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THE ANALYST

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

AN Ordinary Meeting of the Society was held on Wednesday, March 5th, at the Chemical Society's Rooms, Burlington House. The President, Mr. G. Rudd Thompson, F.I.C., was in the chair.

Certificates were read for the first time in favour of:—Messrs. John Joseph Bryant, Edgar Wilfred Deag, Harold Wilton Hewis, B.Sc. (Lond.), A.I.C., Ernest Wilfrid Jackson, F.I.C., Thomas McGrath, and Alfred Scholes, F.I.C.

Certificates were read for the second time in favour of:—Messrs. Philip Walter Alloway, Lorentz Oliver Brekke, B.Sc. (Leeds), A.I.C., Alec Munro Cameron, B.Sc. (Edin.), F.I.C., Thomas William Drinkwater, L.R.C.P., L.R.C.S. (Edin.), F.I.C., John Ralph Furlong, Ph.D. (Wurzburg), A.I.C., Ernest Griffiths-Jones, M.Sc. (Manc.), A.I.C., Basil Gordon McLellan, F.I.C., and William Thomas Rigby, F.I.C.

The following were elected Members of the Society:—Messrs. Hugh Browning Brown, A.I.C., Sidney Augustus de Lacy, A.I.C., A.M.I.Ch.E., Joseph Henry Lane, F.I.C., B.Sc. (Lond.), Leslie Herbert Lampitt, D.Sc. (Birm.), F.I.C., Reginald Francis Moon, B.Sc. (Bristol), Maximilian Nierenstein, D.Sc. (Geneva), Ph.D. (Berne), William Simpson Shaw, M.Sc., A.I.C., Robert Norman Wright, A.R.C.S., B.Sc. (Lond.), A.I.C., Misses Phyllis Honor Price, B.Sc. (Bristol), and Mabel Susanne Lavinia Snelus, A.I.C.

The following papers were read:—"The Composition and Examination of Beef and Malt Wine," by G. D. Elsdon, B.Sc., F.I.C.; "Effect of Fatty Diet on the Composition of Butter Fat," by J. C. Drummond, D.Sc., F.I.C., and H. J. Channon, B.A., B.Sc.; "What is Bondon Cheese?" by G. D. Elsdon, B.Sc., F.I.C.; "Cream Cheese," by T. R. Hodgson, M.A., F.I.C., and "Some Facts on the Composition and Decomposition of Eggs," by R. T. Thomson, F.I.C., and J. Sorley, F.I.C.

Death of a Member.

WE regret to record the death of Edgar Richards, Newport, R.I., on January 21, 1924.

Osmium Tetroxide as a Reagent for the Estimation of Tannins and Their Derivatives.

By C. AINSWORTH MITCHELL, M.A., F.I.C.

(*Read at the Meeting, February* 6, 1924.)

Apart from its use as a stain for fat in microscopy, osmium tetroxide, or "osmic acid," as it is commonly termed, is but little used in analytical work, and, even its more common reactions are unknown to most chemists.

When making experiments as to the possibility of using it as a reagent for developing latent finger prints on paper (Analyst, 1920, **45**, 124), I tried the effect of various photographic chemicals as possible intensifiers, and so accidentally discovered that pyrogallol combines with osmium tetroxide to form a compound which is reddish violet in dilute solution and almost black when concentrated, and that this compound can be used as an ink which does not have to undergo oxidation before forming a black stain on the paper.

The reaction is extremely sensitive, and is capable of detecting as little as 1 part of pyrogallol in 2 millions of water.

The intensity of the coloration is also proportional to the amount of pyrogallol present, and so, by the use of a technique similar to that which I devised for the estimation of pyrogallol, gallic acid and gallotannin by means of a ferrous tartrate reagent (Analyst, 1923, **48**, 1), the reaction can be applied to the colorimetric estimation of pyrogallol.

In the ferrous tartrate method, the estimation is based upon the fact that the violet coloration produced by the tannin material apparently affords a measure of the pyrogallol groups, and that the reaction is not given by many compounds, such as phloroglucinol, in which the hydroxyl groups are in another position.

Catechol and catechol tannins give a dull olive green coloration in neutral solution, and catechol gives a violet coloration in slightly alkaline solution, with the ferrous tartrate reagent, and the possibility of using that reagent for the estimation of that group of tannins is now being studied by Miss Price under our Analytical Research Scheme.

Schluttig and Neumann (*Die Eisengallustinten*, 1891, p.) assert that only compounds with three adjacent hydroxyl groups combine with iron salts to form inks, *i.e.* compounds leaving a permanent stain on paper, but they themselves provide an exception to their rule when they state that catechol (a dihydroxy compound) yields an ink which is darker and more permanent than those produced by gallic acid or gallotannin.

Extending my experiments to other tannin materials, I have found that osmium tetroxide not only gives a violet coloration with compounds such as

gallotannin, gallic acid and pyrogallol, with three adjacent hydroxyl groups in their molecule, but also with catechol, the exception overlooked by Schluttig and Neumann. It gives no coloration with phenol, salicylic acid, phloroglucinol, or resorcinol.

METHOD OF ESTIMATION.—The method I have used throughout is essentially the same as that previously described, the colours being compared in Nessler tubes provided with side tubulures and taps. The reagent consists of the ordinary 1 per cent. solution of "osmic acid" diluted with 10 parts of water.

The standard for the comparison is made by dissolving 0·1 grm. of pure pyrogallol, catechol or gallic acid in 100 c.c. of water. One c.c. of this solution is added to 100 c.c. of tap water, and treated with 1 c.c. of the dilute reagent, and the resulting coloration is matched, after the lapse of 5 minutes, with that given by 1 c.c. of a 0·1 per cent. solution of the unknown substance.

As in the case of the ferrous tartrate reagent, the nature of the coloured compound produced appears to vary with the proportion of the reagent, and subsequent dilution will not change one compound into another. It is advisable, therefore, that the coloration should keep below the limit of intensity of that formed by 1 c.c. of a 0·1 per cent. solution of gallic acid. It is also necessary that the solution should not be acid, but a slight excess of alkali does not affect the result. If tap water is used, the addition of any alkali is usually unnecessary. Otherwise, 1 c.c. of 0·1 *N* sodium carbonate solution may be added.

COMPARISON OF CATECHOL AND PYROGALLOL.—Osmium tetroxide, unlike the ferrous tartrate reagent, does not give different colorations with pyrogallol and catechol, but produces a similar violet coloration with each. The advantage of this is that it enables a simultaneous estimation to be made of the two compounds in the presence of each other, and the results can be expressed in terms of either.

Pyrogallol reacts much more rapidly than catechol, but the initial reactions appear to be complete in about 5 minutes. After about 15 minutes the colour begins to darken, apparently through absorption of oxygen.

For my original catechol standard I used a small, particularly pure specimen, made by Kahlbaum, which was kindly given to me by Dr. Nierenstein, and for the later experiments I used a supply of British origin. In the osmium tetroxide test 0·1 grm. of this catechol was colorimetrically equivalent to 0·098 grm. of the German preparation, and its degree of purity is therefore 98 per cent.

In a series of colorimetric comparisons I found that, as the average of a large number of readings, 87 c.c. of a 0·01 per cent. solution of pure pyrogallol was colorimetrically equivalent to 100 c.c. of a corresponding catechol solution.

The ratio between these values is as 1:1·14, and, if we compare the molecular weights of the two compounds, it will be seen that this is also the ratio between them.

		Mol. Weight.	Ratio.
Catechol	$C_6H_4(OH)_2$	110	1
Pyrogallol	$C_6H_3(OH)_3$	126	1·145

Hence, the entire substances appear to take part in the colour reaction, and the

addition of one hydroxyl group to the catechol molecule increases its tinctogenic power by an amount corresponding to the increase in the molecular weight.

REDUCING ACTION OF CATECHOL AND PYROGALLOL.—On adding a few drops of strong hydrochloric acid to the coloured liquids obtained in the reaction, the pyrogallol solution turns bright blue, whereas the catechol solution becomes first olive green and then bright green. This is not due to any inherent difference between the two compounds, but to the fact that pyrogallol has a stronger reducing action than catechol on osmium tetroxide.

The bright blue coloration is due to the formation of osmous chloride, $OsCl_2$, whilst the green coloration is due to the formation of a mixture of this chloride with osmium tetrachloride, $OsCl_4$, which has a red colour. By increasing the amount of catechol in the solution, it, too, gives the bright blue coloration, which is also given by gallic acid and gallotannin.

CATECHOL AND PROTOCATECHUIC ACID.—A comparison of pure catechol with pure protocatechuic acid in 0·01 per cent. solution, for which I am also indebted to Dr. Nierenstein, gave the following results:

Protocatechuic Acid.		Catechol.
c.c.		c.c.
60	=	**41**
40	=	**27**

This gives a colorimetric ratio of 1:1·40 between the two compounds, which, again, is the relationship between the molecular weights:

Catechol.	Mol. Weight.	Protocatechuic Acid.	Mol. Weight.
$C_6H_4(OH)_2$	110	$C_6H_3(OH)_2.COOH$	154

$$\frac{154}{110} = 1{\cdot}40.$$

COMPARISON OF PYROGALLOL WITH GALLIC ACID.—The results obtained with catechol are, in themselves, an indication that the osmium tetroxide reaction is not concerned solely with the pyrogallic group, as seems to be the violet coloration given by the ferrous tartrate reagent with pyrogallol tannins. It was, however, somewhat of a surprise to find that gallic acid gave a distinctly darker coloration than pyrogallol—a result which indicates that the carboxyl group in the gallic acid also contributes to the reaction.

Pure crystalline gallic acid was used for the estimation, and the average results showed that 0·090 to 0·091 grm. of gallic acid was colorimetrically equivalent to 0·1 grm. of pyrogallol. The colorimetric ratio between the two substances is thus as 1:1·1.

Now, if we refer again to the respective molecular weights (pyrogallol, 126; crystalline gallic acid, 188), we find that the pyrogallic group in gallic acid ought to be responsible for 66·4 per cent. of the tinctogenic value and the carboxyl group for 24·1 per cent. (total 90·5 per cent.), whilst the water of crystallisation (9·5 per cent.) is inert.

The actual increase of tinctogenic power, however, on passing from pyrogallol to gallic acid was only 9·1 per cent., instead of 24·1 per cent., so that, in this case, there does not appear to be any exact numerical relationship between the tinctogenic values and the molecular weights of the two substances, and the factor 1·1 for converting pyrogallol results into terms of gallic acid must be accepted as an empirical one.

COMPARISON OF GALLIC ACID AND GALLOTANNIN.—The gallotannin which I used was that remarkable specimen in which no one has yet been able to detect more than 1 per cent. of glucose. The results obtained by me and by Mr. Ward have since been exhaustively confirmed by Dr. Nierenstein (ANALYST, **1923**, **48**, 321; *Ber.*, 1923, 1876), and it is difficult to reconcile the existence of such a gallotannin with Fischer's theory of gallotannin as a galloyl glucose. I have shown (*loc. cit.*) that this gallotannin gives colorimetric results with the ferrous tartrate reagent in accordance with Nierenstein's formula for a gallotannin free from glucose, and this tannin was, therefore, a suitable one for comparison with gallic acid by the osmium tetroxide method. Here, again, I have found gallic acid to give a distinctly stronger reaction, the two compounds standing towards each other in the ratio of 1:1·1. It is not possible, as yet, to trace any definite relationship between these values and the formulæ.

CATECHOL AND CATECHINS.—Specimens of pure acacatechin, paullinia tannin and hemlock tannin given to me by Dr. Nierenstein, were compared with pure catechol. The ratio between the two first and catechol was in each case as 1:1·22, but hemlock tannin behaved very differently, and gave a ratio of 1:12·3. In view of our lack of knowledge of the exact constitution of these tannins, these values can only be regarded as empirical.

ESTIMATION OF GALLIC ACID IN PRESENCE OF GALLOTANNIN.—The method previously devised (*loc. cit.*) is also applicable in the case of osmium tetroxide. The two substances are first estimated colorimetrically together in terms of gallic acid, the tannin is then precipitated with quinine hydrochloride, and the gallic acid in the filtrate estimated as before.

By this means my standard gallic acid was found to contain 10·5 per cent. of gallic acid—a result which agrees with that previously obtained by the ferrous tartrate method. This procedure is also applicable to the estimation of other tannin derivatives not precipitated by quinine hydrochloride.

APPLICATIONS OF THE METHOD TO PYROGALLOL TANNINS.—I have proved that the method can be used for the estimation of tannin and gallic acid in various products containing pyrogallol tannins, such as galls, myrobalans, etc., but it offers no special advantages over the ferrous tartrate method in the case of these tannins. Some of the results which I have obtained with tea, however, are of special interest, since, in general, they agree with those obtained by the former method.

TANNIN SUBSTANCES IN TEA.—In each case 1 grm. of the tea was boiled with successive portions of water for 1½ hours, the united extracts made up to 100 c.c., and the tannin and gallic acid estimated as described.

The following results were obtained:

Tea.	Total Tannin Substances as Gallic Acid. Per cent.	Gallic Acid in Filtrate. Per cent.	Tannins in terms of Gallic Acid. Per cent.
China	6·0	1·14	4·86 × 1·1 = 5·34
Ceylon	11·1	2·0	9·1 × 1·1 = 10·0

So far, tea tannin does not appear to have been isolated in a pure condition, and we have, therefore, no definite factor for converting the results from their gallic acid to their tannin equivalent.

Smith (ANALYST, 1913, **38**, 312) has shown that it is possible to obtain concordant results by the use of Chapman's method of precipitation with cinchonine sulphate, but he has not proved that his precipitate consists of pure cinchonine tannate. If tea tannin, like gallotannin, may be in some intimate association with glucose without that glucose forming an integral part of the molecule, it seems not improbable that the cinchonine precipitate contains not only the tannin, but also the associated glucose. In fact, Smith himself has shown that by dialysing the tannin separated from tea, a compound is obtained which combines with cinchonine in quite a different way from the original preparation.

CATECHOL TANNINS.—It is for the estimation of tannins in such substances as sawdust, coffee, and hops that the osmium tetroxide method fills a gap, for it enables either catechol tannins or mixtures of catechol and pyrogallol tannins to be estimated together in terms of catechol, pyrogallol, or gallic acid. These colorimetric values, once recorded, can afterwards be translated into their equivalents of the respective tannins as the constitution of these becomes known.

TANNIN IN SAWDUSTS.—One would hardly expect such a product as sawdust to be liable to adulteration, and yet, during the past year, I have had to examine several samples for a firm of bacon curers, to see whether they consisted of oak sawdust or contained deal, the resin in which would have been objectionable for the purpose required.

In addition to other tests, I made a series of estimations of the tannins in various sawdusts of known origin by the osmium tetroxide method, with the following results:

Sawdust.	Catechol Equivalent. Per cent.	Gallic Acid Equivalent. Per cent.	Tannin (Gallic Acid Equiv. × 1·1) Per cent.
Oak (English) I	9·5	7·9	8·69
,, ,, II	10·0	10·0	11·0
Oak (American) I	6·3	5·3	5·8
,, ,, II	4·2	3·5	3·8
Oak (Commercial) I	10·5	8·7	9·6
,, ,, II	—	9·0	9·9
Elm (English)	—	0·1	0·11
,, (Commercial)	0·7	0·58	0·63
Beech (English	—	0·01	0·01
Deal	—	0·005	0·005
Ash (English)	—	0·92	1·01
Mahogany (W. African)	—	10·6	11·6
,, (unknown)	—	3·2	3·52

It will be seen that the two commercial samples contained a proportion of tannin substances agreeing with that in genuine English oak sawdusts. In the case of the American sawdust, No. II., I estimated the amount of gallic acid, and found it to be less than 0·1 per cent.

An interesting point brought out by these estimations is the difference between American and English oak. It is well known that English oak is less suitable than American oak for making casks for beer or vinegar, and here we have the scientific explanation of the fact, namely, that the English wood contains much more tannin, and thus leads to turbidity if the beer or vinegar is put into casks which have only received the amount of seasoning which is sufficient for American oak.

HOPS.—Through the kindness of Mr. J. L. Baker, I have been able to test the method upon typical samples of hops of known origin, and I find that it affords a very simple and rapid means of estimating the tannin substances present.

The following table gives some of the results obtained with 1 per cent. extracts of the hops:

	Hops.	Total Tannin Substances in terms of Gallic Acid. Per cent.	Factor.	Tannin. Per cent.
1.	Alsace	0·82	2·65	2·17
2.	St. Omer	1·42	,,	3·76
3.	Neve, Kent	(1) 0·96; (2) 1·00	,,	2·35
4.	Oregon	1·09	,,	2·88

Sample No. 3 contained 0·18 per cent. of tannin derivatives (expressed as protocatechuic acid) not precipitated by quinine hydrochloride.

Although hop tannin has not been isolated in a pure condition, and its constitution is still not definitely determined, it has been shown by Chapman (ANALYST, **1908, 33, 95**; **1909, 34, 372**) that the substance precipitated from an extract of hops by cinchonine sulphate is probably the pure tannin (less colouring matter), and so we have here a gravimetric standard for comparison. In the case of Sample No. 3, I estimated the tannin by Chapman's method, and obtained a cinchonine precipitate weighing 0·0428 grm., which, multiplied by Chapman's amended factor, 0·55, gives the amount of tannin as 2·35. These hops contained 0·89 per cent. of tannin giving a coloration with osmium tetroxide in terms of gallic acid, and, comparing this with the amount of tannin found by Chapman's gravimetric method, we obtain the factor 2·65 for converting the colorimetric results into lupulo-tannin.

COFFEE.—Hitherto there has been no trustworthy method for estimating tannins in coffee, and even the cinchonine method has been found unsatisfactory in this case (Smith, ANALYST, **1913, 38, 316**). The osmium tetroxide method, however, presents no difficulties, and I have estimated the tannin substances in a number of commercial products, including two samples of the same coffees, before and after roasting.

The following table gives results thus obtained:

Coffee.	Moisture. Per cent.	Total Tannins as Gallic Acid. Per cent.	Not precipitated by Quinine. Per cent.	Tannins in terms of Gallic Acid. Per cent.
Blend, Mysore and Costa Rica	—	(1) 3·47 (2) 3·57	—	—
Caffeineless Coffee	—	4·84	—	—
Costa Rica, raw	10·85	3·60	(1) 1·39 (2) 1·34	2·25
,, ,, roasted	1·98	5·2	3·5	1·7
Nairobi, raw	—	3·56	1·68	1·86
,, roasted	—	3·60	2·45	1·15

It is interesting to note that a portion of the tannins is apparently decomposed during the roasting of the coffee and converted into derivatives which no longer give a precipitate with quinine hydrochloride.

CUTCH.—I have again to thank Dr. Nierenstein for letting me have small samples of genuine cutch typical of those sold in the Bombay market. A 1 per cent. extract of these gives a pronounced coloration with osmium tetroxide under the conditions described, but unfortunately the tint of the colour differs from that given by catechol, pyrogallol, or gallic acid, and so no exact comparison is possible in this case.

This drawback may be overcome when a pure specimen of catechu tannin has been prepared, but meanwhile all that is possible is to compare one sample of cutch with another, and so obtain a relative standard. I have done this in a number of cases, and have found that there is some relationship between the total colorimetric values of the different products. For example, taking one sample as 100, the colorimetric equivalent of another was 32.

The examination of cutch is also complicated by the difficulty of filtration, and by the fact that both the soluble and insoluble portions react with osmium tetroxide. Hence, until these difficulties have been removed, the colorimetric method cannot be recommended for the estimation of tannin in cutch.

DISCUSSION.

Mr. R. L. COLLETT pointed out that these colour reactions varied considerably with small changes in the hydrogen ion concentration, and asked whether the author had assured himself that his conditions in this respect were such as to give standard results.

Mr. A. CHASTON CHAPMAN said that he was interested in the relationship established between the colour reaction and his (the speaker's) cinchonine method, although he was becoming a little sceptical as to the value of colour reactions in general. He would like to know on what grounds the author regarded his standard tannin as exceptionally pure. Might it not be possible that glucose was, after all, an integral part of the tannin molecule, and that a substance free from glucose was not tannin at all.

Mr. C. A. MITCHELL, in reply, said that he agreed that a control of the hydrogen ion concentration would add a degree of certainty to his method, although apparently even considerable variations in the amount of alkali added did not affect the colour. With regard to Mr. Chapman's question about the standard tannin: He had been informed by the manufacturers that it was a product of Chinese galls. It gave all the recognised tests for tannin, including the gold-beater's skin test and precipitation with quinine or cinchonine. Fischer had concluded that glucose was an integral part of the molecule, because, by his method of treatment, he had been unable to separate any more glucose from his preparations. But, as Trimble suggested many years ago, it seemed not improbable that tannin might be free from glucose, and that the presence of glucose in other preparations might be due to its being adsorbed, and not really in combination in the molecule.

The Plea for Standardisation.

BY M. S. SALAMON, B.Sc.

(*Read at the Meeting, December* 5, 1923.)

DURING recent years the importance of commercial analysis has received increasing recognition, and as our knowledge of the composition of both organic and inorganic materials has been added to, so has there been an increasing tendency on the part of both the legislature and the commercial community to use such knowledge for the purpose of setting up legal standards of genuineness and commercial standards of purity and strength.

In the early days of commercial analysis, the number of methods available for quantitative determinations was strictly limited, the number of workers engaged on commercial analysis was few, and those that were so engaged were often pioneers in the subject, and thus, by force of circumstances, their decisions were but rarely challenged.

To-day, however, quite a large number of chemists are occupied in this particular field, and there are but few quantitative estimations in which the analyst has not a choice of a considerable number of processes for effecting the particular estimation that he has in view.

If chemical analysis were the exact science which many people, particularly laymen, believe it is, this multiplicity of methods would cause no trouble, but I think that it must be admitted that, in many cases, the particular method chosen for the analysis influences the result obtained, and analyses of the same material, but carried out by different methods, often show large discrepancies, and in many cases are not even comparable.

Even when only comparatively small discrepancies occur, they may be of considerable commercial importance, and are, moreover, frequently misunderstood and misinterpreted by the layman; with the result that trouble, inconvenience and expense are often caused, for which analysts in particular, and chemistry in general, get the blame.

In addition to the trouble that these differences may give rise to, there is that resulting from the lack of uniformity in expressing the results of analyses and the use of unqualified general terms, which have not received a precise and definite universal interpretation.

It is because of the recognition of these facts and the trouble, inconvenience and expense that they often cause, that attempts have been made to lay down precise details as to how the analysis of a particular material or materials is to be conducted, and precise definitions given so that the results may be expressed in terms which admit of no misinterpretation.

In this country this has only been done in very few cases, and my object to-night is to urge the wider and more general application of what, for want of a better word, is usually referred to as "Standardisation."

Owing to the non-adoption of standard methods the choice of the process to be used is left to the individual analyst, and I will give some examples to illustrate what this results in, and the difficulties that may arise therefrom.

I propose to consider first of all the question of the analysis of dried and condensed milk, and in this connection I would refer to the analyses given by Mr. J. H. Jephcott when reading his paper on "The Analysis of Dried Milk" (ANALYST, 1923, **48**, 529).

A sample of dried milk was divided into four parts and sent to different analysts; the results obtained were as follows:

	A.	*B.*	*C.*	*D.*
	Per cent.	Per cent.	Per cent.	Per cent.
Water	3·3	3·16	3·4	3·55
Ash	5·6	5·87	5·3	5·30
Fat	24·6	24·08	24·5	24·20
Lactose	40·6	40·67	38·6	43·30
Protein	25·6	25·36	25·9	23·65
Non-determined	0·3	0·86	2·3	Nil

All these analyses were carried out in laboratories which have had considerable experience of dried milk analysis.

As regards the results obtained by the analyst designated as *D*, I do not know very much about his methods, and I therefore do not propose to refer to his results in detail. As regards *A*, *B* and *C*, they are all known and recognised as careful workers, their estimations were made in duplicate, and every necessary precaution was taken in order to ensure the accuracy of their results.

Take the fat content, to start with, it will be noticed that *B* returns the fat content lower than either *A* or *C*; these latter are in quite fair agreement, and, as a matter of fact, used the same method, namely, the Werner-Schmidt; *B* used a different method, the Rose-Gottlieb.

This is by no means an isolated instance of the difference in the fat content which results from the use of different methods, and, as regards dried milk, I think that it is the invariable experience of all workers that the Rose-Gottlieb method gives a lower percentage of fat than does the Werner-Schmidt method.

It is true that the differences are not very large, but *B* gives a fat content practically half a per cent. lower than *A* and *C*, and such a difference may be quite sufficient to start a whole host of arbitrations and cause considerable expense, trouble and inconvenience to a number of dealers and manufacturers.

Moreover, a difference of this amount may become of even still greater importance in the near future, when the new regulations for dried milk come into force, and the description of "Full Cream Dried Milk" will acquire a definite legal and commercial meaning.

Now take the percentage of lactose; *A* and *B* both estimated this by optical rotation, and their results are in excellent agreement; the figure of 38·6 per cent. given by *C* was obtained by a gravimetric process, the solutions, method and table given in the Local Govt. Board Report on dried milk being used, but there appears a note on this analysis to the effect that if the lactose be estimated by the gravimetric American method and calculated on the American tables, its percentage comes out at 40·6 per cent., and the unestimated substance is correspondingly reduced to 0·3 per cent., this result being then almost identical with those of both *A* and *B*.

These particular estimations were repeated two or three times without any materially different results being obtained, and I have noticed similar differences between the two methods on other samples of dried milk.

There is the further question of what is meant when lactose is referred to in the analysis of dried and condensed milks. Does it mean hydrated lactose, anhydrous lactose or semi-hydrated lactose?

I have made enquiries of several well-known analysts who are perfectly familiar with these products (two of them being leading Public Analysts) and their opinions on the matter differ; some of them invariably calculate lactose to the hydrated form, others return it as anhydrous lactose, and another told me that as, in his opinion, it was by no means established, particularly in the case of dried milk, which form was present, he usually calculated it as semi-hydrated, although all of them agreed that they always described it as lactose without any qualification.

This lack of precise definition is not confined to these analysts, because, if you refer to the Local Govt. Board Report dealing with condensed milks, you will find there are pages of analyses given, but with no indication whatever as to which form of lactose is referred to, although in their report dealing with dried milks the lactose is specifically described as hydrated lactose.

In these circumstances what interpretation is to be put on the meaning of the words "milk solids" used in the regulations now in force for condensed milk?

There are other points in connection with the analysis of dried and condensed milks which merit attention, but I think that I have sufficiently indicated the need for standardisation in this branch, and I will pass on to consider quite another branch of analytical chemistry, namely, the commercial analysis of essential oils. Here, again, the use of different methods gives, even in the hands of the same

analyst, different results, and slight modifications of the same method will give results that differ by as much as 2 per cent.

My own laboratory and that of Messrs. Crosfield have had occasion to investigate the estimation of so-called geraniol in Java citronella oil, and both of us have been astonished to find what different results are obtained by what are comparatively only slight modifications in detail.

For instance, a difference in weight of 0·2 grm. in the acetylated oil taken for saponification will sometimes mean a difference of over 1 per cent. in so-called total geraniol; the time during which the acetylated oil remains in contact with the dried sodium sulphate will also affect the final result.

Considering that commercial contracts are often made stipulating for a minimum percentage of so-called geraniol, and that allowances are claimed for any deficiency, it will be readily understood that a difference of 1 per cent. may be of considerable importance.

Mr. W. H. Simmons and Mr. C. T. Bennett have also called attention recently to the discrepancies that arise in connection with the estimation of phenols and aldehydes in essential oils, and the former has already put forward a strong plea for the standardisation of essential oil analyses.

In a joint paper by myself and Mr. Bennett, published a few years ago, we showed how the estimation of cineol in eucalyptus oil was affected by even slight modifications in details, and that different processes gave quite discordant results.

Yet you will find but few essential oil laboratories which agree on all the details of the methods employed.

Now it may be argued that, in the examples which I have given, I have chosen organic substances of complex composition, and that what holds good in their case does not necessarily apply to inorganic materials of somewhat simpler composition. That this argument does not hold is shown, I think, by the action in 1909, of what was then the Board of Agriculture, in issuing exact directions as to the methods to be used in analysing the different materials which came under the provisions of the Fertilisers and Feeding Stuffs Act, 1906, and the further issue, in 1918, of additional instructions for the same purpose.

Now the greater number of these methods refer entirely to the analysis of inorganic materials, many of which are of comparatively simple composition, and, in issuing these instructions, the Board evidently realised that, even with inorganic materials of simple composition, different methods might give different results.

The department in question not only apparently realised the importance of defining the method by which the six analytical results were to be obtained, but also published a list of permissible limits of error for the various estimations.

I could quote many further cases where discrepancies in analysis, due to the use of different methods, etc., occur, but as the majority of those present this evening can, doubtless, recollect many other instances within their own experience, I do not believe that it would serve any useful purpose for me to do so, particularly as the examples that I have given are of a sufficiently general character to show

the confusion that exists at present; and to support my plea for wider and more general standardisation, which, I am convinced, is the only remedy.

It is, therefore, only a question as to what steps should be taken, and who should take them, in order that the existing state of affairs may be remedied, and it seems to me that this Society, representative, as it is to-day, of practically every branch of analytical chemistry, is particularly well fitted to take the initiative in this matter.

I do not suggest that we should at once attempt to standardise every analytical process, because I realise that it must take time, and can only be gradual, but I do think that we should make a beginning.

I would suggest, to start with, the formation of a small committee officially attached to this Society, which would act as a clearing house in the matter, and which might publish in a collected form those standard methods of analysis which have already been drawn up by different bodies. The committee might also endeavour to remedy obvious inconsistencies that exist at present as regards definitions; as, for example, the use of the word "oil" in oil-seed analysis, to denote petroleum spirit extract, and the use of the same word in oil-cake analysis to denote methylated ether extract.

Then steps might be taken to introduce standard methods for those articles which are in our immediate province, and which every day are forming the basis of commercial transactions.

In this connection I would particularly emphasise the desirability of the immediate standardisation of analytical methods for those articles for which the legislature has attempted to set up a legal standard of genuineness, and so give to those standards a real and definite meaning, and thus help to increase their usefulness.

Such a committee would be able to consider suggestions from analysts, manufacturers and the commercial community, in general, regarding analytical determinations, and thus act as a connecting link.

I am certain that the steps such a committee could take would reduce unnecessary disputes, make analyses more comparable, help to strengthen the enforcement of legal standards, and so render valuable service to the commercial community, the analytical profession and the State.

Discussion.

The President, Mr. P. A. Ellis Richards, opened the discussion by reading the Council Minute of the 7th November on the subject of standardisation (*cf.* Analyst, 1924, 123).

Dr. Bernard Dyer said that there was the question of the limits of error, and referred to the Committee (of which he was a member) which was appointed to fix the official "limits of error," but this phrase did not refer essentially to errors of analysis, but rather to deviations from such causes as errors incidental to manufacturing, unavoidable lack of uniformity and sampling. For instance, in the case of certain feeding stuffs there was prescribed a limit of error of one-eighth of the quantity of albuminoids guaranteed, so that if the maker guaranteed

32 per cent. of albuminoids the guarantee would be fulfilled by a content varying from 28 to 36 per cent. That did not contemplate that two analysts working on duplicate samples might be expected to differ by 8 per cent. Although a satisfactory standard method for estimating anything might possibly be evolved, neither the person who worked the process, nor his skill in applying it could be standardised. He doubted the wisdom of adopting international standardisation.

Mr. JOHN MYERS said that, in his opinion, standardisation of nomenclature would be an excellent thing, and agreed that in certain cases it might be an advantage to report the method employed together with results obtained, but, on the whole, a general standardisation of processes would tend towards the elimination of initiative on the part of the chemist.

Dr. B. S. EVANS said that he thought it desirable to differentiate between purely empirical processes and processes in which something definite had to be estimated; the thoroughly empirical Reichert process, for instance, should be standardised up to the hilt, but where some definite substance had to be estimated (as in the case of arsenic in food) the public wanted to know what was there, and it was no comfort to the authorities, the consumers, or the salesmen to know that it was estimated by a process which would give concordant results; they wanted to know the amount of arsenic actually there, and analysts must use the best method available.

Standardisation might be applied with advantage to certain of the physical determinations which analysts had to make. It was obviously impossible to use all the refinements of physical science, and the alternative was standard apparatus used in a standard way. Where this was done it should be indicated; for example, a viscosity determined in the Redwood manner might be called a "Redwood Viscosity."

If differences were really vital, as Mr. Salamon suggested they were becoming, there was this dilemma: that standardisation is proclaimed either as a counsel of perfection or as a means of "camouflaging" the analyst—and the latter is undesirable as it stops progress.

Mr. R. F. INNES said that the standardisation of methods of leather analysis and tannin analysis had been adopted some time ago, and had proved satisfactory, with certain modifications from time to time.

Mr. J. ALLAN said that the standardisation of tests might possibly lead to difficulties in certain directions, but it led to a great step in advance in processes. He referred to the Committee on Glycerin Analysis (which consisted of makers, users, and merchants of glycerin) and to the I.S.M. determinations. The methods adopted by that Committee were accepted as international standards, and their publication, in 1907, had completely stopped the disputes which had previously arisen between makers of glycerin, analysts, and the other people concerned. Of course methods of manufacture, which produced alterations in the crude material and altered in some way the general procedure, had to be taken into consideration; and changes had certainly taken place in the crude material since the Committee was first appointed, with the result that to-day the Committee was actually engaged in revising their methods. There was no reason, therefore, for standardisation causing methods to become stultified.

In his opinion standards set up by analysts for analysts were more desirable than the legal standards of a Government Department. He commended the step taken by the Society of endeavouring to exercise some supervision of processes; he thought they might go even further—many methods of analysis could very well do with standardisation.

Mr. E. R. BOLTON said that he held no brief for or against standardisation —there was much to be said from either point of view. Given standardisation, there was always the difficulty of the people who did not carry out the standard processes after the manner described—with such one could not deal.

He felt that it was not practicable to expect a Committee to continue indefinitely carrying out investigations and re-standardising the processes for which standards were demanded. He thought the only practical way of dealing with the matter would be to ask such manufacturers and others, who had a special need for the standardisation of an analytical process, to call together a Committee of chemists to confer in the matter, and it was necessary that such chemists should be paid by the manufacturers or others who were interested in obtaining these standards for the regulation of their trade and for the saving of expense in arbitration and law disputes. Such Committees would put forward to a Committee of the Society the standard processes which their particular trade was prepared to accept, and these processes might be published under the auspices of the Society —the Society merely acting as a clearing house and organising body and taking no responsibility for the accuracy of the methods.

Mr. H. JEPHCOTT said that standardisation would have very hearty support from the manufacturers. It was better, he thought, for the methods of analysis to be agreed upon by the analysts themselves than for the results of analyses to lead to actions in the Courts of Law—as would otherwise undoubtedly happen to an increasing extent, now that the food laws of the country were becoming more exacting.

Mr. E. T. BREWIS said that, in his opinion, international standardisation would be very difficult; for instance, the methods of estimating alaloids were different in different countries.

Mr. W. H. SIMMONS referred to the British Engineering Standards Association who, he said, had found no difficulty in getting people to undertake the work of standardising processes and had arrived at satisfactory methods; their reports received the sanction of sundry Government Departments, and the standardised methods were constantly revised. In his opinion it was better that chemical methods should be standardised by analysts than by engineers.

Mr. EDWARD HINKS said he found himself agreeing with about two-thirds of the remarks of each speaker. There was quite a number of standard methods in use at the present time—more especially the British Pharmacopœia methods, which were very useful in many ways. When there was uncertainty it was useful to have a standard method, so that he was inclined to encourage their adoption. Regarding the danger, mentioned by another speaker, which came from incompetence—whatever method an incompetent worker used did not really affect the issue.

Mr. M. S. SALAMON, replying, said there were other commercial people besides manufacturers who might be willing to pay for the standardisation of methods of analysis.

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.

THE SOLUBILITY OF MILK POWDER.

THE published methods for the determination of the solubility of milk powders are not satisfactory, for a number of reasons. For example, both Hunziker's method (*Condensed Milk and Milk Powder*, p. 321) and the method used at the Government Laboratory (vide *Food Reports*, 24, p. 171) fail, by reason of the difficulty of obtaining a representative sample when the powder has been taken into solution, owing to the separation, or partial separation, of fat. A further disadvantage in the Government Laboratory method is that it fails to differentiate between two powders which may show the same solubility at 60° C., but which at 20° C. would give very different solubilities.

In comparing the solubilities of two powders it is desirable to make due allowance for the moisture content and fat content of the two samples and to express the results as percentage solubility of the solids-not-fat.

The following method depends upon the estimation of the insoluble portion of the powder, and applies to both full cream and skim milk powders. Both full cream and skim milk powders should show a solubility of 99·8 per cent. or thereabouts. A milk powder of poor solubility will show a result as low as 63 per cent. :

METHOD.—(1) To about 38 c.c. of distilled water at 20° C. in a flask of 250 c.c. capacity add 5 grms. of full cream milk powder, or to 45 c.c. of water add 5 grms. of skim milk powder; cork and shake steadily for three minutes. Transfer the whole contents to a tared centrifuge tube, and whirl at about 1500 revolutions for three minutes. If full cream powder has been taken, now remove any layer of cream on the surface of the milk in the tube, and wipe any cream off the inside of the tube.

(2) Taking care not to disturb the deposit in the tube, pipette off about 5 c.c. of the liquid into a tared nickel dish of weight (w); weigh rapidly; say (a) = weight of dish plus fluid; dry for four or five hours in the steam oven, or about 5 minutes on the Mojonnier hot plate, and then for 15 minutes in the Mojonnier vacuum oven; weigh: say (b) = weight of dish plus milk solids.

($a - b$) = weight of water lost.
($b - w$) = weight of solids.

(3) Now decant as much as possible of the fluid without disturbing the residue, wipe off any cream, etc., on side of tube, and weigh the tube plus residue plus the small quantity of associated fluid: say weight of contents = (c). Then wash out the residue by means of a wash bottle into another tared dish. To hasten drying alcohol may be used to wash out the deposit. If the amount of insoluble matter is small, it may be dried in the tube instead of being washed out.

Dry in oven as in (2) and weigh.
Say (d) = weight of solids.
Then ($c - d$) = weight of water lost.

CALCULATIONS.—Assume butter fat = Y per cent.; moisture = Z per cent.

Dissolved solids in the fluid contained in $(c) = (c-d) \times \frac{b-w}{a-b} = f$.

Therefore, weight of insoluble solids contained in $(c) = d-f = s$.

Whence, insoluble matter per cent. of powder $= 20s$,

and solubility of the powder $= (100-20s)$, or,

Insoluble matter per cent. of solids-not-fat $= \frac{20s \times 100}{100-(Y+Z)}$,

and solubility of solids-not-fat $= 100 - \frac{20s \times 100}{100-(Y+Z)}$.

EXAMPLE.—Five grms. full cream powder used.

Dish + 5 c.c. fluid (a)	= 37·702 grms.	Dish + dry solids (b)	= 33·176 grms.
Dish + dry solids (b)	= 33·176 grms.	Dish (w)	= 32·604 grms.
Weight of water lost $(a-b)$	= 4·526 grms.	Dry solids $(b-w)$	= 0·572 grms.

Centrifuge tube + holder + wet residue	= 27·192 grms.	
Centrifuge tube + holder + dry residue	= 27·127 grms.	
Weight of water lost	= 0·065 grms.	$= (c-d)$.
Centrifuge tube + holder + dry solids	= 27·127 grms.	
Centrifuge tube + holder	= 27·114 grms.	
Weight of dry solids in tube	= 0·013 grms.	$= d$.

Dissolved solids in the fluid in residue after centrifuging

$$= \frac{0{\cdot}065 \times 0{\cdot}572}{4{\cdot}526} = 0{\cdot}008 \text{ grms.} = f.$$

Weight of insoluble solids from 5 grms. of powder $= d-f$.

$$= 0{\cdot}013 - 0{\cdot}008 = 0{\cdot}005 = s.$$

Whence, solubility $(100-20s) = 99{\cdot}90$ per cent.

If powder contained 2 per cent. of moisture and 28 per cent. of fat, insoluble matter per cent. of solids-not-fat $= \frac{20 \times 0{\cdot}005 \times 100}{70} = 0{\cdot}143$.

And solubility of solids-not-fat $= 100 - 0{\cdot}143 = 99{\cdot}86$ per cent.

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PUBLIC HEALTH (CONDENSED MILK) REGULATIONS, 1923.

TABLES FOR TESTING "EQUIVALENT PINTS" DECLARATION.

THE tables below may be found of service in testing the "equivalent pints" declaration on the labels of tins of condensed milk.

The method of operation is as follows:—The percentage of Total Milk Solids, Fat, or Milk Solids-not-fat in the condensed milk, as the case may be, is found in its appropriate left-hand column. Level with this figure, in a horizontal direction, will be found the minimum weights of condensed milk which will satisfy the declarations at the top of their respective columns. The weights are given in ounces and drams avoir. and grms., in each case to the next highest whole dram or grm.

An example will make the procedure clear. Let us assume a condensed milk (full-cream, sweetened) containing 31·0 per cent. of Total Milk Solids, and let the contents of the tin weigh 13 oz. 10 dr. The percentage of T.M.S. is found in the left-hand column of Table I. (the table for full-cream milks). Following the 31·0 line horizontally, we find that 13 oz. 10 dr. lies between the minimum weight for $1\frac{5}{8}$ pints (13 oz. 7 dr.), and that for $1\frac{3}{4}$ pints (14 oz. 8 dr.). The label on the tin should therefore declare $1\frac{5}{8}$ pints, since the weight found is not sufficient for $1\frac{3}{4}$ pints, and the Regulations do not recognise fractions smaller than $\frac{1}{8}$ pint. A similar procedure is used when the calculation is to be made from fat or milk solids-not-fat.

In the case of full cream milks (Table I.), it has been pointed out by Hinks (ANALYST, 1923, **48**, 596) that the declaration on the label should be satisfied by calculations from both the fat and the total milk solids, otherwise milk of the prescribed standard has not been used in manufacture. Where no analysis has been made, the T.M.S. is taken, for the purposes of calculation, to be the minimum laid down by the Regulations (31·0 per cent.), and this line has been printed in italics for ease of reference. In calculating the table the sp. gr. of the Standard Milk (12·4 per cent. T.S., 3·6 per cent. fat) has been taken as 1031·8 (Richmond's formula). The columns for T.M.S. and fat can be treated as independent of one another for the purpose of calculation.

In the case of skimmed milks (Table II. for sweetened, Table III. for unsweetened), the calculation should be made from Milk Solids-not-fat (see Hinks, *loc. cit.*). When, however, no analysis has been made, the calculation has to be made from Total Milk Solids. For this purpose it has been assumed that the skimmed milk specified in the Regulations (containing not less than 9·0 per cent. of solids-not-fat) will contain 0·1 per cent. of fat, giving a minimum T.M.S. of 9·1 per cent. and sp. gr. (Richmond's formula) of 1035·4.

Calculating from this, it is found that skimmed condensed milk of the minimum T.M.S. laid down in the Regulations (26·0 per cent. for sweetened and 20·0 per cent. for unsweetened) will contain Milk Solids-not-fat of 25·71 per cent. and 19·77 per cent. respectively (*i.e.* a fat content of 0·29 per cent. and 0·23 per cent. respectively, figures which agree well with the author's experience). These lines also have been printed in italics.

For percentages, or declarations, not included in the tables, the minimum weights may be found accurately enough by simple proportion; *e.g.* a declaration of $\frac{3}{4}$ pint will require one-half the minimum weights given for a declaration of $1\frac{1}{2}$ pints, the result in each case being rounded off to the next highest whole dram or grm.

It should be noted that the Regulations consider two distinct offences, one regarding the composition of the condensed milk, and one regarding the declaration

of equivalent pints. If the weight found has to be searched for in the tables *above* the line in italics, at least one offence (that referring to composition) *must* have been committed (except in certain cases of skimmed milk where the fat is greater than 0·29 per cent. [Table II.] and 0·23 per cent. [Table III.]), and the other *may* have occurred. If, on the other hand, the weight has to be searched for *below* the line in italics, the offence as regards composition has *not* occurred (except in those cases of skimmed milk where the fat is less than 0·29 per cent. [Table II.] and 0·23 per cent. [Table III.]), whereas the offence as regards declaration *may* have occurred.

TABLE I.—FOR FULL CREAM MILKS, SWEETENED OR UNSWEETENED.

Analysis of Condensed Milk.		Minimum Net Weight of Condensed Milk.																	
T.M.S. Per cent.	Fat. Per cent.	1⅛		1¼		1⅜		1½		1⅝		1¾		1⅞		2	
		oz. dr.	grms	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.
30·0	8·71	9.10	273	10.11	303	11.12	333	12.13	363	13.14	393	14.15	424	16.0	454	17.1	484
·2	·77	9.9	271	10.10	301	11.11	331	12.12	361	13.13	391	14.14	421	15.15	451	17.0	481
·4	·83	9.8	269	10.9	299	11.10	329	12.11	358	13.11	388	14.12	418	15.13	448	16.14	478
·6	·88	9.7	267	10.8	297	11.8	326	12.9	356	13.10	386	14.11	415	15.11	445	16.12	475
·8	·94	9.6	265	10.7	295	11.7	324	12.8	354	13.9	383	14.9	413	15.10	442	16.10	472
31·0	*9·00*	*9.5*	*264*	*10.6*	*293*	*11.6*	*322*	*12.7*	*351*	*13.7*	*381*	*14.8*	*410*	*15.8*	*439*	*16.9*	*468*
·2	·06	9.4	262	10.4	291	11.5	320	12.5	349	13.6	378	14.6	407	15.7	436	16.7	465
·4	·12	9.3	260	10.3	289	11.4	318	12.4	347	13.4	376	14.5	405	15.5	434	16.5	462
·6	·17	9.2	259	10.2	287	11.3	316	12.3	345	13.3	373	14.3	402	15.3	431	16.4	460
·8	·23	9.1	257	10.1	286	11.2	314	12.2	342	13.2	371	14.2	400	15.2	428	16.2	457
32·0	·29	9.0	256	10.0	284	11.0	312	12.0	341	13.0	369	14.0	397	15.0	426	16.0	454
·2	·35	9.0	254	9.15	282	10.15	310	11.15	338	12.15	367	13.15	395	14.15	423	15.15	451
·4	·41	8.15	252	9.14	280	10.14	308	11.14	336	12.14	364	13.14	392	14.13	420	15.13	448
·6	·46	8.14	251	9.13	279	10.13	306	11.13	334	12.13	362	13.12	390	14.12	418	15.12	446
·8	·52	8.13	249	9.13	277	10.12	305	11.12	332	12.11	360	13.11	388	14.10	415	15.10	443
33·0	·58	8.12	248	9.12	275	10.11	303	11.11	330	12.10	358	13.10	385	14.9	413	15.9	440

TABLE II.—FOR SKIMMED SWEETENED MILKS.

Milk Solids -not-Fat in Condensed Milk.	Minimum Net Weight of Condensed Milk.																
	1⅜		1½		1⅝		1¾		1⅞		2		2⅛		2¼		
Per cent.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	
24·4	10.9	298	11.8	325	12.7	352	13.6	379	14.6	407	15.5	434	16.4	461	17.4	488	
·6	10.7	296	11.6	323	12.6	350	13.5	376	14.4	403	15.3	430	16.2	457	17.1	484	
·8	10.6	293	11.5	320	12.4	347	13.3	373	14.2	400	15.1	427	16.0	453	16.15	480	
25·0	10.5	291	11.3	318	12.2	344	13.1	370	14.0	397	14.15	423	15.14	450	16.13	476	
·2	10.3	289	11.2	315	12.1	341	13.0	367	13.14	394	14.13	420	15.12	446	16.11	472	
·4	10.2	287	11.1	313	11.15	339	12.14	365	13.13	391	14.11	417	15.10	443	16.9	469	
·6	10.1	284	10.15	310	11.14	336	12.12	362	13.11	388	14.9	41[illegible]		[illegible]39	16.7	465	
25·71	*10.0*	*283*	*10.14*	*309*	*11.13*	*334*	*12.11*	*360*	*13.10*	*386*	*14.8*	*412*	*15.7*	*437*	*16.5*	*463*	
·8	9.15	282	10.14	308	11.12	333	12.11	359	13.9	385	14.8	410	15.6	436	16.5	461	
26·0	9.14	280	10.13	305	11.11	331	12.9	356	13.8	382	14.6	407	15.4	432	16.3	458	
·2	9.13	278	10.11	303	11.9	328	12.8	353	13.6	379	14.4	404	15.2	429	16.1	454	
·4	9.12	276	10.10	301	11.8	326	12.6	351	13.4	376	14.2	401	15.1	426	15.15	451	
·6	9.11	274	10.9	298	11.7	323	12.4	348	13.3	373	14.1	398	14.15	423	15.13	447	
·8	9.10	272	10.7	296	11.5	321	12.3	346	13.1	370	13.15	395	14.13	419	15.11	444	
27·0	9.8	270	10.6	294	11.4	319	12.2	343	13.0	367	13.13	392	14.11	416	15.9	441	

TABLE III.—FOR SKIMMED UNSWEETENED MILKS.

Milk Solids -not-Fat in Condensed Milk.	Minimum Net Weight of Condensed Milk.															
	1		1⅛		1¼		1⅜		1½		1⅝		1¾		1⅞	
Per cent.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr	grms.	oz. dr.	grms.	oz. dr.	grms.	oz. dr.	grms.
18·4	10.3	288	11.7	324	12.11	359	13.15	395	15.4	431	16.8	467	17.12	503	19.0	539
·6	10.1	285	11.5	320	12.9	356	13.13	391	15.1	427	16.5	462	17.9	498	18.13	533
·8	9.15	282	11.3	317	12.7	352	13.11	387	14.14	422	16.2	457	17.6	492	18.10	527
19·0	9.13	279	11.1	313	12.5	348	13.8	383	14.12	418	16.0	452	17.3	487	18.7	522
·2	9.12	276	10.15	310	12.3	345	13.6	379	14.9	413	15.13	448	17.0	482	18.4	516
·4	9.10	273	10.13	307	12.1	341	13.4	375	14.7	409	15.10	443	16.14	477	18.1	511
·6	9.9	270	10.12	304	11.15	337	13.2	371	14.5	405	15.8	439	16.11	472	17.14	506
19·77	*9.7*	*268*	*10.10*	*301*	*11.13*	*334*	*13.0*	*368*	*14.3*	*401*	*15.6*	*434*	*16.8*	*468*	*17.11*	*501*
·8	9.7	267	10.10	301	11.13	334	13.0	367	14.2	401	15.5	434	16.8	468	17.11	501
20·0	9.5	265	10.8	298	11.11	331	12.14	364	14.0	397	15.3	430	16.5	463	17.8	496
·2	9.4	262	10.7	295	11.9	327	12.12	360	13.14	393	15.0	426	16.3	458	17.5	491
·4	9.3	260	10.5	292	11.7	324	12.10	357	13.12	389	14.14	421	16.0	454	17.3	486
·6	9.1	257	10.3	289	11.5	321	12.8	353	13.10	385	14.12	417	15.14	449	17.0	481
·8	9.0	255	10.2	286	11.4	318	12.6	350	13.8	382	14.9	413	15.11	445	16.13	477
21·0	8.15	252	10.0	284	11.2	315	12.4	346	13.6	378	14.7	409	15.9	441	16.11	472

These tables have been calculated for use in the laboratories of Messrs. Lipton, Ltd., and the author wishes to express his thanks to Mr. J. W. Black, chief chemist, for permission to publish them, and for suggestions regarding the form in which they have been drawn up.

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THE REICHERT-MEISSL VALUE OF ALMOND OIL AND APRICOT KERNEL OIL.

Ross and Race (Analyst, 1911, **36**, 263) give the Reichert-Meissl value of almond oil and apricot kernel oil as 2·6. As these figures are very different from those found by Hawley and one of us (*Year Book Pharm.*, 1913, 573), and as it seemed difficult to understand such a high figure from oils having a composition such as these oils have, a number of further determinations have been made.

Sixteen samples of almond oil, obtained from various sources, have been examined, and the highest Reichert-Meissl value obtained was 0·2. In the case of eleven of the samples the figure was 0·1, whilst in four of the samples it was 0·0.

Two samples of apricot kernel oil had a Reichert-Meissl value of 0·1 in each case, whilst two samples of peach kernel oil gave 0·1 and 0·0 respectively.

The Polenske values of these oils were determined in each case, with results as shown in the following table:

Polenske Value.	Number of Samples. Almond.	Apricot Kernel.	Peach Kernel.
0·2	2	–	–
0·3	5	1	1
0·4	4	1	–
0·5	2	–	1
0·6	1	–	–
0·7	1	–	–
1·0	1	–	–

It is a little difficult to understand the high figure obtained by Ross and Race, although, as they do not give the acidity of their samples, it might conceivably be due to rancidity, as it is well-known that rancid oils give a high Reichert-Meissl value; but such oils are usually so rancid that they would not be accepted, even superficially, as normal samples. Another possible explanation is that the glycerin used in saponification contained a proportion of volatile acids, as a number of years ago it was not generally recognised that some samples of glycerin gave blanks as high as 3·0. This suggestion is supported to a certain extent by the fact that the almond oil and apricot kernel oil gave the same figure.

Whatever be the true explanation, it would appear fairly certain that these figures are abnormal, and do not represent those given by ordinary oils; in fact, it is not usual for fresh seed oils, with the exception of castor oil, to give Reichert-Meissl values of much more than about 0·5.

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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.

CITY OF BIRMINGHAM.

REPORT OF THE CITY ANALYST FOR THE FOURTH QUARTER, 1923.

THE total number of samples examined during the quarter was 1245, of which 1069 were analysed under the Sale of Food and Drugs Acts. Of these, 844 were bought informally, of which 16 were adulterated; 225 samples were bought under the provisions of the Acts, and of these 3 were adulterated.

MILK.—Of the 585 samples examined, 10 contained less than 11·5 per cent. of total solids.

CONDENSED MILK.—Six samples were taken for analysis under the new Regulations. Of these, 5 were properly labelled, but one was marked "Skimmed" on the declaration, and "Machine-skimmed" on another part of the label. As it only contained 0·4 per cent. of milk fat the declaration was incorrect, as *uncondensed* skimmed milk may contain about 1 per cent. of fat. The vendor was cautioned.

The Regulations appear to be defective in making no distinction between "skimmed" and "machine-skimmed" products. In fact, one is not aware of any condensed skimmed milk being on the English market.

EGG SUBSTITUTE POWDER.—Five samples were, as usual, little more than coloured baking powders. In one case tartaric acid was used, and in the others acid phosphate. Two samples, claiming to be "complete substitutes" for eggs, contained only 0·2 and 0·3 per cent. of fat respectively. The vendors were cautioned.

BORAX.—Six of seven informal samples contained from 1 to 3 parts of arsenic per million, but the seventh contained 100 parts per million, and ought to have been labelled as unsuitable for internal use. The vendor was cautioned.

An aluminium pan, which had been stained by boiling water in it, was examined for the Water Department. It was found that water from the works in Wales did not stain aluminium, but that harder waters from local streams or deep wells did produce a stain.

J. F. LIVERSEEGE.

COUNTY OF KENT.

REPORT OF THE AGRICULTURAL ANALYST FOR THE FOURTH QUARTER, 1923.

DURING the quarter 400 samples of fertilisers and 33 samples of feeding stuffs were submitted for analysis. Of the former, 138, and of the latter, 10 were found unsatisfactory.

SHODDIES.—The total number examined was 320; of 177 samples sold with a guarantee, deficiencies of ammonia were found in 110 samples. This unsatisfactory state of affairs could be remedied if the guarantee given at the factory could be attached to the sample taken at the farm, but at present the Fertilisers and Feeding Stuffs Act only concerns the last seller, and a vendor is exonerated from liability to prosecution if he purchases a fertiliser with a written warranty which contains a false statement subsequently used, provided that he has no reason to believe the statement to be false and that the fertiliser is sold in the same state as he received it

FUR WASTE.—A sample, guaranteed to contain 12 per cent. of ammonia, contained only 6·46 per cent.; it was also unsatisfactory owing to the fur being in very large pieces and containing waste cotton wool.

FEATHER WASTES.—One of the samples, sold as feather dust, contained nearly 50 per cent. of mineral matter or dirt, whereby its ammonia content was reduced to 8·7 per cent.

FLUE DUST.—A sample, sold at a relatively cheap rate, contained 12·6 per cent. of potash (=23·3 per cent. of potassium sulphate). Washed with water the sample yielded 14·8 per cent. of potassium sulphate, and the remainder of the potash was easily soluble in dilute acids. Field trials with flue dusts have shown that apparently they have a higher manurial value than that due merely to soluble potash.

DECORTICATED EARTHNUT CAKE.—A sample was low in albuminoids, owing to the fact that no shell had been removed from the nuts, so that the cake was really undecorticated.

The presence of as little as 0·1 per cent. of castor seed in some earthnut cake caused havoc in a dairy herd.

F. W. F. ARNAUD.

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.

CHESHIRE CHEESE.

On January 14th, R. D. Johnson was summoned at Ashton-under-Lyne for selling Cheshire cheese not of the nature, substance and quality demanded. The Inspector gave evidence that he had seen on the defendant's stall at Ashton market a large cheese labelled "Finest Cheshire Cheese," and that he had bought a pound of this cheese for 1s. 2d. under the provisions of the Act.

The official certificate of the Analyst embodied the following analysis and opinion:—"Water, 54·9; fat, 14·0; mineral matter, 4·3; proteids (casein, etc.), 24·4; and lactose, etc., 2·4 per cent. This is not a sample of Cheshire cheese, but is a cheese made from part-skimmed milk. This opinion is based upon the fact that genuine Cheshire cheese contains, at least, 24 per cent. of fat, whereas the sample contains only 14 per cent. of fat. Alternatively, genuine Cheshire cheese contains, when expressed on the water-free sample, at least 45 per cent. of fat, whereas the above sample, similarly expressed, contains only 31 per cent. of fat."

The defendant said that what was known to the trade as Cheshire cheese was cheese made under a particular system in Cheshire or adjoining counties. On his stall was Dutch cheese at 1s. 2d. and Cheshire cheese at 1s. 6d., and his assistant might not have heard the inspector ask for Cheshire cheese.

The magistrates imposed a fine of £5, with 2½ guineas costs.

SHREDDED SUET.

On February 12, Messrs. Pearks, Ltd., were summoned at the Tower Bridge Police Court for the sale of shredded suet, not of the nature, substance and quality demanded.

The packet purchased by the inspector was labelled "Britox Shredded Suet."

Mr. Ryall, for the prosecution, stated that the mixture was not declared as a mixture at the time of purchase, and, on analysis, was found to contain 76·7 per cent. of fat, 20·2 per cent. of rice flour, and 3·1 per cent. of moisture. This showed 0·6 per cent. excess of moisture, and 2·7 per cent. excess of rice flour over the mixture allowed by the now obsolete "Shredded Suet Order." He contended that there could be no warranty of a mixture such as the label indicated, and that, the Order having been annulled, it was for the Court to decide. The statement on the invoice that the article was "A mixture of suet and rice flour" could not be a warranty of the contents of the packet.

The Magistrate (Mr. Fry) said that the sale was admitted, and there was no denial that there was an admixture of rice flour in the packet. No expert evidence had been called to assist the Court, and even the prosecution did not suggest that the rice flour and moisture were much in excess. The case would be dismissed.

Dominion Laboratory, New Zealand.

FIFTY-SIXTH ANNUAL REPORT OF THE DOMINION ANALYST FOR THE YEAR 1922.

THE report of Dr. J. C. Maclaurin, of the work done in the Dominion Laboratory during the year 1922, gives particulars of the 4579 samples analysed for different Government departments, including 2637 for the Public Health Department, 597 for the Customs, 789 for the Mines Department, and 150 for the Explosives Branch.

JUSTICE.—Samples from the Justice Department comprised liquor, drugs, brandy chocolate and exhibits relating to cases of suspected poisoning. The amount of brandy in the chocolates was approximately 0·5 per cent. Poisons found in three exhibits were, respectively, arsenious oxide, cresylic acid, and potassium cyanide, each in sufficient quantity to cause death.

DEPARTMENT OF HEALTH.—Foodstuffs in great variety and some medical preparations were submitted for analysis. Preservatives were found in some foods in which they are not permitted. Boric acid was detected in four samples of bacon and three of whitebait, and salicylic acid in a lemon squash.

Samples of borax were found to contain from 10 to 350 parts of arsenic per million.

Flour and Oatmeal.—Samples of oatmeal and wheat meal preparations were analysed to enable comparisons of their nutritive values to be made. The following results were obtained:

OATMEAL AND OAT PREPARATIONS.

N/159 (1–7) were oatmeal and oat preparations. No. 1, oatmeal: a very coarse meal consisting of large uniform particles. No. 2, oatmeal: fairly finely ground meal, but coarse particles of husk present. No. 3, porridge-meal: a finely ground meal with a few particles present. No. 4, prepared meal: finely ground meal with fewer coarse particles than No. 3. No. 5, prepared meal: in thin concave flakes, roughly circular in shape; diameter, $\frac{1}{8}$–$\frac{3}{16}$ in. No. 6, prepared meal: in large flakes; the cleaned grain flattened; average size, $\frac{3}{8}$ by $\frac{1}{4}$ in. No. 7, rolled oats: similar in appearance to No. 6.

Analyses.

Results expressed as Percentages.

	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)
Water lost at 100° C. ..	8·35	8·97	8·71	8·40	9·10	8·78	9·95
Fat	7·45	7·16	8·33	7·77	8·54	9·05	7·14
Ash	1·48	1·73	1·63	1·43	1·40	1·73	1·60
Phosphoric anhydride ..	0·83	0·92	0·82	0·80	0·82	0·90	0·87
Nitrogen	1·96	1·85	2·10	2·03	1·89	2·31	2·03
Protein (N × 6·31) ..	12·37	11·67	13·25	12·81	11·93	14·57	12·81
Crude fibre	1·10	1·60	1·70	1·40	1·00	1·30	0·90
Hot water soluble, 35° C.	5·03	6·93	6·73	4·50	4·70	6·95	3·90
Cold water soluble, 10° C.	4·20	4·60	4·53	3·68	4·45	4·43	3·45
Difference	0·83	2·33	2·20	0·87	0·25	1·52	0·45
Starch (by difference) ..	69·25	68·87	66·38	68·19	68·03	64·57	67·60

The analyses show that in none of these preparations has the process of milling materially reduced the percentage of fat, or of phosphoric anhydride. In milling wheat the phosphoric anhydride is reduced from 1 per cent. in whole wheat to 0·20 per cent. in patent flour.

If the vitamin content runs parallel to the phosphoric anhydride (as it does in wheat and corn products) the above oat products are all equally rich in vitamins, and not inferior in that respect to the unmilled oats.

The very small differences in the water soluble at 10° C. and 35° C. show that in no case has any great alteration been made in the starch by heating. This was confirmed by microscopic examination.

Wheatmeal and Flour.

N/1988, 2197, 2294 (1, 2), 2295 (1, 2), 2823 (1, 2), 2824 (1, 2), 2825 (1, 2): Wheatmeal and flour. For convenience these were renumbered 1 to 12 in consecutive order.

Analyses.

Results expressed as Percentages.

	(1.) Wheat-meal.	(2.) Wheat-meal.	(3.) Wheat-meal.	(4.) Wheat-meal.	(5.) Flour.	(6.) Flour.
Water	13·90	13·44	13·18	12·97	13·75	13·46
Fat	1·69	1·98	1·95	1·87	1·14	0·94
Protein ($N \times 6·25$)	10·50	9·00	8·50	9·40	8·40	10·10
Ash	1·53	1·69	1·19	1·55	0·49	0·52
Phosphoric anhydride	0·740	0·970	0·587	0·689	0·268	0·287

	(7.) Wheat-meal.	(8.) Flour.	(9.) Flour.	(10.) Wheat-meal.	(11.) Wheat-meal.	(12.) Flour.
Water	13·92	13·58	13·38	13·40	13·40	13·60
Fat	1·82	1·00	0·96	1·78	1·65	1·03
Protein ($N \times 6·25$)	10·00	9·60	9·00	10·00	10·50	9·00
Ash	1·85	0·54	0·55	1·77	1·50	0·46
Phosphoric anhydride	0·880	0·287	0·236	0·829	0·740	0·287

It will be seen that the amount of fat in the whole meals is almost twice that found in the flours. The reduction in the amount of mineral matter is, however, more striking, the flours containing only one-third of the amount of mineral matter present in the wheatmeals. The phosphoric anhydride has suffered a corresponding reduction. If it is established that the vitamin content of flour runs parallel to the phosphoric anhydride, the above results show that the white flours sold in New Zealand are very deficient in vitamins when compared with the whole meals. It should be noted that the lowest proportion of phosphoric anhydride (0·236 per cent. in No. 9) is higher than the lowest (0·20 per cent. in Virginia patent flour) found by Voegthin and Meyers in American flour. It is probable that No. 3 is not entirely whole meal.

Chloroform.—Ten samples were examined, and all complied with the B.P. tests except one, which gave a distinct reddish colour when shaken with sulphuric acid. This was in a corked bottle, and it is suggested that unprotected corks should not be allowed in containers for anæsthetic chloroform, and that the manufacturers should be required to put the date of manufacture on the bottles.

ETHER FOR ANÆSTHESIA.—Nine samples were examined. None complied with the B.P. test for acidity, and one contained a very large amount of free acid, and gave marked reactions for peroxides. In the case of two samples of the same make the test for peroxides showed none in the newer preparation, but traces in the older one. This emphasises the necessity of discarding old preparations for anæsthetic use. As suggested in the case of chloroform, the date of manufacture ought to be stated on the bottle.

Institute of Chemistry of Great Britain and Ireland.

FORTY-SIXTH ANNUAL GENERAL MEETING: 3RD MARCH, 1924.

AT the 46th Annual General Meeting of the Institute of Chemistry, held at Russell Square to-day, the Meldola Medal, the gift of the Maccabaeans, was presented to Mr. C. N. Hinshelwood, B.A. (Oxon). The Medal is awarded for the work of most promise published by a British chemist under thirty years of age, brought to the notice of the adjudicators during the year.

Mr. A. Chaston Chapman, F.R.S., the retiring President, in his address, referred to the growing activity of the Institute during his three years of office. The roll of membership had increased by 1129, and about 1000 new chemists had been absorbed into useful professional life. He emphasised the point that the Institute endeavoured to counteract the modern tendency to turn out narrow and imperfectly educated specialists. He deplored the tendency on the part of Government departments to undervalue professional scientific and technical service, especially in view of the fact that the public chemical service is becoming every year a more important part of the machinery of government.

Dealing with the proposals for closer co-operation amongst chemical societies, which he thought should have the warm support of all, he expressed the hope that in any scheme of co-operation the Institute would not sink any of its individuality. The general public was coming more and more to recognise in chemistry one of the most powerful factors in the creation of material wealth, at a time when it is more important to create wealth than to quarrel about the distribution of what little the war had left us. He quoted Mr. Baldwin, the late Prime Minister, who, in a recent speech at Glasgow, had said that under the stimulus of the war we had made great headway in pure chemistry, and we had schools of chemistry in this country which compared with any in the world. We should take care that our industries absorbed the output of those schools, and should not be content to run only rule-of-thumb industries and leave those more highly organised industries, which depend upon science and brain power, to the foreigner. He felt that those words had a very special significance with reference to the reported negotiations between the British Dyestuffs Corporation and the Interessen Gemeinschaft.

The new President, Prof. G. G. Henderson, F.R.S., Regius Professor of Chemistry in the University of Glasgow, was formally installed.

The Officers, Council and Censors for 1924–25 were elected.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Composition of "Tasajo." A. Bickel and J. A. Collazo. (*Zeitsch. Unters. Nahr. Genussm.*, 1923, **46**, 360–363.)—"Tasajo" is a preserved meat exported from Rio de la Plata, and consists of salted and pressed flesh which has been sun-dried. A similar unsalted prepartion consumed by the natives, but unsuitable for export, is known as "charque." The following analyses of tasajo are given:

	Per Cent.	Per Cent.
Water	20·98	20·90
Albuminoids	23·25	20·48
Fat	45·15	45·00
Ash	13·51	—
(including salt)	11·63	—

Biological experiments proved that "tasajo" is rich in vitamins *A* and *B*.

H. E. C.

Estimation of Rye Flour in Wheat Flour. J. König and F. Bartschat. (*Zeitsch. Unters. Nahr. Genussm.*, 1923, **46**, 321–339.)—The authors have thoroughly investigated chemical methods for the estimation of these two flours when present in admixture, and show that the diastase method proposed by several workers (*e.g.* Amberger, ANALYST, 1922, **47**, 73), methods dependent on the gluten content, on the solubility of the non-glutenous protein, or on the protein soluble in 20 to 70 per cent. alchohol are not reliable for the analysis of the mixed flours. It is shown, however, that the percentage of the total protein soluble in saturated solution of calcium sulphate is constant for each flour, and independent of the actual amount of protein in any particular sample of the flours. Ten grms. of the flour are moistened in a 500 c.c. flask with the saturated calcium sulphate solution at the room temperature (0·22 grm. in 100 c.c.), made up to the mark and shaken in a machine for one hour, after which the nitrogen is estimated in 100 c.c. of the clear filtrate and expressed as percentage of the total nitrogen in the flour. Treated in this way, wheat flour shows 29·1 per cent., and rye flour 51·5 per cent., so that the proportion of the two flours may be interpolated from the following table:

Wheat.	Rye.	Per Cent.	Wheat.	Rye.	Per Cent.	Wheat.	Rye.	Per Cent.
100	—	29·1	60	40	38·06	20	80	47·02
90	10	31·34	50	50	40·30	10	90	49·26
80	20	33·58	40	60	42·54	—	100	51·50
70	30	35·82	30	70	44·78			

The average experimental error with the method is about 5 per cent., but may be exceeded in the case of flour of unusually high acidity. H. E. C.

Rapid Analysis of Sugars. Purification and Concentration of Enzyme Solutions. F. W. Reynolds. (*J. Ind. Eng. Chem.*, 1924, **16**, 169–172.)—Yeast extracts may be decolorised and clarified by dialysing the crude extracts in collodion dialysing sacks for twenty-four hours, or longer, against running water; 4 drops of acetic acid per 100 c.c. of extract are then added and, after fifteen hours, the flocculent precipitate produced is removed by filtering the extract through paper. The clarified extract thus obtained is concentrated by filtering off the required amount of water through a collodion membrane filter; the enzyme is retained on the filter and thereby obtained in concentrated form. It is quite practicable, in this way, to prepare invertase solutions, which, when used in the proportion of 10 c.c. per 100 c.c. of sucrose solution, will hydrolyse the sucrose completely within fifteen minutes at ordinary temperature. W. P. S.

Compounds developed in Rancid Fats. W. C. Powick. (*J. Agric. Res.*, 1923, **26**, 323–362.)—The Kreis test with phloroglucinol and hydrochloric acid is the chemical reaction which gives results most nearly parallel with organoleptic tests for rancidity; but application of the test to a large number of substances which have been suggested as the cause of rancidity shows that the fatty acids, their corresponding aldehydes, hydroxy-stearic acids, acrolein, methyl-glyoxal, dihydroxyacetone and oleic acid ozonide, do not give the reaction and are not the cause of the phenomenon. Oxidation of oleic acid produces a typical rancidity; hence the glyceryl radical is not essential. A number of substances give reddish or pink colours with phloroglucinol and hydrochloric acid as, for example, cotton seed oil, but such colours are distinguishable spectroscopically from the colour of true rancidity; this latter has a maximum extinction coefficient in hydrochloric acid solution at a wave length of approximately 5400; hence, if the colour obtained with the Kreis test is examined spectroscopically, the reaction becomes a true criterion. Epihydrin-aldehyde, an unstable compound formed by the interaction of acrolein and hydrogen peroxide which has not been completely separated, gives the colour of rancidity and is its probable cause, although nonyl aldehyde is responsible for the characteristic smell. It is suggested that the epihydrin compound is formed by the atmospheric oxidation of oleic acid, with the concurrent formation of heptyl and other aldehydes which have been isolated from rancid fats. A review of previous work, together with a bibliography, is given. H. E. C.

Oil of *Cyperus esculentus*. J. Pieraerts. (*Matières Grasses*, 1924, **16**, 6674–6681.)—A detailed study of the oil pressed out from the fleshy tubercles at the end of the rhizome of this plant (found in Mediterranean countries) is given. They contain 20 to 27 per cent. of a liquid pale yellow edible oil having the following characteristics:—Sp. gr. at 15°, 0·9176; solidifying point, liquid at 1° C.; saponification value, 191·3; unsaponifiable matter, 0·62 per cent.; iodine value, 76·9; Reichert-Meissl value, 0·2; free fatty acids as oleic, 0·85 per cent.; rotatory power, +0·06. The low temperature at which stearine is deposited, together with the good keeping qualities, enhances the value of the oil for edible purposes.

The oil is non-drying, and the lead salt ether separation shows approximately 80 per cent. of liquid and 20 per cent. of solid fatty acids. The liquid acids had an iodine value of 84·6 and consisted chiefly of oleic acid, and the solid acids (approximately 60 per cent. of palmitic and 40 per cent. of myristic acids) had an iodine value of 75·1. For further detailed analysis the original paper should be consulted. It also includes references to the distribution of the genus *Cyperus* in the Congo.

W. F. Baughman and G. S. Jamieson (*J. Agric. Res.*, 1923, **84**, 77–82, and *J. Soc. Chem. Ind.*, 1924, **43**, B139) agree, in the main, with the characteristics of the oil given above, but they found the oil (obtained by extraction with petroleum spirit) to consist of the glycerides of the following acids: Oleic, 73·3; palmitic, 11·8; stearic, 5·2; linolic, 5·9; arachidic, 0·5; lignoceric, 0·3 per cent.; and myristic, a trace. D. G. H.

Vernine in Green Leaves and Berries of the Coffee Plant. T. de A. Camargo. (*J. Biol. Chem.*, 1924, **58**, 831–834.)—The berries of the coffee tree in varying stages of development, while yet green, contain caffeine, adenine, hypoxanthine, xanthine and vernine (guanosine), this last in relatively large quantities. Experimental details are given of work carried out on the green leaves and berries of the coffee tree of the species "arabica." In these exists a pentoside containing guanine. This is probably the guanosine discovered in several plants by Schulze, and by Levene and Jacobs in nucleic acid. This pentoside is probably the origin of the caffeine in the green leaves and berries of the coffee tree. The guanosine is transformed to guanine, then to xanthine, and, lastly, from xanthine to caffeine, by the action of enzymes. P. H. P.

Estimation of Paraffin Oil in Pharmaceutical Preparations. J. Weichherz and Z. Klinger. (*Chem. Zeit.*, 1924, **4**, 20.)—Paraffin oil emulsions are generally prepared by means of carbohydrates or albumins. Comparative results are given showing the percentages of oil, as estimated by extraction in a Soxhlet apparatus for a minimum time of 36 hours, and also by the following method:—Five grms. of the emulsion are treated with 100 c.c. of a 35 per cent. potassium hydroxide solution and kept gently boiling for half an hour. The solution is cooled and shaken with 50 c.c. of petroleum spirit, which separates completely in one or two minutes, after which 25 c.c. are pipetted off, evaporated in a tared flask, and the residue heated to constant weight at 105° C. This rapid method is not free from error, which, however, lies between the limits of 0·66 and 1·45 per cent. The preparations examined included "Cristolax," "Laxamel," "Semprolin," and two emulsified by means of milk with malt extract and gum arabic. Hydrolysis of the emulsifying agent by means of strong sulphuric or hydrochloric acids was not satisfactory, as this treatment caused much darkening in colour, and the shaking with the petroleum spirit caused a stable emulsion. Different samples of the above trade products showed much variation in the paraffin oil content, *e.g.* "Cristolax," 44 to 51 per cent.; "Semprolin," 77 to 80·5 per cent.; and "Laxamel," 59 to 63 per cent. R. F. I.

Biochemical, Bacteriological etc.

Absorption of Metallic Salts by Fish. A. Thomas. (*J. Biol. Chem.*, 1924, **58**, 671–674.)—Experiments with nickel salts were carried out on a number of fish of the species *Fundulus heteroclitus*. The preparation of the fish for analysis is described, and also the method of analysis. Fish were kept in sea water to which nickel chloride had been added, and a table gives the amount of nickel absorbed from solutions of different concentrations in a given time by *Funduli*, in terms of metallic nickel in the dried material, as found by analysis. *Funduli* absorb a considerable proportion of nickel from solutions of the chloride in sea water without evidence of poisoning. They exhibited no signs of sickness, even after 2 weeks in solutions of $N/250$ concentration. In fresh water, however, nickel chloride is toxic, even though the fish are accustomed to fresh water. A solution of $N/8{,}000$ concentration caused death in a few hours. Nickel was eliminated from *Funduli* after the fish had been kept in running sea water for 8 days, subsequent to their immersion in a $N/500$ solution of nickel chloride in sea water for 90 hours. P. H. P.

Estimation of the Hydrogen Cyanide Content of Amygdalin. J. H. Roe. (*J. Biol. Chem.*, 1924, **58**, 667–669.)—The author's method for estimating simple, soluble cyanides (*J. Amer. Chem. Soc.*, 1923, **45**, 1878) is applied to the estimation of the hydrogen cyanide produced from amygdalin by enzymic hydrolysis and application of the aeration procedure, and this method should prove a favourable means for quantitative investigations of cyanogenetic plants in general. The procedure is as follows:—An apparatus suitable for aeration is prepared. In one flask a 0·10 grm. sample of amygdalin is placed, about 0·05 grm. of the enzyme emulsin added, and then 100 c.c. of water, and a few drops of amyl or capryl alcohol. A stopper is now inserted, the aeration tubes are closed by means of rubber tubing and pinch-cocks, and the flask is thoroughly shaken and warmed to 45° for 15 minutes. This flask is then connected with a second flask containing 100 to 150 c.c. of 5 per cent. sodium hydroxide, and attached to a suction pump. A current of air is passed through the flask containing the amygdalin mixture into the one containing alkali, at the rate of about 3 litres per minute, thus carrying the freed hydrogen cyanide over, aeration is continued for about 3 hours, and then the flasks are disconnected. After 10 drops of 10 per cent. potassium iodide have been added to the alkaline cyanide solution in the second flask, as an indicator, it is titrated with 0·01 N silver nitrate until a faint turbidity appears. The reading of the burette, multiplied by 0·0005404, gives the number of grms. of hydrogen cyanide yielded by the sample of amygdalin. It is important to notice that the enzyme continues to work while aeration is in progress. P. H. P.

Destruction of Vitamin *B* by Age. G. M. Findlay. (*Biochem. J.*, 1923, **17**, 887–890.)—Samples of Indian lentils and peas kept for 38 years still contained appreciable quantities of vitamin *B*. In contradistinction to the observations of

Ghose (*Biochem. J.*, 1922, **16**, 35), however, they appeared to have lost a small amount of their vitamin *B* content, even if allowance was made for the slight differences of technique in the experiments described (*e.g.* the rats fed with the lentils were somewhat lighter in weight than those used by Ghose). The author could not obtain fresh lentils for comparison with the old seeds. Graphs of the results of his experiments are given. Seeds which have lost the power of germination have not necessarily lost all their vitamin *B* content. The whole question of the destruction of vitamin *B* with age is obviously one which requires further and fuller investigation, more especially in regard to the effects of different climatic conditions, *e.g.* heat and moisture, on the rate of destruction. P. H. P.

Alleged Colour Reaction for Vitamin *C*. H. D. Kay and S. S. Zilva. (*Biochem. J.*, 1923, **17**, 872–874.)—Recently Bezssonoff (ANALYST, 1921, **46**, 462) devised a reagent—a modification of Folin's reagent for phenol—which he claimed gave a specific colour reaction for the antiscorbutic factor, because with certain antiscorbutically active substances it gave a positive reaction. The authors have employed this reaction on a great many substances which have been simultaneously tested on guinea-pigs, and have decided that the test is not reliable enough to be of any use in the detection of the vitamin. They describe experiments showing that an antiscorbutically active substance, *viz.* decitrated lemon juice (adsorbed with "norit") fails to give the colour reaction, and certain antiscorbutically inactive substances, *viz.* yeast and yeast-extract, produce the blue coloration in question. Similarly, when the blue coloration obtained with an active substance is compensated in a comparator with untreated marmite, the same olive-green coloration is produced as that obtained with the reagent and a yeast preparation, marmite. It is obvious that the reagent is not specific for the detection of vitamin *C*. It is of interest to notice that the substance which gives the blue reaction is, like the vitamin, destroyed by oxidation. P. H. P.

Some Chemical Reactions of the Substance Containing Insulin. H. A. Shonle and J. H. Waldo. (*J. Biol. Chem.*, 1924, **58**, 731–736.)—The pancreatic substance containing insulin used in this work was prepared from the pancreas of hogs. Attempts were made to isolate the physiologically active substance as a compound possessing a definite chemical constitution, or to discover some characteristic reaction peculiar to the active principle. Neither of these results was achieved, but disconnected data were secured. From these the authors conclude that the pancreatic substance containing insulin appears to be a complex mixture of proteoses, which give typical protein reactions. Numerous unsuccessful attempts were made to reactivate insulin (destroyed by a brief warming in an alkaline medium) by warming with acid, and also to reactivate reduced insulin by oxidation. It was also found that precipitation methods are inadequate to purify insulin to the point of securing a substance of constant composition. Further research must determine whether the active principle is a proteose, or is merely intimately associated with a proteose fraction. P. H. P.

Active Chlorine as a Germicide for Milk. H. Hale and W. L. Bleecker. (*J. Agric. Res.*, 1923, **26**, 375–381.)—The germicidal activity in milk of chlorine from chlorine water, and from sodium and calcium hypochlorites has been compared. The results show that chlorine water is much the most efficient; one part of chlorine in 1000 reduced the total bacteria in milk from 1,500,000 to 7000 per c.c., and killed all *B. coli* in 45 minutes, and 1 in 3000 reduced the bacterial content to 160,000; at this concentration the flavour is only just perceptible. Chlorine from sodium or calcium hypochlorite only attains this efficiency in 1½ and 19 hours, respectively, and both salts seriously affect the flavour. The germicidal action is not strictly proportional to the concentration. The *o*-toluidine test for free chlorine is not applicable to milk, and gives no colour with quite high concentrations; the starch-iodide reaction has a limit of sensitiveness in milk of about 1 in 160,000. H. E. C.

Toxicological and Forensic.

Contamination of Beverages and other Food with Zinc. J. W. Sale and C. H. Badger. (*J. Ind. Eng. Chem.*, 1924, **16**, 164.)—Analyses of bottled "root" beer, which had produced vomiting immediately after it had been consumed, showed that the beverage contained 229 mgrms. of zinc per litre. The metal had possibly been dissolved from galvanised pails in which the beer had been kept before being bottled. Other cases of zinc poisoning due to the consumption of foods which had been in contact with galvanised vessels are recorded, and the authors have determined the rate at which zinc is dissolved by various liquids from ordinary galvanised iron pails; the results obtained are given in the following table:

	Zinc mgrms. per litre.		Acidity c.c. *N*/10 acid per litre.	
	After 17 hrs.	After 41 hrs.	After 17 hrs.	After 41 hrs.
Tap water	5	21	0	0
Distilled water	9	27	1	0
Carbonated water	193	181	348	96
Milk	438	1054	—	1109
Orangeade	530	854	397	533
Lemonade	1411	2700	493	366

The increase in the acidity of the orangeade was due to the formation of carbon dioxide by fermentation. W. P. S.

Agricultural Analysis.

The Perchlorate Method for the Estimation of Potassium in Soils. H. J. Page. (*J. Agric. Sci.*, 1924, **14**, 132–138.)—High results in the estimation of potash in soils and fertilisers when using the perchlorate method led to the examination of commercial perchloric acid, and it was found that when chloric acid is present, even to a comparatively small extent, high results are obtained,

due to the partial insolubility of barium and potassium chlorates in alcohol. The perchloric acid method is quite as accurate as the well-known platinum method, but it is essential to test the acid for chlorate, which is readily done by boiling the diluted acid with ferrous sulphate and testing with silver nitrate. It is also shown that when estimating potash in soil deficient in lime it is sufficient to add 0·1 grm. of calcium carbonate, instead of 0·5 grm. as recommended by Neubauer. This effects a considerable saving of perchloric acid. H. E. C.

Estimation of Nitrates in Soils by the Phenoldisulphonic Acid Method. H. J. Harper. (*J. Ind. Eng. Chem.*, 1924, **16**, 180–183.)—In the method described clear and colourless soil extracts, free from organic substances (which yield a coloration with the reagent) are obtained by treating the extract with copper sulphate and calcium hydroxide. Fifty grms. of the soil are shaken for ten minutes with 250 c.c. of water, containing 5 c.c. of *N*/1 copper sulphate solution; 0·4 grm. of calcium hydroxide and 1 grm. of magnesium carbonate are then added, the mixture is shaken for five minutes, and filtered. Ten c.c. of the filtrate (or more if the nitrate content is very small) are evaporated to dryness in a basin, the residue, when cold, is treated with 2 c.c. of phenoldisulphonic acid, and the basin is rotated so that the reagent comes into contact with all the re[illegible]due. After ten minutes 15 c.c. of water are added, the solution is coo[illegible], rendered slightly ammoniacal, and the coloration is compared with that produced by a known amount of nitrate. If the soil contains more than 15 parts of chloride per million, the 250 c.c. of water with which the extract is made should also contain 10 c.c., or more, of 0·4 per cent. silver sulphate solution. The phenoldisulphonic acid is prepared by dissolving 25 grms. of pure phenol in 150 c.c. of concentrated sulphuric acid, adding 75 c.c. of fuming sulphuric acid, and heating the mixture at 100° C. for two hours. W. P. S.

Estimation of Tannin in Plant Tissues. P. Menaul. (*J. Agric. Res.*, 1923, **26**, 257–258.)—Twenty grms. of the ground grains or tissue are thoroughly extracted with petroleum spirit for at least 12 hours, and 200 c.c. of 95 per cent. alcohol are added to the dry residue, and allowed to stand for 16 hours, with occasional shaking, and then filtered. To 10 c.c. of the filtrate 2 c.c. of 10 per cent. lead acetate solution are added, the mixture is warmed to 75° C., and then centrifuged, and the liquor decanted. The tannin in the residue is dissolved, and the lead precipitated by the addition of 5 to 10 drops of 5 per cent. sulphuric acid. The mixture is now diluted and centrifuged, and the clear solution diluted to 50 or 100 c.c. To this is added 2 c.c. of the reagent described below, and the intensity of colour is matched against standard solutions containing 1 or 2 mgrms. of tannin in 50 c.c. The reagent is prepared by boiling 100 grms. of sodium tungstate, 30 grms. of arsenious oxide, 300 c.c. of water, and 50 c.c. of hydrochloric acid under a reflux condenser for 2 hours, and then diluting to 1 litre. The colour is affected by reducing agents, but not by phenols, sugars or proteins, and is stable for about 1 hour; it is not specific for tannins, but these are the only substances producing a colour after the above process of extraction. H. E. C.

Organic Analysis.

Evaluation of Purity of Various Organic Products by the Dichromate Method. E. C. Grey. (*Biochem. J.*, 1923, **17**, 768–771.)—The author discusses his own dichromate method (*J. Chem. Soc.*, 1914, **105**, 2204) for the volumetric estimation of carbon and that of Martin (*Rev. Intern. Falsif.*, 1904, **17**, 48; *J. Chem. Soc., Abstr.*, ii, 520) for the estimation of alcohol. The former measures the carbon dioxide produced and, when necessary, the acetic acid formed, whilst the latter measures the dichromate reduced, and is more convenient to employ. Provided the oxidation products are known, the dichromate method could be used for estimating many substances. By combining the two methods, two constants can be obtained, which permit of the estimation of the proportions of substances. In calculating the dichromate value of any aliphatic substance, the rule is that the substance is completely oxidised to carbon dioxide, except the carbon atom of a methyl group and the next adjacent carbon atom, which appear as acetic acid. Results of experiments described, measuring the dichromate reduced, support the writer's theory that substances devoid of methyl groups should yield no acetic acid, but only carbon dioxide and water. Succinic acid is apparently the one exception to the rule. The oxygen equivalent of any substance can, therefore, be calculated and tables constructed for mixtures of any two substances. The proportions of a mixture of two alcohols can be ascertained, and also the proportions of two acids in a mixture, provided there is a difference in their oxygen value. P. H. P.

Iodimetric Estimation of Osazones. D. R. Nanji. (*Biochem, J.*, 1923, **17**, 761–763.)—During the study of the decomposition of osazones with hydrochloric acid it was observed that so long as the ratio of the nitrogen to the hydrochloric acid used was fixed, the percentage of the osazone decomposed was constant. By keeping the amount of hydrochloric acid constant and varying the amount of nitrogen present, a curve was obtained which gave very concordant results when applied to different sugar osazones. This is the basis of the following empirical method for the estimation of nitrogen in sugar osazones: The phenylhydrazine formed is estimated by the iodimetric method of Ling and Nanji (*Biochem. J.*, 1921, **15**, 466). From 5 to 60 mgrms. of the osazone are treated in a Freudrich flask with 10 c.c. of *N* hydrochloric acid, the mixture is heated in a boiling water bath for 1 hour, then washed into a beaker, and to it 10 c.c. of *N* sodium hydroxide are added. It is next acidified with a drop of dilute acetic acid, and the solution made alkaline with an excess of pure sodium bicarbonate solution. The alkaline solution is then washed into an Erlenmeyer flask containing an excess of a known volume of standard 0·02*N* iodine solution. The excess of the iodine is found by titration with a standard solution of sodium thiosulphate. A table is given showing the amounts of nitrogen which correspond to different numbers of c.c. of 0·02 *N* iodine solution used. P. H. P.

Essential Oil of Manuka. (*Leptospermum scoparium.*) R. Gardner. (*J. Soc. Chem. Ind.*, 1924, **43**, 34–35T.) This shrub is very plentiful in New Zealand; the oil distilled from the leaves and branchlets is pale greenish-yellow in colour. It showed $[n]_D$, 1·50; Sp. gr. at 15° C., 0·921; with a range of b. pt. from 160°–270° C. The approximate composition of the oil was found to be phenols (leptospermol), 2·8; terpenes, 2·8; esters of cinnamic acid, (calculated as ethyl cinnamate), 4·8; other esters (acetic etc., esters of alcohol, unidentified, of rose odour) calculated as $CH_3COOC_{10}H_{15}$, 12·9; semi-solid, non-volatile matter, 7·7; sesquiterpene (by difference), 69·0 per cent. The sesquiterpene gives similar reactions to aromadendrene, but yields a definite liquid monohydrochloride.

D. G. H.

Rutin from the Flowers of Elder. C. E. Sando and J. U. Lloyd. (*J. Biol. Chem.*, 1924, **58**, 737–745.)—Details are given of the preparation and purification of a yellow pigment from the white flowers of the elder (*Sambucus canadensis* L.) which was briefly described by Lloyd (*Eclectic Med. J.*, 1920, **80**, 591) and tentatively called "eldrin." The authors have attempted to establish its exact identity and to determine its composition. Figures show the resemblance between crystals of eldrin and crystals of *Eschscholtzia* rutin. Results show that purified eldrin has the same empirical composition as rutin; that upon hydrolysis it yields quercetin, glucose and rhamnose; that the quantity of quercetin obtained, with a slight difference shown by investigation to be caused by the presence of an impurity, difficult to eliminate, agrees with the quantity theoretically expected from rutin; and that spectroscopically eldrin agrees with authentic rutin from *Eschscholtzia*. The authors feel justified therefore, in concluding that eldrin, the yellow pigment from the flowers of *Sambucus canadensis* L., is rutin. ($C_{27}H_{30}O_{16}$.) P. H. P.

Application of a new Reaction of Resorcinol to the Detection of Nitroprussides and Ammonia. M. Caseneuve. (*Bull. Soc. Pharm. Bordeaux*, 1923, No. 3; *Ann. Chim. anal.*, 1924, **6**, 43–44.)—If the reagent of Legal (nitroprusside, sodium hydroxide and acetic acid) is applied to a solution containing at least 1 per cent. of resorcinol, a green coloration results. Substitution of sodium by ammonium hydroxide renders the reaction more delicate. According to the quantities of reagents used, the presence of resorcinol, nitroprusside and ammonium hydroxide may be detected. *Resorcinol*:—To 2 or 3 c.c. of a solution containing 10 c.c. of a recently prepared 10 per cent. solution of sodium nitroprusside, 5 c.c. of a saturated solution of sodium acetate and 10 c.c. of ammonium hydroxide, are added a few drops of resorcinol solution. A green or blue-green coloration develops with as little as 0·5 mgrm. of resorcinol, and the reaction is not produced by other phenols. *Nitroprusside*:—To 2 or 3 c.c. of a 10 per cent. solution of resorcinol in ammonium hydroxide (scarcely yellow if the resorcinol is pure) are added a few drops of a solution of a nitroprusside or a particle of the solid salt. The presence of 0·1 mgrm. of nitroprusside gives rise to a blue-green coloration, which also results from salts of zinc, cadmium, nickel and cobalt, but, in the latter cases, the colour is not altered by adding an excess of sodium hydroxide, which, in the case of the nitroprusside,

causes a change to yellow. *Ammonia gas and volatile amines.* A drop of a freshly made solution of 2 grms. of sodium nitroprusside, 1 grm. of resorcinol, and enough water to dissolve them, held on the end of a glass rod, turns blue or blue-green in the presence of these gases. In the case of ammonium salts the ammonia is first liberated by means of sodium or potassium hydroxide. D. G. H.

Estimation of Cellulose in Wood by the Chlorination Method. G. J. Ritter and L. C. Fleck. (*J. Ind. Eng. Chem.*, 1924, **16**, 147–148.)—Two chlorination methods were investigated, the long method (20, 15, 15, 10 and 10 minutes' chlorination) and the short method (5, 5, 5, and 5 minutes' chlorination). The removal of lignin from the cellulose was about the same in both methods, indicating that the reaction between lignin and chlorine is fairly rapid; the substance, "lignin chloride," soluble in sodium sulphite solution, must be removed from the surface of the wood particles, since it is impermeable to chlorine, and prolonged contact of the gas with chlorinated saw-dust has little effect in further removing lignin. The short method yields slightly more cellulose than does the long method, the difference between the two varying from 0·5 to 1·41 per cent. according to the kind of wood. In general, the pentosan content of the celluloses obtained by the two methods is about the same, and there is not much difference in the amounts of α-, β-, and γ-cellulose in the two products. Prolonged chlorination, however, breaks down the α-cellulose. W. P. S.

Estimation of Copper in Cellulose Substances by the Molybdomanganic Method of Fontès-Thivolle. H. Gault, B. C. Mukerji. (*Comptes rend.*, 1924, **178**, 711–13.)—The microchemical estimation of copper by the Fontès–Thivolle method, as applied to celluloses, gives very satisfactory results, and is carried out as follows:—Fifty c.c. of Fehling's solution in 100 c.c. of water are put into a pyrex glass flask provided with a mechanical agitator and a condenser ground into the neck. A known weight of cellulose (about 1 grm.) is introduced into the boiling solution, heated by a bath of calcium chloride at 120° C., and boiling continued for exactly 15 minutes. The cellulose, with the cuprous oxide, is separated by filtering and washing, and the cuprous oxide either dissolved directly in the phosphomolybdic reagent, or the filter paper and its contents are ignited in Pregl's micro-furnace, reduction to metallic copper effected by means of a current of pure hydrogen, and the copper dissolved in the reagent; the second method of procedure is twice as accurate as the former. The molybdenum is then estimated by titration with a 0·008 per cent. solution of permanganate. The whole estimation only takes 30 minutes. Tables of results for different purified celluloses and hydro-celluloses are given to three places of decimals, but it is pointed out that such precision is only of meaning when the different estimations are carried out under absolutely identical conditions. Corrections are necessary if other metals, particularly iron, are present. D. G. H.

Action of Trypsin on Various Leathers. A. W. Thomas and F. L. Seymour-Jones. (*J. Ind. Eng. Chem.*, 1924, **16**, 157–159.)—It is shown that trypsin is capable of hydrolysing collagen (*e.g.*, hide-powder) which has been treated with

such substances as gallotannin, quinone, formaldehyde, and copper sulphate. Copper sulphate appears to combine with the carboxyl group, and in this case both tryptic and ordinary hydrolysis proceed to the same extent as with untanned hide-powder. With quinone and formaldehyde, combination probably takes place at the amino group, and the amount of hydrolysis depends on the quantity of tanning substance combined with the collagen. Some other kind of combination seems to occur in chrome tannage, since chromed hide-powder is not hydrolysed by trypsin.

W. P. S.

Inorganic Analysis.

Separation of Bismuth as Phosphate. G. Luff. (*Chem. Zeit.*, 1924, **48**, 61.)—The method previously described (ANALYST, 1923, **48**, 238) for the separation of bismuth from lead, copper, and cadmium has been found applicable to the separation from silver, manganese, zinc, nickel, cobalt, magnesium, aluminium, and ferric iron. Silver was recovered from the filtrate as chloride, and the five divalent metals as tertiary phosphates $M''NH_4PO_4$. Aluminium and iron were precipitated as phosphates by neutralisation of the filtrate with ammonia and digestion at boiling heat in a porcelain dish. The two precipitates, which are difficult to wash out, being contaminated with silica, must be evaporated with hydrofluoric and nitric acids until the weight after ignition is constant.

W. R. S.

Estimation of Alkali Metals in Aluminium and its Alloys. Schürmann and Schob. (*Chem. Zeit.*, 1924, **48**, 97–98.)—The method is based on the precipitation of aluminium chloride by saturation of the solution with hydrogen chloride. From 5 to 20 grms. of metal are dissolved in hydrochloric acid; the solution, diluted to 300 to 600 c.c., is cooled with a freezing mixture (ice-salt), and saturated with hydrogen chloride gas through a funnel dipping into the liquid. The precipitate is filtered off on a perforated porcelain disc covered with small porcelain fragments, supporting a 2 cm. layer of sand, which is again covered with porcelain fragments. The filtering material is previously extracted with hot strong hydrochloric acid until the extract leaves no fixed residue. The filter can be used again after being washed with dilute hydrochloric acid. The crystalline precipitate is washed with hydrochloric acid saturated with hydrogen chloride. The filtrate and washings are evaporated in a platinum dish, the residue is taken up with water and a few drops of hydrochloric acid, and the last traces of aluminium and iron are precipitated with ammonia. The filtrate is evaporated and treated with a few drops of ammonia and ammonium oxalate. The filtrate from the last operation is evaporated with sulphuric acid, and the residue ignited and weighed as sodium sulphate. This should be tested for purity by solution in water and addition of a few drops of ammonia and ammonium carbonate; if cloudy, the solution must be filtered, and the filtrate treated as before. Blank tests must be carried out, and the same glass vessels used in successive analyses. In the case of copper or zinc

alloys, these metals are removed by the usual method before or after the precipitation of aluminium chloride. The process was found to be reliable for the separation of small quantities of sodium and lithium from large quantities of aluminium. (See also ANALYST, 1922, **47**, 452.) W. R. S.

The Carrying down of Cobalt and Nickel by Tin Precipitated as Stannic Sulphide. V. Auger and L. Odinot. (*Comptes rend.*, 1924, **178**, 710–711.)—Hydrogen sulphide, passed into solutions of stannic salts, generally results in the formation of mixtures of stannic sulphide and meta- and para-stannic acids, which are particularly liable to carry down cobalt and nickel. Solutions containing, respectively, about 24 mgrms. of cobalt chloride and 45 mgrms. of stannic chloride in 100 c.c. of water, acidified with hydrochloric acid, so that they contained 0·5 to 7 per cent. of hydrochloric acid (tin is not completely precipitated if more acid is present), were treated with hydrogen sulphide, and the precipitate washed with hydrogen sulphide water, and then dissolved in hydrochloric acid containing a few drops of nitric acid, evaporated to dryness, taken up with concentrated hydrochloric acid, and the cobalt estimated colorimetrically. The proportion of cobalt carried down was approximately in inverse ratio to the acidity of the solution, so that tin and cobalt cannot be separated by this method. If, however, the stannic solution is first reduced to the stannous condition, no cobalt is carried down. Nickel solutions behave in a similar way. If precipitation of the tin from the stannic solution is carried out by means of cupferron, no nickel or cobalt is found to be present.

Colorimetric Estimation of Cobalt.—Cobalt salts, dissolved in a large excess of concentrated hydrochloric acid, free from all traces of iron, give a blue coloration, due to formation of a cobaltohydrochloric acid. If increasing quantities of water are added to 40 per cent. hydrochloric acid, practically no lessening in intensity of colour occurs with 10 to 20 c.c. of water present in 100 c.c. of mixture, but, on adding more water, the colour diminishes rapidly, and when 7 c.c. of hydrochloric acid and 3 c.c. of water are present, is only 85 per cent. of its first intensity; 50 per cent. with 6 c.c. of acid and 4 c.c. of water, until finally, with 4·5 c.c. of acid and 5 c.c. of water, the colour turns pink, with re-formation of Co++ions.

D. G. H.

Direct Estimation of Secondary Phosphate. I. N. Kugelmass and C. Rothwell. (*J. Biol. Chem.*, 1924, **58**, 643–648.)—Saturated calcium sulphate is a precipitant of secondary phosphate, forming calcium orthophosphate according to the equilibrium equation: $4K_2HPO_4 + 3CaSO_4 \rightleftarrows Ca_3(PO_4)_2 + 2KH_2PO_4 + 3K_2SO_4$. This equation was confirmed by analysis of the precipitate, as well as by conductivity measurements. The following simple method is given for the direct estimation of secondary phosphate, containing at least 0·05 mgrm. of phosphorus as phosphoric acid in the presence of 20 times the amount of primary phosphate in solution, with an error of ± 5 per cent.:—To 1 c.c. of a solution containing at least 0·05 mgrm. of phosphorus as phosphoric acid in a centrifuge tube, 5 c.c. of saturated calcium sulphate are added, and the tube is put in a water bath at 60°

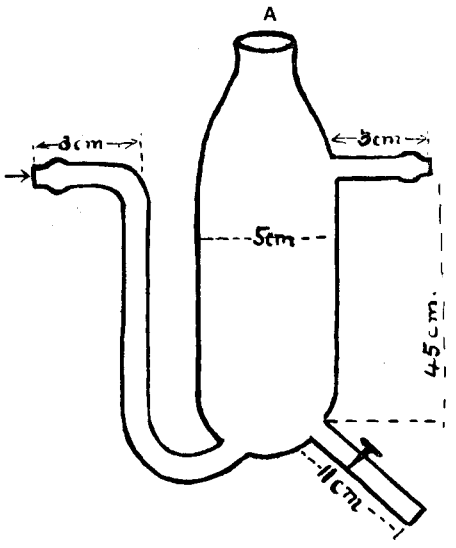
for a few minutes. The solution is centrifuged, the supernatant liquid is blown off, and the precipitate is twice washed with warm, half-saturated calcium sulphate solution. The final residue is dissolved in 10 per cent. nitric acid, the volume made up to 10 c.c., and the phosphorus is estimated in an aliquot portion by Briggs' modification of the Bell-Doisy method (*J. Biol. Chem.*, 1922, **53**, 13). The value of phosphorus obtained colorimetrically, multiplied by 2, equals the phosphorus of the secondary phosphate. Another method, very slightly different, is also given. The preparation of the materials is described. P. H. P.

Estimation of Sulphonitric and Sulphonitrous Acids. A. Glaire. (*Ann. Chim. anal.*, 1924, **6**, 40–41.)—The estimation of nitrogenous products in commercial and industrial acids cannot be accurately carried out by the usual methods, owing to reduction phenomena or formation of complex salts of nitrogen peroxide. Schloesing's ferrous chloride method for the estimation of acids and oxides of nitrogen gives, however, sufficiently accurate results for ordinary work. If an acid containing ferrous or cuprous impurities is introduced into the nitrometer a certain quantity of nitric oxide is formed, but a further proportion remains in combination with the metal. If the nitric oxide is gradually ejected, little by little, from the nitrometer by the side tube, till the acid reaches the level of the upper part of the apparatus, and the acid is run, drop by drop, with shaking, into a solution of permanganate, all the remaining oxides and acids of nitrogen go into solution. On treating this solution with ferrous chloride in the flask of Schloesing's apparatus, N_2O_3 is again reduced, and produces a further quantity of nitric oxide, which is measured. On examining an acid of known composition, it was found that these two volumes of gas together make up a total exactly corresponding to the nitrogen content of the acid. D. G. H.

Physical Methods, Apparatus, etc.

Fluorescent Powers of Cellulose and its Derivatives. S. Judd Lewis. (*J. Soc. Dyers and Colour.*, 1924, **40**, 29–41.)—An improvement in the author's method of spectro-fluorescometry is described, in which a rotating tungsten arc is used instead of a spark, as the source of light; this affords clearer and much more complete photographs. (The method has already been described, *cf. J. Chem. Soc.*, Abst., 1922, **122**, ii. 334.) When the fluorescent power is plotted against the wave length all the forms of pure cellulose exhibit the same type of curve, which is not materially affected by the physical condition of the fibres, whereas hydrocellulose, cellulose acetates, and oxycelluloses show definite and distinct forms, even in materials of quite different origin. It is suggested that the pronounced projections upwards and downwards, respectively, at wave-lengths about 2400 and 2900, and other similar features, indicate certain definite linkages which cellulose has in common with some of the sugars. The form of the curves, when compared with those of known cellulose derivatives, serves clearly to indicate the composition of a fabric or the progress of tendering operations. H. E. C.

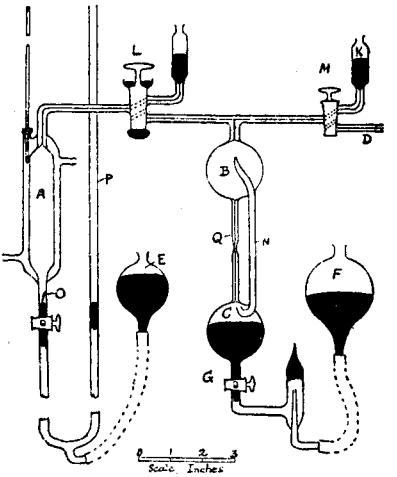
Improvements in Colorimetry. R. V. Stanford. (*Biochem. J.*, **1923, 17,** 839–843.)—It is not possible to compare the depths of colour of two solutions unless they are of the same shade of colour. Consequently the author (*Z. physiol. Chem.*, 1913, **87,** 159; Reports from the Chemical Laboratory, Cardiff City Mental Hospital, No. 3) described a dilution colorimeter, but it was inconvenient for actual use. In its original form the colorimeter has the usual pair of rhomboidal prisms, each of which illuminates one half of the field of view in the eye-piece. In front of the prisms there is a box containing two parallel-sided glass cells, one of which contains the standard solution, and the other the unknown solution. Over each cell is a burette, so that the solvent can be run into the stronger solution until equality of colour is reached. Improvements are now described which make this colorimeter as rapid and simple to manipulate as any other colorimeter. As an unvarying artificial source of light the Sheringham Daylight Lamp is recommended. Diagrams and a full description of the colorimeter, with an attachment to remove eye-strain and waste of time, are given. For a person of average perception in regard to colour about 3 minutes is the time required for a colorimetric comparison. This colorimeter has no errors due to principles. When equality is reached the liquids under comparison are of the same concentration, are being viewed through the same thicknesses of layer and, therefore, must be equal in all respects. The only trouble from the construction might be an unsymmetrical mounting, or a subsequent displacement, of the rhomboidal prisms. A mechanical stirrer is also described, and is an advantage, since a hand-stirrer is very fatiguing. P. H. P.



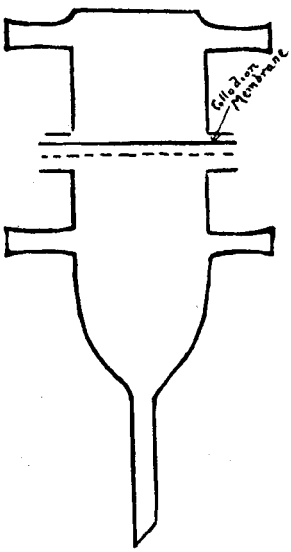
Apparatus for Drying Gases. V. T. Jackson. (*J. Ind. Eng. Chem.*, **1924, 16,** 163.)—A simple piece of apparatus for drying gases is shown in the illustration. A layer of glass-wool is placed at the bottom of the cylinder, and small glass beads are placed on the glass-wool to a depth of about 10 cm.; concentrated sulphuric acid is added until the cylinder is filled to a point about 1 cm. above the top of the beads, and the opening *A* is then closed with a rubber stopper. The gas is aspirated through the apparatus in the direction indicated by the arrow. If filled with potassium hydroxide solution, the apparatus may be used for removing carbon dioxide from air. The tapped tube at the bottom of the cylinder allows spent acid, etc., to be drawn off without disconnecting the drier from a train of apparatus.

W. P. S.

Absorption Pipette for Gas Analysis. S. W. Saunders. (*J. Chem. Soc.*, 1923, **124**, 2826–2828.)—The apparatus was designed to eliminate any joints between the measuring vessel and the absorption pipette. *A* is the water-jacketed measuring bulb forming one limb of a U-shaped manometer, the arrangement being for analysis at constant volume; the gas is confined between *L* and the pointer *O*, and its pressure measured. The bulbs *B* and *C* of the absorption pipette have about the same capacity as *A* (ca. 30 c.c. each); they are connected by a capillary constricted at *Q* and a tube *N* with a wide jet inside *B*. The apparatus is filled with mercury by raising *E* and *F*. After the gas has been introduced through *D*, the temperature and pressure are noted, and the reagent is sucked into *B* through glass tubing attached to *D*; no special connection is required. Any air introduced is expelled through *D*, mercury is allowed to run from *K* to *B*, and *M* is closed. The gas is transferred to *B*, and *L* is closed. If *F* is now raised, the reagent is sprayed through the gas *via N*. *F* is then lowered, after which the spraying is repeated. The gas is returned to *A*, followed through by mercury from *K*; the reagent is expelled through *D*, and the pipette washed with water. *B* is then filled with water and the gas washed and transferred to *A* for pressure measurement. The process is then repeated with other reagents. W. R. S.



Collodion Membranes of High Permeability. J. M. Nelson and D. P. Morgan, jun. (*J. Biol. Chem.*, 1923, **58**, 305–319.) The membranes here described are an improvement on those of Walpole (*Biochem. J.*, 1915, **9**, 287). The procedure for their preparation has been developed after many experiments. Four-inch circular glass plates were used. One, thoroughly cleaned to remove grease, rinsed with dust-free distilled water, dried in an oven at 50° C. and chilled if necessary, was weighed, carefully levelled on the desk and fogged, and 5 c.c. of a 2 per cent. solution of Du Pont's parlodion in 75:25 (by weight) alcohol-ether solvent mixture were run upon it and allowed slowly to evaporate. The plate was shielded from draught. As soon as a jelly formed the plate was removed to a balance and allowed to evaporate down to a weight found by trial to give, after water immersion, a grade (G_w), *i.e.* a "wetness" per grm. of dry collodion, somewhat higher than that desired. The water-wet membrane was gently removed from the plate under water and left to soak in water overnight. These membranes kept their grades for weeks. A few were dried in an oven to get the dry weight (D) which had to be known in order to calculate the (W_w), *i.e.* the weight of the membrane plus the water retained in the jelly, corresponding to the desired (G_w). $G_w = \frac{W_w - D}{D}$



The error in assuming that all membranes made from the same solution would have the same dry weight is, on the average, less than 2 per cent. The figure shows a filtration apparatus designed for the use of these membranes. Two pieces of heavy walled tubing, 2 inches in diameter, were flanged and ground to fit each other. By means of strong rubber bands over the arms the flanges were effectively held tightly together with the membrane between. Where necessary, the membranes were braced by the use of an ordinary nichrome gauze. Where they came in contact with the flanges the meshes of the gauze were filled with a gummy preparation consisting of rubber dispersed in paraffin to make the system air- and water-tight. This apparatus was set up in a suction flask connected with a manometer and a suction pump. These membranes were reasonably strong, and had a permeability almost three times as great as any previously reported. Their suitability for the study of invertase diffusibility has been established. P. H. P.

Reviews.

THE ELECTRON IN CHEMISTRY. By Sir J. J. THOMSON, O.M., F.R.S. Pp. 144. Philadelphia: The Franklin Institute. Price $1.75.

This volume contains the substance of five lectures given before the Franklin Institute in April, 1923, and which have since been published in the Journal of that Institute.

The object of these lectures was to show (1) that the electron is the dominating factor in chemical theory, and (2) the importance of interpreting chemical problems in the light of electrons and their orientation. How far this has been accomplished is doubtless a matter of opinion. Regarding the first point, the author has certainly succeeded, but in reference to the second the reviewer is at a loss to see what real advantage the chemist is to receive from the electron theory in its present stage of development.

The theory has had to suffer some extraordinary amendments in order to account for the existence of elements showing variable valencies, and for the trivalency of consecutive rare earths, although they have consecutive atomic numbers. It is true that some remarkable circumstantial evidence has been advanced in support of these amendments.

The character of the book may, perhaps, be obtained from an outline. Chapter I. is a discussion of the fundamentals of the electron theory, such as the

configuration of the electrons and its relation to chemical properties. It is here that one has a good deal to accept. So far, it has not been possible to glean experimentally any information relating to the forces at play between the various components of the atom, and, in consequence, conjecture has had to be resorted to. In dealing with inter-electronic forces, the author writes, "I suppose that the repulsive force between two electrons is always inversely proportional to the square of the distance," but when the force between a positive nucleus and an electron is considered, an expression is assumed which would account for a force of attraction becoming one of repulsion when the distance between the charges is of the order of 10^{-8} cm. It is necessary to make this fundamental assumption, for we are told that "the mental picture conveyed by the multitude of orbits (of electrons, *i.e.* if the inverse square law held good) would be too blurred and complicated to be of much assistance in helping us to get readily a clear idea of what is going on in chemical processes." Later on, in referring to this vital assumption, he writes, "The size of atoms being what it is, is a proof that there is some law of physics not recognised in the older science which is all-important in connection with the theory of the atom, and must form the basis of that theory. If this law of force is that just given, then a number of electrons can be in stable equilibrium without necessarily describing orbits around it." From calculations of the size of atoms a curve has been constructed showing the relationship between the atomic diameters and atomic numbers. This curve is somewhat different from the well-known diagram of Lothar Meyer, inasmuch as the minimum diameters occur at the ends of the periods in the periodic classification and not in the middle.

Simple chemical combination is dealt with in Chapter II. Reasoning on the basis that eight is the maximum number of electrons which can exist in a layer of an atom in stable equilibrium not only leads to an explanation of the extended theory of valency of Abegg, but points to the existence of compounds not in accordance with these laws. "The electron theory states that any distribution of atoms and electrons in stable equilibrium is a possible compound, and will be saturated, provided that each electronegative atom is surrounded by a layer containing eight electrons." Then follows a discussion of the apparently important Polar and Non-Polar molecules, and also of the mathematical principles which have to be satisfied in any arrangement of electrons and atoms in a compound. Incidentally and in this regard, appears the trite statement that "chemistry is something more than freehand drawing." This chapter closes with a brief discussion of the disposition of electrons in typical compounds.

Combinations between molecules are studied in the third chapter. The treatment is based on Werner's Theory of Co-ordination—in spite of its serious defects—and the rôle played by polar molecules. The deduction is then made that electrolytic dissociation of simple and complex molecules in aqueous solutions is due to the influence of the polar molecules present. "Thus, in an aqueous solution of calcium chloride, the positively electrified part of the calcium atom would have next to it the negative ends of polar water molecules, and the attraction between it and the oppositely charged chlorine atom would be diminished."

This shows why calcium chloride will dissociate, and at the same time indicates why calcium ions must necessarily be hydrated.

The following chapter deals with the mechanism of chemical combination. Again, the part played by polar molecules is regarded as essential. The well-known experiments of H. B. Baker and H. B. Dixon, on the effect of moisture on chemical combination, are cited as being examples in which polar molecules in the form of water enable a reaction to take place. Had water molecules been present, they would have formed aggregates with the reactants, and union would have ensued, for the work, it is stated, required to separate the opposing aggregates is so much greater than that required to separate the elementary molecules. This is followed by a consideration of the influence of active surfaces in promoting combination, and of the formation of the colloidal "double layer," and once more, polar molecules play the important part. Among other topics, some attention is directed to Thiele's Theory of Partial Valencies, and to the production of light in the course of some reactions. Afterwards comes a comparative study of isotopes, the rare earths and transition elements, and elements showing variable valency. Those valencies which do not apparently conform with the theory are supposed to be caused by the wandering of one or more electrons into the inner layers, even though they already contain their maximum number. Accordingly, a certain dissymmetry is produced in the molecule, and this property seems to be confirmed by the fact that in such molecules the property of paramagnetism is pronounced.

The last chapter is devoted to an application of the electron theory to solids. Much support is forthcoming from calculations of such properties as "selective photoelectric effect" and compressibility of solids, and the surface tension when in the molten state.

There is a little mathematics scattered throughout the volume, but, as a rule, it is of an elementary nature. The book is well worth reading, and, coming from such an authority, should be read by all who are interested in the subject.

HUBERT T. S. BRITTON.

SYNTHETIC INORGANIC CHEMISTRY. ARTHUR A. BLANCHARD, Ph.D., and JOSEPH W. PHELAN, S.B. Pp. 321. New York: John Wiley & Sons; London: Chapman & Hall, Ltd. 3rd Edition. Price 15s. net.

The search for the best methods of teaching chemistry, or any other subject, will presumably continue till the end of time; each teacher has his own scheme, and fashions change in this as in other matters. Whereas, in organic chemistry, the preparation of various compounds constitutes the greater part of a student's practical work, in inorganic there is very little preparation work, and a considerable amount of time is usually devoted to analysis. The authors of this book are of opinion that greater stress should be laid on the preparation of inorganic substances, and they rightly call attention to the interest aroused by this type of experiment, as well as to the variety of manipulative processes involved. It cannot be denied that analysis by itself is too highly specialised to be adequate

for the attainment of a general knowledge of chemistry and a course such as this book provides will doubtless prove of great value.

Of eleven chapters the first only is of a definitely quantitative character; the other ten are devoted to the preparation of typical compounds of the commoner elements in the various groups of the periodic classification, and experiments are included illustrating the properties of many of these compounds. A number of appendices at the end include solubility tables and other useful information.

This book reveals, once again, certain differences between American practice and our own. Many teachers will feel that there is in it a tendency to over-organisation and superabundant detail, which leave too little to the initiative of the student; on the other hand, these very features may be helpful to the teacher himself and his laboratory assistants, as a list of all the apparatus and materials required for each experiment will save time in preparing for the day's work. Three points may be selected as open to criticism: the frequent use of archaic names, such as blue and white vitriol; the introduction of new terms of doubtful utility, *e.g.* molal and formal solutions; the representation of the bleaching action of hypochlorous acid as color + HOCl $\longrightarrow$ color oxide + HCl.

The printing and style of the book are satisfactory in every way.

A. F. KITCHING.

PLANT PHYSIOLOGY. By V. I. PALLADIN, edited by B. E. LIVINGSTONE. Second Edition. Pp. 360. Philadelphia: Blakiston, Sons & Co. Price $3·50.

This book is the second American edition of the authorised English edition of Palladin's "Plant Physiology." The first edition was based on the German translation of the sixth Russian edition, and on the seventh Russian edition of 1914.

The editor, Prof. Livingstone, of the Johns Hopkins University, U.S.A., deserves thanks for arranging this translation in 1917, for, as he says with justice in his preface to the first edition, "Its small size, together with its generally excellent arrangement and manner of presentation, render it very well suited to the use of beginning students, who really desire to obtain a general grasp of the subject in a comparatively short time."

The text of the 1922 edition is an improvement on that of the original translation, and the editor has added some new notes and a few fresh references. An important new feature, which will be of value to the student, is the introduction of a full summary of each chapter. For these the editor assumes entire responsibility.

To the chemist who is curious about the chemical happenings in a plant, this book may be recommended as a suitable introductory book to read, possibly in conjunction with *Practical Plant Biochemistry*, by Onslow, or *An Introduction to the Chemistry of Plant Products*, by Haas and Hill, or both. These books are cited in a long list of reference books classified by Dr. Livingstone, which list is a valuable adjunct of the book under review. Prof. Livingstone truly says, "Palladin approaches the subject from the point of view of a student of physiological chemistry, and it is the chemical aspects of plant physiology that here receive the greatest

emphasis." A connected story is given of the synthesis of chemical materials in both green and non-green plants, and of the transformations and movements of these materials in plants. The energy requirements and transformations are discussed, and respiration in plants is analysed in terms of enzyme activity, in which analysis Palladin was one of the most noted pioneers.

The second part of the book, in which the vital manifestations of growth, reproduction, and plant movements are described, may be read with interest and profit, but it is not to be compared in worth with the first part of the book. There are few men who can at the same time satisfy the physicists, the chemists and the biologists of their time in text-books, either of animal or plant physiology. Sachs and Pfeffer in the past were able to do so, and their books on plant physiology are classics. With increasing knowledge the task becomes more difficult. The tendency to issue monographs written by specialists becomes more pronounced. This is to be desired, but a man who can put a connected story together will assist in realising a perspective otherwise difficult to obtain.

The specialist worker in plant physiology still feels this need, although this translation of Palladin's book is the latest important text-book in English; and, although the book has the value already indicated and has the additional value of containing a summary of his brilliant researches, it is somewhat behind the times. For example, none of the recent work on oxidations in the living cell is mentioned, and this work is all part of a chapter which Palladin helped to commence.

The writing of plant physiology monographs by experts has been, and will be, of great value to the advanced student, but there is still urgent need for a complete modern text-book of plant physiology. M. THOMAS.

ORGANIC SYNTHESES. Vol. III. HANS THACHER CLARKE, Editor-in-chief. Pp. 104. New York: John Wiley & Sons; London: Chapman & Hall, Ltd. 1923. Price 7s. 6d. net.

The third volume of this series follows exactly the line of its predecessors, and, therefore, little need be added to what has already been said about Vol. I. (ANALYST, 1922, **47**, 187) and Vol. II. (ANALYST, 1923, **48**, 243); the general character is identical, and the same standard is well maintained.

It is satisfactory to notice that the number of contributors is steadily increasing, so that this book receives material from thirteen workers, in addition to the five members of the Editorial Board. There is growth, also, in the size of the volume, as the present number contains twenty-nine syntheses, extending over a hundred pages. The methods outlined are, of course, not new, but the endeavour all through has been to choose the best, and to work out in detail the most favourable conditions; special points are emphasised by notes at the end of each section. In six cases only are the yields claimed less than 60 per cent. of the theoretical.

The inclusion of a number of simple substances, such as acetamide and *p*-cresol is welcome, for it shows that improvement is possible even in long-established processes. It seems probable that careful revision of all the details

of many elementary preparations would lead to results more satisfactory than is at present the case. The index covers all three volumes now published, and it is the intention of the editors to continue this collective index in subsequent volumes.

A. F. KITCHING.

COLLECTION OF LEGISLATIVE PRESCRIPTIONS CONCERNING CHEESE. By Dr. A. J. SWAVING. Pp. 104. The Hague: Hugo de Grootstratt. 1923. Price 7s. 6d.

The present work, which is written in English, follows on the same lines as the author's *Recueil de Législations Beurrières et Margarinières concernant la Répression des Fraudes dans le Commerce du Beurre,* which was reviewed in the ANALYST some years ago (ANALYST, 1914, **39**, 474). It will be invaluable to Public Analysts and others in this country who have to deal with the composition of cheese. The book contains the legislative enactments which are more or less in force in 33 different countries in all parts of the world, in many of which definite standards have been laid down for the composition, marking, and sale of various kinds of cheese. Apparently the compilation has been well and carefully done, and the book can be confidently recommended to those interested in this subject.

The position of the Public Analyst in this country, so far as the legal aspects of adulteration are concerned, is particularly unfortunate, and, in this connection, cheese is one of the most difficult subjects with which he is called upon to deal. A large quantity of skimmed, and partially skimmed, milk cheese is imported into this country from Holland, and is sold to the public as "cheese," although, in the country of origin, it cannot be so described. At the present time large quantities of such cheese, described by the makers as "half meat" and "three-quarter meat," are being imported into this country and are being sold to retailers as "Dutch Cheshire" and "Dutch Lancashire." The Ministry of Agriculture have been approached time and time again to make at least some efforts to prevent this gross misrepresentation, but, up to now, no action has been taken. There are rumours that the matter is again under consideration by the Ministry, and it may be that a perusal of that section of Dr. Swaving's book which deals with "The Dutch Cheese control under Government Supervision," will remove at least a portion of their apparent nervousness at issuing "cheese regulations."

G. D. ELSDON.

A SYSTEMATIC SURVEY OF RUBBER CHEMISTRY. (A bibliography, with copious abstracts, of the entire literature of rubber chemistry and closely allied subjects; thoroughly indexed by authors and subjects, with full cross-references, together with a patent index and introductory chapters summarising the present status of rubber chemistry.) By CLAYTON W. BEDFORD and HERBERT A. WINKELMANN. Pp. 385. New York: The Chemical Catalog Company. 1923. Price $7.00 net.

To the analyst who only occasionally comes in contact with the problems of,

or related to, rubber chemistry, the work under review may be a little disappointing, for, notwithstanding the sub-title, a number of subjects, including Analysis of Rubber, Synthetic Rubber, Physical Properties of Rubber and Rubber Testing, have been designedly omitted, with the exception that articles dealing with these subjects have been included where they contain data relative to molecular structure, ageing, accelerators or similar subjects. The introductory chapters, both critically written, consist of articles on "Organic Accelerators of Vulcanisation," by Dr. L. B. Sebrell, and on "Theories of Vulcanisation," by Dr. W. J. Kelley. The summaries of our knowledge of these subjects, and the inferences drawn by the authors, should provide interesting and illuminating reading for a wide scientific public. The main object of the book is to present (with the exceptions already referred to), as accurately and as completely as possible, a systematic survey of the field of rubber chemistry up to January 1st, 1923. An excellent system of cross-indexing between authors, subject and patent indexes has been adopted, and the abstracts which accompany the references are designed to be indicative of the nature of the work rather than condensations of data.

A valuable feature of the references is that, in addition to one to the original, references are included showing the location of abstracts and reprints as well as of many discussions referring to the same in various books and reviews. For the benefit of future editions, the authors request the reader to make a note of all errors and omissions which he may observe, and it is to be hoped that Messrs. Bedford and Winkelmann's volume will receive in every direction the whole-hearted support which a work likely to prove of inestimable value to those interested in rubber science and technology undoubtedly deserves.

PHILIP SCHIDROWITZ.

CHEMICAL SYNONYMS AND TRADE NAMES. By W. GARDNER. Pp. 271. London: Crosby, Lockwood & Co. 1924. Price 25s. net.

One of the minor difficulties which consulting chemists have to surmount is the use of various trade names for one and the same product. This is particularly noticeable in the case of dyestuffs, for many of which, of the same composition, separate names have been devised by each firm of manufacturers or agents. There was, therefore, a distinct need for a concise dictionary of these trade synonyms, and the compiler may be congratulated upon the thoroughness with which he has done his work.

There are about 14,000 definitions of the chemical nature of trade materials, including, *inter alia*, dyes and pigments, drugs, explosives, minerals and alloys, and these are classified in alphabetical order, and comprise some 180,000 words. The system of cross references is very full; for instance, no fewer than 22 trade synonyms for adrenaline, and 16 for emerald green, are given, and each of these will be found in its proper place, with a reference to the key word.

It is a book which everyone who has to deal with trade chemicals in any way will find of the greatest value.

EDITOR.