volume of the solution is then adjusted so that more than 1 gm. of the metals is present per 100 c.c. Ten c.c. of a mixture of equal volumes of 9.0 per cent. barium chloride solution and 3.6 per cent. sodium carbonate solution are then added, the solution is boiled for two minutes and filtered, and the precipitate washed with hot 2 per cent. sodium chloride solution and re-dissolved in dilute hydrochloric acid. If carbon dioxide is not evolved on the addition of the acid, too little barium carbonate suspension has been used, and the platinum solution should be given a further treatment. The hydrochloric acid solution is filtered, diluted to 200 c.c., treated with sodium hydroxide and barium carbonate as before, boiled for three minutes, and filtered. If more than 1 per cent. of rhodium is present, a third separation may be necessary. The final hydrochloric acid solution, containing 25 c.c. of

dilute hydrochloric acid (1:4) is diluted to 150 c.c., heated to 100° C., and treated for thirty minutes at this temperature with hydrogen sulphide. The precipitated rhodium sulphide is collected on a filter, washed with dilute ammonium chloride solution, ignited in a porcelain crucible, reduced in a current of hydrogen, and the reduced metal cooled in an atmosphere of hydrogen and weighed. W. P. S.

The Hydrostrychnine Reagent for the Estimation of Nitrite and Nitrate. I. M. Kolthoff. (*Chem. Weekblad*, 1924, 21, 423.)—The hydrostrychnine reagent is prepared as follows: Five c.c. of a 1 per cent. aqueous solution of strychnine is mixed with 5 c.c. of hydrochloric acid (sp. gr. 1.19), and from 4 to 5 grms. of granulated zinc are added. The mixture is placed in a boiling water-bath for 5 to 10 minutes, cooled, and, after one hour's standing, the clear supernatant liquid is decanted. To prevent the reagent becoming coloured through oxidation by the air, it is advisable to leave it in a loosely stoppered bottle in the presence of a small quantity of zinc amalgam. The best method of using the reagent is that given by Denigès (*cf. ANALYST*, 1911, 36, 432).

The reagent may be used for the quantitative estimation of nitrate, but it must be borne in mind that the reaction is not specific for nitrates, as it is also given by nitrites and oxidising agents. Traces of iron also give a coloration, and it is necessary to remove the iron as hydroxide. When nitrite is present in the water being examined for nitrate, the tint obtained must be compared with that given by a standard nitrate solution containing the same quantity of nitrite as the water under examination. W. S. S.

Physical Methods, Apparatus, etc.

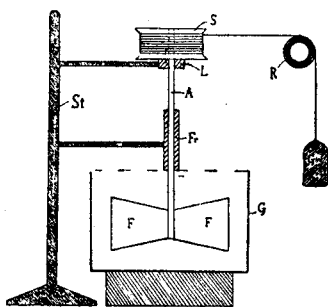
Use of Paper Pulp in Analytical Filtrations. E. Wilke-Dörfurt and E. Locher. (*Zeitsch. anal. Chem.*, 1924, 64, 436-441.)—Dittrich's method of filtering ferric and aluminium hydroxides by mixing them with filter pulp occasionally leads to low results, the cause of which was investigated. Iron (aluminium) complexes, not precipitated by ammonia, are formed when a solution containing filter pulp and sulphuric as well as nitric acid is evaporated. If the evaporation is prolonged on the water-bath until the nitric acid is expelled, the presence of as little as 0.1 c.c. of sulphuric acid causes slightly low results. The ferric complex is completely precipitated by ammonium sulphide; the aluminium complex is far more stable, not precipitated by ammonium sulphide, and destroyed only by evaporating with a large excess of strong nitric acid until fumes appear. W. R. S.

Determination of the Rate of Solidification of Paraffin Wax. K. Fricke. (*Chem. Zeit.*, 1924, 48, 624-625.)—A more definite indication of the value of paraffin wax for candle-making is obtained by measuring the rate of solidification than by determining the m.pt. A simple apparatus is designed for its measurement: 100 grms. of the wax are heated in a shallow tray to 65° C., then placed under a frame which holds vertically a rectangular iron rod which has a flat end and carries

on the top a 2 kilo. weight. The rod is so arranged that it slides freely up and down. The time is noted from the attainment of 65° C. until, on applying the rod to the setting wax, it no longer makes any visible impression thereon. The temperature of the surrounding air should be from 20° to 22° C. Under these circumstances the best qualities of high m.pt. paraffin ($54^{\circ}/56^{\circ}$ C.) should show a setting time of 50 to 60 minutes, and a medium quality from 60 to 70 minutes, whilst a common candle paraffin of m.pt. $50/52^{\circ}$ C. takes 70 to 80 minutes.

H. E. C.

Measurement of the Viscosity of Heterogeneous Systems such as Paints. H. Wolff. (*Chem. Zeit.*, 1924, 48, 647.)—In order to overcome the difficulties due to settlement in heterogeneous solutions, such as diluted paints or varnishes, the apparatus shown in the figure has been devised. The time in seconds is measured during which the weight Gw falls through a space corresponding

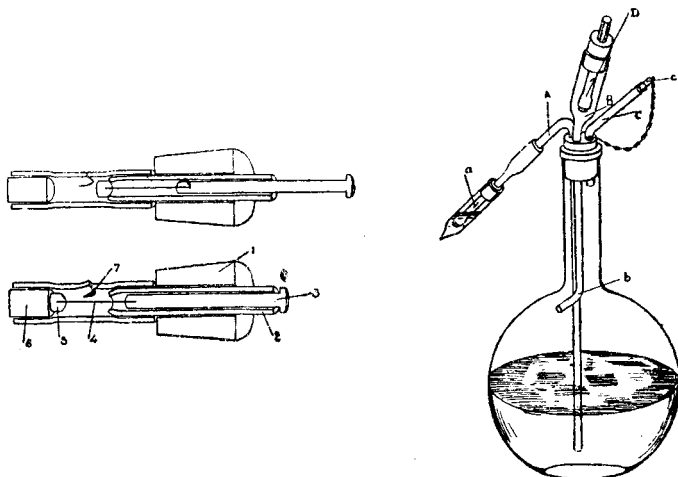


to the distance between two marks on the spindle S ; in falling the weight rotates the vane stirrer F , which is immersed in the paint in the pot G . The results obtained are quite empirical, but the measurements of viscosity in different dilutions in various solvents gives valuable information. An example is given showing that the viscosity of a paint when diluted with turpentine decreases as a simple linear function, but when the solvent is benzene or petroleum spirit there is a more rapid non-linear fall in viscosity.

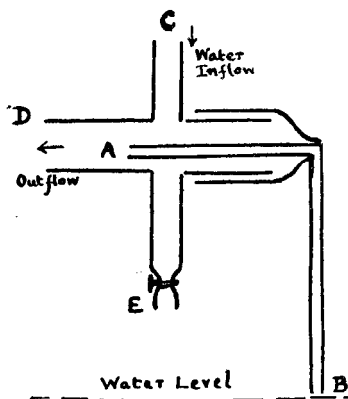
H. E. C.

Micro-analytical Technique. H. Häusler. (*Zeitsch. anal. Chem.*, 1924, 64, 361–379.) A. Benedetti-Pichler (*ibid.*, 409–436).—The analytical method described makes use of a reaction vessel (small porcelain crucible, or beaker made from a test tube) and a filtering-tube, containing a minute plug of asbestos, through which the liquid is separated from the precipitate by suction while the vessel is at rest. The first paper gives directions for the manipulations and for the estimation of chlorine, nickel, mercury, nitric acid, calcium, barium, iron, copper, magnesium, and potassium. The tabulated results are very accurate. The method may also be used macro-analytically. The second paper contains diagrams of filtration apparatus, filtering tubes, beakers, etc., and directions for their manipulation. A detailed description is then given of the following separations: Silver from copper, calcium from magnesium, and potassium from sodium. W. R. S.

New Continuous-flow Wash-bottle. A. G. Nasini. (*Giorn. Chim. Ind. Appl.*, 1924, 6, 377.)—The part *a*, consisting of a glass tube, is joined to *A* by means of rubber tubing, and the Bunsen valve, which should be capable of acting in the air, prevents the tube *A* from becoming evacuated as a result of the external pressure. In the tube *B* is inserted, by means of a stopper, the part *D*, which is shown in detail separately; here the Bunsen valve has a wedge-shaped slit. When pressure is exerted on the glass tube 3, which is joined by a nickel wire to the ball



5, the pressure is transmitted to the glass plug 6. In this way the edges of the Bunsen valve are forced apart, the outside pressure being re-established in the flask; hence, the flow of liquid may be interrupted without removal of the bands from the jet or from the object being washed, as 3 may be pressed by the chin. If an increased flow of water is desired, the plug *c* is removed from *C* and the bottle inverted, air being drawn in through the valve *D* and the inclined tube *b*. The latter must not be immersed and if, in addition, the Bunsen valve is made of moderately thin rubber, the flow will be continuous. T. H. P.



Device for Maintaining a Constant Level in a Waterbath. R. Brooks. (*J. Chem. Soc.*, 1924, 125, 1546.)—The stream of water enters down *C* dividing between *D* and *E* (to the water bath) and together with the hydrostatic tension of the column of water from *D* to the sink draws air through *B* till water level is reached, and then water from the bath.

D. G. H.

Reviews.

A DICTIONARY OF APPLIED CHEMISTRY. By SIR EDWARD THORPE and Eminent Contributors. Volume V., Oxygen to Rye. Pp. 722. London: Longmans, Green & Co. 1924. Price 63s.

Sir Edward Thorpe is to be congratulated on his selection of contributors to this volume, whose names form an impressive list.

On examining the more important subjects treated, it is evident that each writer has an intimate knowledge of his subject at first hand, a feature which is by no means common to all publications dealing with the applications of chemistry.

The work under review is so well known to chemists that few comments are necessary. Each successive edition becomes more complete as regards subject matter than its predecessor, and the more modern advances in the branches dealt with in this volume are fully described. As in previous editions, an excellent account is given of the développements by Linde and Claude of the process for the manufacture of oxygen by the liquefaction of air, and the electrolytic processes in use at the present time are described in some detail. The relative costs of production by the "liquid air" and electrolytic processes are compared, and, in discussing the commercial applications of oxygen, the writer explains the advantage of the oxy-acetylene over the oxy-hydrogen flame in welding.

Under "Ozone" the various forms of ozonisers on the market are briefly described, and the efficiency, cost, and mode of application of ozone for the sterilisation of water supplies are discussed.

Full details are given in the section entitled "Electrical Precipitation" of the application of the Lodge-Cottrell process for recovery and utilisation of the waste products from flue gases.

Installations are described for the precipitation of acid mist from sulphuric acid concentrators, of precious metal dust from metallurgical works, and of dust from blast furnaces and cement kilns. This section will doubtless be of the greatest value to chemists and others engaged in the industries where the purification of waste gases can be advantageously applied.

A feature of the new editions the chapter on photosynthesis contributed by Professors Baly and Heilbron. In this chapter the writers discuss the fascinating problem of the course of the reactions occurring in the laboratories of the living plant cells, whereby the infinite varieties of complex carbohydrates, proteins, alkaloids, etc., are formed from carbon dioxide, water, and nitrate. An admirable historical introduction outlines the work of the pioneers in this field, an account being given of the experiments of Priestley, Ingen-Housz and de Saussure, which conclusively established the fixation of atmospheric carbon dioxide by the green part of the plant with the aid of sunlight, and the evolution of oxygen.

The observations of the above and subsequent workers led Baeyer to enunciate his celebrated hypothesis that formaldehyde is an intermediate product in the elaboration of sugars and starches by the living plant. The work of Willstätter in unravelling the complex constitution of chlorophyll and the accompanying pigments is next described, and Willstätter's views on the part played by chlorophyll in the assimilation process are outlined.

After the excellent summary mentioned above, the writers proceed to a formulation of their theory as to the mechanism of the process by which atmospheric carbon dioxide is converted to carbohydrates by the plant, and of how, by the addition of nitrates derived from the soil, the proteins and alkaloids occurring in the plant may be supposed to have been formed.

The theory enunciated is based on the assumption that formaldehyde is first formed by the reduction of carbon dioxide, and a general scheme is tabulated indicating the main lines along which the writers consider that the reactions proceed.

To explain the absence of formaldehyde from the leaf it is assumed that activated formaldehyde molecules have the constitution $\text{H}-\text{C}-\text{OH}$, and condense to form complex molecules without passing through the intermediate stage of formaldehyde in its stable form.

The reader will admire the ingenuity of the views propounded in this very stimulating article, and all students of the chemistry of plant life will eagerly await the results of the experiments now being carried out at Liverpool. Special attention might be well drawn to "Radiology," which is well to date in both theory and practical applications.

Whilst "Petroleum," as may be imagined, is a very ample section, with the various commercial tests described in detail, it is perhaps to be regretted that (probably for trade reasons) the methods of refining are hardly as modernised as could have been desired, but the information generally in the article is most valuable. In the space at the disposal of the reviewer it is impossible to do more than touch upon a few of the more salient features of this publication, and by far the greater part of the contents must be left without mention.

Throughout the book, errors and misprints are exceedingly rare, but on page 36, under Dental Porcelains, the word "Glucinum" is mis-spelt by the omission of "c," reading "Gluinum." The high standard attained in the previous volumes of this edition is fully maintained in Volume V., and the Dictionary can be unreservedly recommended as an authoritative source of information on applied chemistry.

Geo. R. THOMPSON.

THE COCOA AND CHOCOLATE INDUSTRY. A. W. KNAPP. Pp. 147. London: Sir Isaac Pitman & Sons, Ltd. 1923. Price 3s.

The author has aimed at producing a low-priced primer dealing with the whole subject of the cocoa and chocolate industries. He is to be congratulated on the amount of information, of interest alike to the general reader, the antiquarian,

the scientific man, and the trade, which is compressed into the 147 pages of this little volume.

A clear distinction is drawn between the words "cocoa" (for the finished product) and "cacao" for the raw material, seeds, beans and butter, and it is greatly to be hoped that this distinction may soon become universal, thus obviating any confusion with coconut products.

The space devoted to the history of cocoa and chocolate will probably appear unduly generous to the average reader, but the appeal this aspect of the subject makes to the author seems irresistible. The account of the various factors influencing the growth of the cacao tree, the harvesting and treatment of the beans, and particularly the various manufacturing processes the beans are subsequently passed through, are clearly and concisely set out, although there are a few interludes written in the discursive and lighter vein beloved of the author.

The analytical data include the composition of cocoa essence, soluble cocoa, and cocoa shell, and the equivalent food units. No figures, however, are included for cacao butter, and although a short section is devoted to this product, it is not mentioned in the index.

The chapter on cost of production is most instructive, but the book as a whole is to be regarded by the analyst as more of a luxury than a necessity.

D. G. HEWER.

THE PLANT ALKALOIDS. By T. A. HENRY, D.Sc. Second Edition. Pp. viii. + 456. London: J. & A. Churchill. 1924. Price 25s. net.

This, the second edition of Henry's "Plant Alkaloids," is a comprehensive book brought thoroughly up-to-date, and there has been enough important work on the chemistry of alkaloids, completed since the first edition was published ten years ago, to call for a new edition.

It is in all respects a very admirable production, complete, readable, concise, and well printed, with clear formulæ.

The chemistry of plant alkaloids is a very illuminating and fascinating part of our science. The unravelling of the constitution of the complex structure of alkaloids has occupied the attention of many of the world's best chemists, and the story of their achievements, as brought together in this book in readable condensed form, is worthy of the attention of all who are interested in organic chemistry.

The arguments based on experimental evidence by which the various constitutional formulæ have come to receive acceptance, make the book excellent reading to the student, to the research worker, and to the specialist.

The alkaloids are roughly classified according to the principal nitrogen-containing nucleus. This forms a convenient basis, and the best available in the present state of our knowledge, but is not of far-reaching significance. Such a book is helpful to workers in this field by laying bare the many gaps in our knowledge, and paving the way to a more complete classification and correlation of chemical constitution, biological occurrence and pharmacological action.

Each subject is dealt with in a historical manner, the principal physical and chemical properties of the bases and their salts are described, and there is given an account of the more important methods of isolation and analysis.

The pharmacological action of the successive groups is discussed, and in this respect more than in any other the gaps in our knowledge are conspicuous.

Ample references to original contributions are given at the foot of each page, and these greatly add to the value of the book.

Reading the book, one cannot fail to be impressed by the outstanding contributions of English chemists during the past twenty years, particularly those by what may be termed the Manchester school, Perkin, Pyman and Robinson.

FRANCIS H. CARR.

THE CHEMISTRY OF THE INORGANIC COMPLEX COMPOUNDS. AN INTRODUCTION TO WERNER'S COORDINATION THEORY. R. SCHWARZ. Authorised Translation by L. W. BASS, Ph.D. Pp. x. +82. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. Price 8s. 6d. net.

This little work supplies the long-felt need of a succinct account in the English language of Werner's theory. The translation, like the German original, presents "a synopsis of the Chemistry of the Inorganic Complex Compounds with as few details as possible." After an introductory chapter on valency, an *exposé* of the theory is given in Chapter II., followed by a substantial chapter on the isomerism of the complex compounds.

The translator rightly states that no English systematic nomenclature for the coordination compounds has yet been developed. However, committees appointed by the *Union Internationale de la Chimie Pure et Appliquée* are now engaged in elaborating a uniform terminology. It is to be hoped that their labours will soon bear fruit, and the nomenclature recommended by them be adopted by the whole profession. At the present time, the majority of British chemists conform, for the sake of uniformity, to the nomenclature used in the *Journal of the Chemical Society*, by referring to the latest Decennial Index; the terminology applied to inorganic complex compounds is an adaptation of Werner's German nomenclature, and appears to follow the rules given in Mellor's *Modern Inorganic Chemistry* (1917, p. 649). These the writer may be permitted to quote, as they are the only ones he could find in the English literature, and, moreover, they appear to be little known.

"Werner's system of naming the metal-ammonia compounds has been almost universally adopted. The constituents of the complex are taken first, and, of these, the acid radicles with the suffix "o" come first; then follow any groups which behave like ammonia, e.g. H₂O is called "aquo"; NO₂, "nitrito" or "nitro"; NO₃, "nitrato"; CO₃, "carbonato"; SO₃, "sulphito," etc., and lastly, preceding the metal itself, the ammonia molecules are designated "ammines," and spelt with a double "m" to distinguish the word from the "amines" or substituted ammonias. The prefixes di, tri, . . . indicate the number of each. The whole is written as one word." (Example: *chloropentamminechromic bromoiridate*.)

A somewhat similar system is applied in Roscoe and Schorlemmer's *Treatise*, as well as in the *Textbook* published under the editorship of Dr. Newton Friend. The writer regrets to note that Dr. Mellor, in compiling his great *Comprehensive Treatise*, is not adhering to the rules quoted from his earlier book, to judge from the term "*aurous dodeca-ammino-chloride*," and similar ones, in Volume III. The nomenclature outlined in the present translation is substantially the same as Mellor's older one, but the names of the coordinated radicals are separated from one another and from that of the central atom by hyphens. In addition, the valency of the central atom is shown by an ending: thus, $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl}$ is, *trichloro-triammine-platé chloride*, "é" indicating quadrivalency. The reviewer would like to see a substitute for the accented "é," which is un-English and not found on the typewriter keyboard.

In Volume IX., Part I., of his *Textbook*, Dr. Friend departs from Werner's nomenclature in applying the name "*ammoniate*" to the ammonia complexes of the bivalent metals, thus: $\text{CoCl}_2 \cdot 6\text{NH}_3$, *cobaltous chloride hexammoniate*, instead of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$, *hexamminecobaltous chloride*. The term brings out the analogy with $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$, *cobaltous chloride hexahydrate*, but would lead to the inference that the above compound differs from *hexamminecobaltic chloride*, $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (luteo-salt), in the mode of linking of the ammonia molecules. As a matter of fact, whilst the cobaltous compound gives up its ammonia to the most dilute acids, the luteo-salt is remarkably stable. The results of the work of Biltz and his students, who are investigating the constitutional affinities between the two types of compounds, will, no doubt, have a decisive bearing on their terminology.

W. R. SCHOELLER.

BOILER CHEMISTRY AND FEED WATER SUPPLIES. By J. H. PAUL, B.Sc., F.I.C.
2nd Edition. Pp. ix.+252. London: Longmans, Green & Co. 1924.
Price 14s. net.

This now well known book has deservedly reached a second edition. The text has been revised, and a number of fresh analyses of waters from various parts of the world have been added.

The subject matter is dealt with in 17 chapters, of which the first two are introductory—describing the origin of natural waters and the changes in their constituents which take place when passing through the soil, under the influence of chemical, biological and mechanical action. The author then attempts the difficult task of conveying, in popular language, for the benefit of non-scientific readers, the meaning of such terms as acids, bases and salts, of indicators, and of the nature of the changes which occur when salts are brought into solution in water.

The more technical portion of the work begins with the consideration of the normal constituents of natural waters, their solubility and the influence on them of high temperature when dry and in solution. The composition of boiler deposits and scales is illustrated with numerous analyses which shew the conditions under which such deposits had been produced, after which their prevention and cure are discussed. The consideration of the concentrated solutions remaining in the

boiler naturally leads up to the important question of corrosion and its causes, and the special effects of carbon dioxide and alkaline carbonates under the influence of heat and pressure.

To complete this summary, the book deals with the condensed steam, if returned to the boiler, the removal of acidity and of oil, and, finally, with the problems arising in connection with the super-heater, with the cause and cure of priming, and with the damage to the external surfaces of boiler plates and tubes from the volatile constituents of the fuel.

The treatment of the subject is very complete and, while the practical side of boiler management is never lost sight of, the theoretical aspects of the problems involved are treated with an amount of detail which the growing knowledge of the subject now demands. The full story is yet to seek, but the mass of observations that have now been accumulated is gradually eliminating many of the early theories, and Mr. Paul's book has the merit of making a clear path through the maze of conflicting speculations.

The book is intended for the engineer as well as for the chemist, and this has necessitated the use of more or less popular phraseology and the intrusion of a certain amount of elementary chemistry which, from the point of view of the chemist, has involved some want of accuracy and precision. Such subjects as those dealt with in Chapter II. (Acids, Bases and Salts), involving the use of indicators, and also the various theories of corrosion, cannot satisfactorily be explained without the ionic theory. The same remark applies to the tables of analyses of boiler waters, which might well mislead those who are not chemists into thinking that the salts are really combined in solution in the manner recorded, instead of these tables being merely conventional and convenient methods of stating the results.

Readers who are chemists certainly have a grievance against the author for providing no references to the literature of the subject. He states that "the principle of giving authorities is a subterfuge for passing on to others a responsibility which he has not the courage to assume on his own," but it is unreasonable to expect that all the statements in a book of this sort are the direct result of the writer's own work or observation. If these statements have any bearing on matters still in the controversial stage, the desire for the original sources of information is eminently reasonable, however carefully verified may be the facts.

The absence of these references makes it difficult to feel certain that the author himself has fully explored the literature of his subject. Certainly, some of the published work in connection with the effects of high pressure and temperature on water in boilers, on the action of dilute alkaline solutions on iron, and on the solubilities of some of the scale-forming salts appears to have had rather scant notice. The same may be said as to the various devices for the removal of oil; and the processes for the de-gassing of waters have been overlooked altogether.

These, however, are relatively small defects in a book which is a mine of original information, is fertile in suggestion, and eminently practical in its scope.

CECIL H. CRIBB.

CHEMICAL ENCYCLOPÆDIA. By C. T. KINGZETT, F.I.C. 3rd Edition. Pp x. + 606.
London: Baillière, Tindall & Cox. 1924. Price 30s. net.

The author is to be congratulated on the publication of the third edition of his book so soon after the second, for it is the best proof that the very large amount of work he has put into it has been appreciated by the particular class of readers he originally had in mind.

It will be noticed that whereas the former editions bore the title of "The Popular Chemical Dictionary," the limiting adjective has now been dropped, and the work has become a chemical encyclopædia.

Referring to this change in his preface, the author observes that the original title implied that his dictionary was not strictly scientific in character or accurate in detail, but it is open to question whether the more ambitious title is not likely to meet with more criticism from another direction. To be of use as an encyclopædia for the professional chemists mentioned in the preface, the work should give copious references to original papers and English abstracts of them, so that it could serve as a general subject-index in a much handier form than the bulky chemical dictionaries. If the author will adopt this suggestion, he will make a greater appeal than he can hope to do at present to practising chemists. As yet, the book must still be regarded mainly from the popular point of view—that is to say, as a readable digest of chemistry best suited to those who know but little of the science.

If this limitation is accepted, there is much to praise. The definitions are, as a rule, concise, yet clear, and the account of recent advances in all branches of chemistry is up-to-date and given in an interesting manner.

In the review of the last edition (*ANALYST*, 1922, **47**, 143) attention was directed to certain errors; these have now been corrected, but a few minor points call for correction in the next edition. On p. 273 the name of the Dutch chemist is given as "Wij" instead of "Wijs." It is not correct, without qualification as to the class of oil, to say (p. 213) that "the drying properties of oils are almost in direct ratio of their iodine values"; nor is it sufficient to say that "the acetyl value shows the amount of oxy-acids present," for it may show many other things. The statement about the use of graphite at Borrowdale (p. 86) is misleading, for the graphite used there is now imported from other places.

No man can hope to have a practical knowledge of all the subjects included in a chemical dictionary, and instances such as these only go to show the advisability of having the proof sheets revised by specialists in the various subjects.

The publishers have done their share of the work well, for the printing is excellent, and the binding and general style make the book very attractive in appearance.

EDITOR.

Milk Products Sub-Committee.

UNIFORMITY OF METHODS OF ANALYSIS.

The above Committee will be glad to receive from Chemists particularly concerned with the analysis of Condensed Milk (sweetened and unsweetened), and of Dried Milk, details of unpublished methods, or variations in established methods, which they have found to be of service in their laboratories in such analysis.

Communications should be sent, if possible not later than the 6th December next, to the Hon. Secretary of this Committee,

MR. E. B. HUGHES, M.Sc., F.I.C.,
7, Sumburgh Road, Clapham Common,
London, S.W. 12.

Publications Received.

- ALLEN'S COMMERCIAL ORGANIC ANALYSIS. 5th Edition. Vol. II. (Fixed Oils, Fats and Waxes). J. & A. Churchill. 1924. Price 36s. net.
- CHEMISTRY IN THE TWENTIETH CENTURY. Edited by E. F. Armstrong. E. Benn, Ltd. Price 15s. net.
- QUANTITATIVE ORGANIC MICRO-ANALYSES. By F. Pregl. Translated by E. Fyleman. J. & A. Churchill. 1924. Price 12s. 6d. net.
- VOLUMETRIC ANALYSIS. By Francis Sutton. 11th Edition. J. & A. Churchill. 1924. Price 35s. net.
- THE EXTRA PHARMACOPOEIA. Vol. I. 18th Edition. Revised by W. H. Martindale and W. Wynn Westcott. H. K. Lewis & Co. 1924. Price 27s. 6d. net.
- THE CONSTITUENTS OF COAL TAR. By P. E. Spielmann. Longmans & Co. 1924. Price 12s. 6d. net.
- A SYSTEM OF PHYSICAL CHEMISTRY. By W. C. McLewis. Vol. III. (Quantum Theory). Longmans & Co. 1924. Price 15s. net.
- L'ORIGINE TOURBILLONNAIRE DE L'ATOM ET LES CONSEQUENCES. Par J. Varin D'Ainvelle. Paris: Gauthier-Villars et Cie. 1924. Price 20 fr.
- CHART OF THE CHEMICAL REACTIONS OF THE COMMON ELEMENTS. J. A. Timm. Chapman & Hall. 1924. Price 10s. net.

ERRATUM.

The title of Mr. Poucher's book reviewed in the October issue (p. 500) should have read "Perfumes and Cosmetics with especial reference to synthetics."