

# THE ANALYST

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

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### The Application of Artificial Daylight to Laboratory Purposes (Sheringham System).

BY S. H. GROOM, B.A.

*(Read at the Meeting, April 5, 1922.)*

It has been suggested to me that the subject of artificial daylight is one which would be of interest to the Society, since, although colour discrimination is mainly of importance to the dye-chemist, it also plays a considerable part in both qualitative and quantitative analysis. In this paper I propose to confine myself mainly to a brief discussion of the physical principles of artificial daylight, and to conclude with a demonstration of one or two simple examples of its application to analytical work. Members will know from their own experience the colorimetric difficulties they encounter in their own particular practice, and having seen a demonstration of a few applications, will doubtless be able to form their own opinions as to the extent to which daylight units will be of service in their laboratories.

The need for an artificial daylight has arisen chiefly from the different appearance of coloured objects under natural and artificial sources of light respectively. We naturally regard the appearance under daylight as the normal one, and the distortion caused by artificial light is frequently a source of inconvenience. Although the fact that the appearance of a colour depends upon the illuminant is known in a general way by everyone, yet, owing to our extremely short colour-memory, it is doubtful if many realise the full extent of this dependence. Colour is a subjective phenomenon, and we are easily influenced by pre-conceived notions.

Thus we are apt to regard a sheet of paper as being white even when, owing to the particular illuminant in use, it may be a distinct yellowish-red, and it is only when we get a contrast between the effects of two light-sources, either simultaneously or in rapid succession, that we can adequately realise the real difference in their quality.

The cause of this difference is a very simple one, and requires only brief reference. The apparent colour of an object, except in the case of very low illumination, depends solely upon the distribution of energy in the light actually reaching the eye after reflection from, or transmission through, that object. This, in turn, depends upon two factors—firstly, the energy-distribution in the source of light; and secondly, the reflection or transmission characteristics of the coloured object. It is clear that the first factor is just as important as the second, and the production of artificial daylight thus resolves itself solely into a question of energy-distribution.

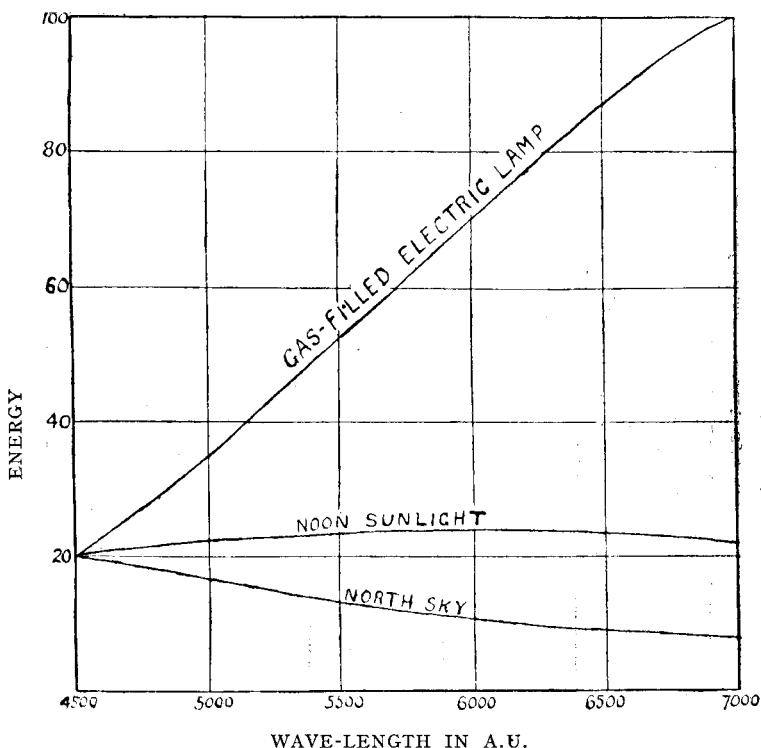
At the outset we are met with the difficulty of deciding on a standard at which to aim, since it is well known that the quality of daylight itself is very variable. Direct sunlight is not usually considered desirable for the accurate discrimination of colour, and a room with a north aspect is generally preferred. Even then, the quality of the light available will vary according to the presence or absence of clouds, and is even appreciably affected by such adventitious circumstances as the presence of trees or buildings close to the window. The variations between the different types of daylight are, however, small when compared with the wide difference between average daylight and artificial light, even from the whitest sources now in use. The best ideal is probably found by taking the mean of a large number of readings of the energy-distribution of north-sky light. In this connection it should be noticed that an artificial daylight possesses one advantage over daylight itself in providing a more constant standard, but to maintain this it is important to see that old or under-run bulbs are not employed.

The first essential in producing an artificial daylight is that the source shall have a continuous spectrum, a requirement which is fulfilled by practically all illuminants in common use, except those in which the light is produced by an electrical discharge. In the case of pure temperature-radiation, the laws of distribution of energy have been deduced from the principles of thermodynamics by Planck and Wien. Generally speaking, the effect of an increase of temperature is to shift the position of maximum energy towards the region of shorter wave-lengths, the wave-length at the maximum being inversely proportional to the absolute temperature. The sun itself behaves as a black body at a temperature of about  $5000^{\circ}$  C., the maximum energy being at about 5900 Ångström units, roughly at the position of the sodium line. With the much lower temperatures of artificial illuminants, the maximum is naturally well within the infra-red region. Owing to the selective absorption by the atmosphere of the longer waves in sunlight and the scattering of the shorter ones, the maximum in the light from a blue sky occurs at about 4500 in the blue region. The energy-distribution curves of many sources may be found fairly accurately from their temperatures

by applying the laws mentioned, though this does not apply to such cases as the gas-mantle, which shows selective emission varying with its chemical composition. In other cases the curves may be determined either by comparison, step by step, throughout the spectrum with a source whose energy-curve is known, or directly by means of a bolometer.

Approximate curves for north-sky light, sunlight and the gas-filled lamp, taken from data given by Ives, are shown in Fig. 1. The actual values of the

FIG. 1. RELATIVE DISTRIBUTION OF ENERGY.



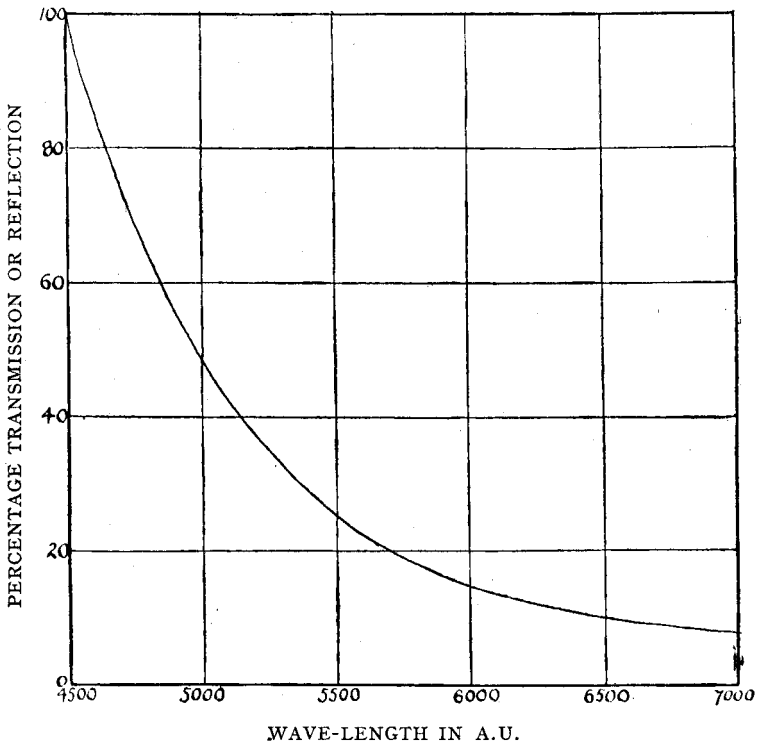
ordinates would obviously depend upon the intensities of the sources, so that, for purposes of comparison, they can be plotted through any arbitrary point. In the figure shown, this has been done for a wave-length of 4500, since, although of course the visible spectrum includes shorter waves than this, it is found sufficient for practical purposes to commence the correction from this point.

It will be clear from the figure that the transformation of artificial light to daylight is necessarily a process of eliminating rays in increasing amounts from the blue to the red end of the spectrum, and therefore involves a considerable loss in efficiency in the narrow sense of the word, the respective areas under the curves showing the precise proportion of the energy of the artificial light which is available

as daylight. In producing north-sky light from the light of the gas-filled lamp, about 20 per cent. of the energy is available, giving an efficiency which is thus about equal to that of the carbon filament lamp which was in general use until a few years ago.

The absorption of the excess rays present in the light from an artificial source can obviously be carried out in two distinct ways: either by transmitting the light

FIG. 2. IDEAL TRANSMISSION OR REFLECTION CURVE.  
GAS-FILLED LAMP TO NORTH-SKY LIGHT.



through a suitably coloured transparent screen, or by reflecting it from a coloured surface. Considerable attention has been devoted to the transmission method during the past few years, the screens usually being made of glass coloured by the inclusion of metallic compounds such as those of copper and manganese; gelatin screens are usually inadmissible owing to the high temperatures involved. The ideal transmission curve may readily be obtained by dividing the ordinates of the daylight light curve by the corresponding ordinates of the artificial curve. If the data thus obtained are plotted through 100 per cent. at wave-length 4500, as shown in Fig. 2, we have the ideal transmission curve both as to quality and efficiency. If the ordinates are all reduced in the same proportion, the curve

remains ideal as regards the quality of the light, but there is, of course, a reduction in efficiency. It will readily be appreciated that much difficulty has been experienced in producing a glass having just the required transmission throughout the spectrum, and also in making two successive melts of glass which are identical from a colour standpoint. However, units of this type are now manufactured in England and America and on the Continent.

The reflection method has been employed for the first time in the Sheringham Daylight. The light from a gas-filled electric lamp is thrown upwards by means of a reflector on to the coloured interior of a shade, the under-reflector at the same time serving to prevent the escape of any uncorrected light. It is clear that the ideal transmission curve shown in Fig. 2 may also be regarded as the ideal reflection curve of a pigment to be used on the interior of the shade, but no permanent pigment has been found whose reflection curve approximates sufficiently closely to the ideal for the purpose. This difficulty is overcome by employing a number of different pigments in definite proportions by area; what may be termed the effective reflection curve of the whole shade is easily calculated from the curves of the individual pigments and the areas employed. In this way, by using a specially chosen ultramarine, a smaller area of emerald-green and a few per cent. of a yellow pigment, an effective reflection curve is obtained closely approximating the ideal, and the resulting light has thus the quality of daylight. The reflection method possesses the advantages of indirect lighting, giving good diffusion and an absence of sharp shadows, and as long as fresh batches of pigment are carefully tested, there is little difficulty in reproducing a result once obtained.

The change produced in the appearance of coloured objects under different illuminants varies widely in different cases. If the object is one which transmits or reflects only a small portion of the spectrum, the change in colour is comparatively small, although the value or brightness of the colour may change considerably. Thus a yellow will look brighter under artificial light than under daylight of the same intensity. At the same time, if on a white background, it will stand out more clearly under daylight than under an artificial light, since in the latter case the background looks yellow and the contrast is less. We shall see this when we come to examine such an indicator as methyl orange. The greatest change is shown in the case of an object which reflects two widely different portions of the spectrum more strongly than the intervening portions, as in the case of a purple pigment. In this case, the blue or red constituent predominates according as we employ daylight or an artificial light.

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## The Use of the Daylight Lamp in Volumetric and Colorimetric Analysis.

By WILLIAM SINGLETON.

(*Read at the Meeting, June 7, 1922.*)

THE recent advent of the daylight lamp and its commercial use in the matching of colours, where such matching was impossible in the light from the ordinary electric lamp, led to the investigation of the possibilities of its application in removing the difficulties which often occur in the process of volumetric and colorimetric analysis with the use of indicators in artificial light. The chief difficulties are in the sharpness of the end-point and the accuracy of noting the colour change of the various indicators used in such work. It is not always possible or convenient to carry out titrations involving the use of the indicators in actual daylight.

The results of these investigations show the comparative merits of the daylight lamp in relation to the ordinary electric lamp and to natural daylight, and also the close concordance of the results obtained by the use of the daylight lamp with those obtained by natural daylight. The daylight lamp has decided advantages over the ordinary lamp in increasing the efficiency of many chemical indicators, and is, in consequence, being employed in these laboratories.

INDICATORS.—The indicators used in these investigations were:—Thymol blue (acid range); thymol blue (alkaline range); bromphenol blue; methyl red; bromcresol purple; bromthymol blue; phenol red; cresol red; cochineal; Congo red; dimethyl-amino-azo-benzene; lacmoid; litmus; methyl orange; phenolphthalein; and thymolphthalein.

TESTS APPLIED.—Several titrations were carried out, and observations carefully made of the limits of the colour range, and the sharpness of the end-point. One-fiftieth *N* solutions of acid and alkali were used throughout the titrations. In each case 50 c.c. of the solution, either acid or alkali, were taken, and no further dilution with distilled water was made.

The investigations with the daylight lamp were made in a room entirely illuminated by two 110 volts/200 watts daylight lamps; other titrations were also undertaken by the light of two 60 watts daylight lamps. Further experiments with 100 watts lamps proved similarly successful.

The titrations by ordinary artificial light were carried out in the chemical laboratory illuminated by 100 watts vacuum lamps. Those by natural daylight were made out of doors, in the shade, and free from direct sunlight.

DEGREE OF ACCURACY.—The following table shows the range of colour change of the end-point expressed as parts of a c.c. of 1/50 *N* solution, when each of the indicator dyes was used in natural daylight, artificial daylight and ordinary artificial light respectively.

The parts of a c.c. indicate the length of the colour-range covered by the end-point in the respective lights, and also indicate the degree of accuracy with which it is possible to determine the end-point of the titration. The number of drops of indicator used are also shown, together with the strength of the indicator solution.

Indicator	Strength of Indicator solution Per Cent.	Drops of Indicator used	Degree of accuracy found possible in determination of end-point		
			Natural Daylight	Artificial Daylight	Ordinary Artificial light
			N/50 Solution c.c.	N/50 Solution c.c.	N/50 Solution c.c.
Thymol blue	0.04	3	0.1	0.1	0.05
Bromphenol blue	0.04	3	0.15	0.20	0.20
Methyl red	0.02	3	0.15	0.15	0.20
Bromcresol purple	0.04	3	0.20	0.15	0.20
Bromthymol blue	0.04	5	0.10	0.20	0.20
Phenol red	0.02	3	0.05	0.05	0.10
Cresol red	0.02	3	0.05	0.05	0.10
Cochineal	—	10	0.20	0.15	0.20
Congo red	—	3	0.20	0.20	0.25
Dimethyl-amino-azo-benzene	0.04	3	0.35	0.30	0.40
Lacmoid	—	5	0.25	0.30	0.30
Litmus	—	5	0.20	0.20	0.30
Methyl orange	0.02	3	0.30	0.25	0.50
Phenolphthalein	0.04	3	0.10	0.10	0.20
Thymolphthalein	0.04	5	0.20	0.10	0.20

Other titrations were made; for instance, "spot" titrations, with the use of an external indicator. It was noted that the use of artificial daylight from the daylight lamp increased the accuracy of titrations such as the estimation of lead by means of a standard solution of ammonium molybdate, with use, as a "spot" indicator, of a 0.5 per cent. solution of tannic acid. The colour-change of the indicator from pale yellow to yellowish-brown was much sharper, and consequently more accurately observed, than in natural daylight or artificial light. The same remark also applies to the uranium titration in the estimation of phosphoric acid, with the use of powdered potassium ferrocyanide as "spot" indicator. The Nessler test for ammonia, and the titration with the use of cochineal in the estimation of nitrogen, also proved more accurate in artificial daylight, and much more easily observed than in ordinary artificial light.

It will be noticed from the foregoing table that the range of colour covered by the end-point with some of the indicators used was shorter and more accurately observed in artificial daylight than in natural daylight. With other indicators it was at least as good. In a few cases only was the end-point sharper in ordinary artificial light.

In addition to increasing the accuracy of these titrations, the use of the daylight lamp greatly increased the ease with which this accuracy could be attained. It is difficult, however, to express in actual figures the degree of ease with which titrations may be made under the different lighting conditions, and it is only by

actual practice that one can appreciate the advantages (which are considerable) of the daylight lamp for such work.

The lamps used were of the tungsten filament type fitted with "daylight" glass bulbs, and made by the Osram-G.E.C. Lamp Works. Any reasonably accurate daylight-glass filter will of course produce the same result, but the daylight lamps, as used in these investigations, are inexpensive. The cost of a daylight lamp is 25 per cent. more than that of the ordinary electric lamp. They are also easy to manipulate, it being only necessary to replace the ordinary electric lamp by one of the daylight type.

RESEARCH LABORATORIES OF  
THE GENERAL ELECTRIC COMPANY, LTD., LONDON.

## The Composition of Cows' Milk in the Sudan.

BY A. F. JOSEPH, D.Sc., F.I.C., AND F. J. MARTIN, M.A., A.I.C.

(Read at the Meeting, June 7, 1922.)

THE observations recorded in this paper embody the results of the analyses of samples of cows' milk examined in the Wellcome Tropical Research Laboratories, Khartoum, during the last 10 or 15 years. A considerable number of samples are taken by the Public Health Inspectors as a check on the ordinary milk supply of Khartoum, and others have been obtained from animals kept under supervision; the latter are of course undoubtedly genuine, and give an idea of the "normal" composition of milk in this country, enabling a comparison to be made with similar results obtained in other parts of the tropics.

All the samples have been obtained from the Khartoum district, of which the following climatological notes may be given:—(a) *Position*.—Lat. 15°36'N long. 32°32'E., about 1300 miles south of Cairo. Height above sea level 1200 feet. (b) *Temperature*.—Average for the year 95° F. Mean maximum in May, 107·5° F., mean minimum in January, 58·5° F. (c) *Moisture*.—Mean annual rainfall 4", all in July and August. Humidity varies from 15 per cent. in April to 48 per cent. in August.

Animals kept by native farmers are called "Beladi" cattle, and those of the Khartoum district are shorthorned and humped. The bulls are used for draught purposes. At the Government Dairy, selection and crossing has resulted in animals having apparently a much higher order of milk-producing power; at present, however, it is exceedingly difficult to separate the combined effects of selection, careful feeding and good housing.

RELATION BETWEEN MORNING AND EVENING MILK.—Our arrangements did not always allow of effective supervision in taking samples in the afternoon; the principal series of observations are therefore confined to those on morning



milk, a special series of 80 samples being taken from five selected animals both in the morning and afternoon to determine the relative composition. The result of this test was as follows:

TABLE I.

			Morning	Evening
Time of milking	..	..	4.45 a.m.	3.30 p.m.
Mean percentage of fat	..	..	4.04	4.80
„ Solids-not-fat	..	..	9.53	9.54
„ Quantity of milk (lbs.)	..	..	15.86	13.50
„ Quantity of fat (lbs.)	..	..	0.641	0.648

The equality of the total amount of fat in the morning and evening milk is consistent with the results reported from similar observations in England; thus from the examination of over 2400 samples, Monier Williams (ANALYST, 1920, 45, 204) calculates the mean fat production as 0.44 lb. in the morning and 0.38 lb. in the evening. Similar results may be calculated from data given by Ingle (*Manual of Agricultural Chemistry*, 1920, p. 355) as follows:

TABLE II.

	Series I		Series II		Series III	
	Morning	Evening	Morning	Evening	Morning	Evening
Time of milking	6	3	6	5.30	6	3
Percentage of fat	2.94	4.50	3.20	3.63	2.90	4.48
Mean quantity of fat in lbs.	0.570	0.576	0.500	0.484	0.446	0.484

AVERAGE COMPOSITION OF GENUINE MILK.—The mean composition of 284 genuine samples, collected between 1906 and 1921, is given below, together with figures obtained by workers in Egypt, British East Africa and India.

TABLE III.

	Egypt <sup>1</sup>	British East Africa <sup>2</sup>	India <sup>3</sup>	Sudan (Morning milk)
Fat	5.4	5.25	5.9	4.74
Solids-not-fat	9.2	9.25	—	9.56

If the percentage of fat in the Sudan morning milk be multiplied by the ratio of fat in morning milk to fat in total milk (from Table I.), the average percentage of fat becomes 5.15 instead of 4.74.

The point noteworthy in all these results is the high percentage both of fat and solids-not-fat in tropical milk; in consequence, the use of English legal standards is entirely inapplicable in these countries.

The 284 samples referred to above were obtained in the course of four series of tests, of which the following are the separate results:

TABLE IV.

Series	Origin	No. of samples	Fat	Solids-not-fat
1	Government herd, 1906	18	5.43	9.27
2	Private herd, 1915-1916	23	4.96	9.24
3	The same herd, 1920	87	5.05	9.41
4	Government herd, 1920-1921	156	4.46	9.74

(1) *Reports of the Dept. of Pub. Health*, Cairo, 1919. (2) THE ANALYST, 1920, page 301. (3) *Mem. Dept. Agr. India, Chem. Ser. 2* (1911), No. 1 (abstracted in *Expt. Sta. Record*, 25, 1911, p. 778).

SEASONAL VARIATIONS.—The first of the above series was carried out by the late Dr. Beam, and the details published in Report of the Wellcome Tropical Research Laboratories for 1908 (p. 396). The samples were collected during February, March and April, and from the general constancy of the composition it was concluded that the pronounced seasonal variations present in other countries were not pronounced in the Sudan. An examination, however, of the detailed results of the second series shows a maximum fat content in the rainy months of the year, July and August, when green forage material is at its best, and a minimum in November, for which no explanation suggests itself.

The results were obtained by the examination of the mixed milk of 10 animals taken twice a month.

TABLE V.

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Fat	4.62	4.90	5.02	5.11	5.11	6.05	5.72	5.10	4.60	3.88	4.55	4.92
Solids-not-fat	9.56	9.43	8.98	9.05	9.25	9.38	9.19	9.53	8.89	9.12	9.25	9.45

DAILY VARIATIONS IN COMPOSITION.—The variations in composition in the individual samples from Series 3 and 4 of Table IV. are shown in Tables VI. and VII., from which it will be seen that the percentage of fat of a single animal in this country may vary to an astonishingly high degree; and although part of the variation in fat content is due to the period of lactation (the percentage of fat steadily increasing), yet the milk from successive samplings also shows a very wide variation, this feature being more marked in the case of the privately-owned pure Beladi herd.

TABLE VI.

VARIATIONS IN PERCENTAGE OF FAT IN MILK OF PRIVATE HERD (SERIES 3).

Mark of Cow	No. of samples	Per Cent.			Percentage of samples falling within the range given below						
		Mean	Max.	Min.	below	3.5	4 to	4.5 to	5 to	5.5 to	above
					3.5	to 4	4.5	5	5.5	6	
S	16	4.60	6.3	3.3	6	31	25	12	6	6	12
B	18	5.37	8.3	2.7	6	6	0	28	17	28	17
C	17	4.95	8.1	3.3	11	11	6	30	18	11	12
Ar.	18	4.47	6.5	3.1	29	11	0	39	17	0	6
Al.	18	5.88	7.6	2.8	6	0	17	6	6	17	50
For all samples	87	5.05	8.3	2.7	11	12	10	23	13	12	18

TABLE VII.

VARIATIONS IN PERCENTAGE OF FAT IN MILK OF GOVERNMENT HERD (SERIES 4.)

No. and Breed of Cow	No. of samples	Per Cent.			Percentage of samples falling within the range given below						
		Mean	Max.	Min.	below	3.5	4 to	4.5	5 to	5.5 to	above
					3.5	to 4	4.5	to 5	5.5	to 6	6
8. Sudan	25	4.57	7.0	3.3	8	24	32	20	4	4	8
11. Do.	28	4.61	6.1	3.2	4	7	36	39	7	4	4
18. Egyptian & Shorthorn	34	4.25	6.3	3.6	3	41	32	18	0	3	3
21. Sudan	35	4.50	6.5	3.1	6	26	29	14	6	17	3
37. ¼ Shorthorn & ¾ Sudan	8	5.55	7.1	3.9	0	13	13	25	13	0	37
40. Do.	26	4.09	5.0	3.1	8	31	46	15	0	0	0
For all samples	156	4.46	7.0	3.1	5	24	31	22	5	5	9

The greater uniformity in quality of the milk from the Government herd as compared with that from the privately-owned herd can be seen by plotting the usual distribution curves from Tables VI. and VII., or, more conveniently, by

calculating the "probable variation" from the results of all the analyses from each animal. This has been done by a simplified Peter's formula  $\frac{0.845 \Sigma (v)}{n - \frac{1}{2}}$ , where  $n$  is the number of analyses, and  $\Sigma (v)$  the sum of all the variations of the fat percentages from the mean fat percentage for the animal. The figures are given in the next table:

TABLE VIII.  
PROBABLE VARIATIONS IN FAT PERCENTAGE.

Government Herd			Private Herd (all Beladi)	
No. of Cow	Breed	Probable Variation	Letter of Cow	Probable Variation
8	Beladi	0.57	S	0.69
11	Beladi	0.35	B	0.68
18	$\frac{1}{2}$ Shorthorn	0.38	C	0.71
21	Beladi	0.64	Ar.	0.61
40	$\frac{1}{4}$ Shorthorn	0.31	Al.	0.97
Mean		0.45	Mean	0.73

Whilst the greater uniformity of the milk of the Government herd is probably partly due to better care, housing and feeding, it is apparently also due, at least in part, to the breed. It will be seen from the above table that, whilst the mean of the probable variations of the three Beladi animals is 0.52, that of the two with shorthorn blood is 0.35, a fact strongly suggesting that the introduction of shorthorn blood has resulted in greater uniformity of milk.

COMPOSITION OF SAMPLES TAKEN FROM MILK-SELLERS IN KHARTOUM AND OMDURMAN.—In conclusion, the figures may be given for the average composition of all samples submitted by the Medical Officer of Health for analysis, of which the stated origin was the cow. They include, of course, a number of obviously adulterated samples, but the mean composition is, on the whole, satisfactory. The number of samples is not large, as most of the milk sold in the streets is from goats or sheep, or is stated to be mixed. Of the 290 samples examined during the past two years only 37 were stated to be cows' milk. The average composition was: Fat 4.24 per cent., solids-not-fat 9.26 per cent.

SUMMARY.—(a) Cows' milk in the Sudan resembles that in other tropical countries in being rich both in fat and other solids.

- (b) The total fat production is approximately the same in the morning and evening.
- (c) There is a distinct seasonal variation in composition, the fat percentage being highest in the rainy months of July and August, and lowest in November.
- (d) Wide variations in the composition of milk of individual animals occur in both herds, but are more marked in the case of the privately owned herd. Detailed examination of the results of the analyses suggest that these variations are due partly to the breed and partly to conditions of housing and feeding.

Our thanks are due to the Director of the Veterinary Department for his co-operation in carrying out these experiments.

## Notes.

*The Editor desires 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.*

## QUANTITATIVE MICROSCOPY UNIT.

IN using the valuable method of T. E. Wallis (ANALYST, 1916, 41, 357) we have felt the need of a standard unit for comparison of counts made under different conditions, and for the calculation of adulteration. The number of starch grains contained in a weight of the substance equal to the weight of 100 lycopodium spores is a convenient value. It may be qualified if only a particular size of grain is counted.

$$\text{Lycopodium equivalent } \left. \vphantom{\begin{matrix} \text{Lycopodium} \\ \text{equivalent} \end{matrix}} \right\} = \frac{\text{No. of starch grains} \times \text{weight of lycopodium} \times 100.}{\text{No. of lycopodium spores} \times \text{weight of substance.}}$$

For example, 0.1 gm. of wheat starch mixed with 0.1 gm. of lycopodium and about 20 c.c. of olive oil gave, in 20 fields, 345 starch grains over  $17\mu$  and 172 lycopodium spores. The quantity of olive oil does not enter into the calculation.

$$\left. \begin{matrix} \text{Lycopodium equivalent over } 17\mu \text{ of} \\ \text{wheat starch} \end{matrix} \right\} = \frac{345 \times 0.1 \times 100}{172 \times 0.1} = 200.$$

Another count, in which 0.05 gm. of the same starch and 0.1 gm. of pure mustard were mixed with 0.1 gm. of lycopodium and about 20 c.c. of olive oil, gave 187 starch grains over  $17\mu$  and 192 lycopodium spores.

$$\left. \begin{matrix} \text{Lycopodium equivalent over } 17\mu \text{ of} \\ \text{wheat starch} \end{matrix} \right\} = \frac{187 \times 0.1 \times 100}{192 \times 0.05} = 195.$$

In another test 0.2 gm. of compound mustard mixed with 0.1 gm. of lycopodium and counted as before gave a lycopodium equivalent over  $17\mu$  for the mustard of 21.4, and a second similar mixture gave 22.2. By using mean results of 197.5 and 21.8, and, assuming the compound mustard to contain wheat starch and not wheat flour, the proportion of wheat starch was calculated as:  $21.8 \times 100 \div 197.5 = 11$  per cent.

When it is desired to express the results on dried substances, the dry weight must be substituted in the calculations for the total weight.

To ascertain the weight of 100 lycopodium spores, a weighed quantity of lycopodium was mixed with olive oil and counts made in a Zappert counting chamber. It was found that 100 lycopodium spores weighed 0.0012 mgrm. Wallis (ANALYST, 1919, 44, 321) stated that 94,000 spores weighed 1 mgrm., which gives the weight of 100 spores as 0.0011 mgrm.

The lycopodium equivalent is, therefore, the number of starch grains in about 0.001 mgrm. of the substance. This result, however, is not required in the calculation of it.

## NOTE ON THE SULPHURIC ACID REACTION FOR LIVER OIL.

MESSRS. DRUMMOND and WATSON'S paper on this subject (ANALYST, 1922, 48, 341) has aroused a great deal of interest, and we have been testing cod liver oil by their dilution method since its appearance. Probably owing to the fact that they have not defined strictly the exact details of their procedure, we have been unable to obtain good or constant results by dilution with petroleum spirit.

In our experience, the sulphuric acid appears to remove and char the oil from petroleum spirit solution, and it is extremely difficult to see if a purple reaction is obtained or not.

By the use of a petroleum fraction of higher boiling point the test is more easily standardised, and the procedure we adopt is as follows:—To 10 c.c. of liquid paraffin B.P. add 1 c.c. of the cod liver oil to be tested; mix well and, by means of a pipette, run 10 drops of this into a white porcelain basin; add 1 drop of sulphuric acid (B.P.), and stir with a glass rod.

If a transient purplish colour develops, add petroleum oil in successive 5 c.c. quantities till no purple is given, and record the dilution at which a faint transient purple was seen. If no purple is seen, add successively 1 c.c., 1 c.c., 2 c.c., and 5 c.c. of cod liver oil.

We find that by this means results can be duplicated without any trouble.

Liquid paraffin (B.P.) gives no colour, in the cold, with sulphuric acid; it is sold under proprietary names such as Regelax, Nujol, Paroleine, Chrismaline, etc.

BOOTS PURE DRUG CO., LTD.,  
NOTTINGHAM.

H. DROOP RICHMOND.  
E. H. ENGLAND.

## 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 SECOND QUARTER, 1922.

DURING the second quarter of the year 1287 samples were submitted for analysis, 1127 of which were analysed under the Sale of Food and Drugs Acts. Of the latter samples 1025 were bought informally, of which 43 were adulterated, and 102 samples were taken formally, of which 21 were adulterated.

MILK.—Eight per cent. of the 550 samples were adulterated. The average composition of all the samples was: Fat, 3.48 per cent.; and solids-not-fat, 8.77 per cent. Two samples taken from milk carts contained 7 and 8 per cent. of water respectively, and large amounts of boric acid. The vendor was fined £40.

ALE.—Two informal samples each contained 1 grain, and one informal sample 0.5 grain of salicylic acid per pint.

RHUBARB.—The B.P. requires that the ash shall not exceed 15 per cent., but this is unsatisfactory, as no details of the method of estimation are given. One sample of powdered rhubarb yielded from 11.5 to 19.8 per cent. of ash according to the conditions of the test. A more satisfactory result is obtained if the calcium oxide in the ash is converted into carbonate before weighing.

NATIONAL HEALTH INSURANCE DISPENSING.—Twenty-nine insurance prescriptions were taken to 24 panel pharmacists to be dispensed. Twelve of these medicines from eight different pharmacists did not comply with the prescriptions.

J. F. LIVERSEGE.

## SCOTTISH BOARD OF HEALTH.

REPORT ON THE ADMINISTRATION OF THE SALE OF FOOD AND DRUGS ACTS AND  
ABSTRACT OF REPORTS OF PUBLIC ANALYSTS FOR THE YEAR ENDING  
SEPTEMBER 30, 1921.\*

Most of the local authorities in Scotland devote a good deal of attention to sampling and analysis. In some localities, however, sampling of only a few articles is carried out, and in others the only article sampled is milk. Moreover, in some areas sampling is done on one or two days in the year.

**FORMAL SAMPLES.**—The total number of samples purchased for analysis under the Acts was 6327, of which 514 were reported as adulterated or not up to standard. In the year ending September 30, 1921, the corresponding figures were 6430 and 591.

**MILK.**—During the year 4418 samples of milk were analysed, of which 402 were reported against, whilst in 1920 there were 513 adulterated samples out of 4514. In the Burghs of Edinburgh, Dundee, Glasgow, and Aberdeen, the proportions of adulterated samples were 39·6, 8·8, 7·3, and 5·8 per cent. respectively. In the 12 other Burghs, with a population of over 30,000, the proportion was 8·3 per cent., and in the remainder of the country 8·6 per cent.

**BUTTER.**—Of the 411 samples submitted 34 were reported against, 7 containing foreign fat (5 to 90 per cent.), and 25 excess of water; two were of doubtful purity.

**MARGARINE.**—The only sample reported against of the 202 analysed contained 16·5 per cent. of water.

**SELF-RAISING FLOUR AND BAKING POWDER.**—Thirty-eight samples were analysed, and one (self-raising flour) reported against.

**EGG POWDER.**—Nine samples examined by Dr. Tocher (Aberdeenshire) had the following average composition: Ether extract, 1·2; proteins, 3·6; moisture, 12·8; sodium bicarbonate, 9·0; potassium hydrogen tartrate or tartaric acid, 9·5; and starch, 63·9 per cent. "The statement that 'egg powder is the only real substitute for eggs' is not warranted from the results of analysis."

**COFFEE.**—Of 77 samples examined 3 were found to contain 22 to 29 per cent. of chicory.

**VINEGAR.**—Twenty-one samples were taken, and one (diluted acetic acid sold as malt-vinegar) was reported against.

**CINNAMON.**—Of 57 samples examined 13 were reported against.

**DRUGS.**—During the year 191 samples were examined, 11 of which were reported against. Of these 191 samples, 118 were cream of tartar. This figure reveals very insufficient sampling of drugs in Scotland.

**GENERAL.**—*Spirits:* Many representations were made to the Board in regard to the sale of whiskey and rum in a more diluted state than that authorised by the Licensing Act, 1921. In terms of the existing law, if notice of the dilution is given to the purchaser, no offence is committed by any extent of dilution.

*Mixtures of Malt and Cod Liver Oil:* A sample was found to contain 2·82 per cent. of oil, whereas according to the B.P. Codex cod liver oil emulsion should contain 50 per cent. of oil, and, if mixed with malt, 15 per cent. The Board therefore communicated with the General Council of Medical Education and Registration, giving their opinion that, if possible, uniform standards should be fixed. In reply the Board were informed that the question of the inclusion in the British Pharmacopœia of an emulsion of cod liver oil and of an extract of malt

\* H.M. Stationery Office, 23, Forth Street, Edinburgh, and Imperial House, Kingsway, London. Price 3s. net.

and cod liver oil would be considered during the preparation of a new Pharmacopœia, or earlier, should an addendum to the Pharmacopœia be necessary.

*Production of Ice Cream in Zinc Containers:* A representation was made to the Board that ice cream freezing machines with zinc containers were being made in Scotland. The information on the subject points to the possibility of slight contamination of ice cream with zinc, but at present the only way of dealing with the matter is the indirect method of a prosecution, under the Food and Drugs Acts, for the sale of ice cream containing zinc in a quantity sufficient to be a danger to health. The Board have the matter under consideration.

Referring to this Report, Dr. Tocher has written as follows: "The Scottish Board of Health intend that a separate report of this kind should be published each year.

"The document is not a large one, and the price is fairly high, viz. 3s. It is understood, however, that unless there is a sufficient sale the publication in future years will not be permitted, owing to the necessity for economy. It would be a great pity if the abstract of the reports of Public Analysts were not published in any form, and such an event is certain unless a reasonable sale of this document is obtained. Accordingly, it is to be hoped that Local Authorities and Public Analysts will make a point of purchasing the Report, which, though short, is of considerable importance."

## GOVERNMENT OF MADRAS.

### REPORT OF THE CHEMICAL EXAMINER FOR 1921.\*

THE Chemical Examiner (Major Clive Newcomb, M.D., A.I.C.) reports that during the year 3952 analyses were made, as against 3714 in 1920, the average for the previous 16 years being 3577. The number of human poisoning cases investigated was 224, and there were 406 stain cases and 1515 stained articles, all of these figures being records for a single year.

MEDICO-LEGAL INVESTIGATIONS: HUMAN POISONING.—Poison was detected in 91 of the 224 cases, giving a percentage of detections of 40·6 as compared with 41·8 in 1920, and 33·2 in 1919. One of the 132 cases in which no poison was detected followed the eating of betel leaf. No poison has hitherto been found to account for the symptoms which sometimes occur in such cases.

In 92 of the cases in which poison was detected 188 persons were affected and 70 died. Mercury (23 cases) displaced arsenic (17 cases) as the poison most frequently found, whilst opium (14 cases) took the third place, and aconite (11 cases) the fourth. Of the less common poisons there was one case each of antimony, nitric acid, phosphorus, chloral hydrate, and oduvan leaves. In the last-mentioned case an alkaloid which proved fatal to a frog was extracted from the contents of the stomach.

In the nitric acid case the poison had been poured into a man's ear. Notwithstanding the authority of the King in *Hamlet*, this orifice is not to be recommended for the introduction of poison when a fatal result is desired.

ANIMAL POISONING.—There were 56 cases with 202 articles, against 77 cases with 225 articles in 1920, and 89 cases with 335 articles in 1919. Thevetin, the active principle of yellow oleander, was the poison most commonly found (9 cases), and arsenic came second (8 cases). Poison was detected in 32·1 per cent. of the cases.

\* G.O., No. 633, P.H., May 6, 1922, 16 pp.

**STAIN CASES.**—Of the 368 cases and 1391 articles examined for blood only positive results were obtained in 75·3 per cent. of the cases, and 68·6 per cent. of the articles. The remainder of the 406 cases were examined for semen or semen and blood. During the year 1024 specimens of blood stains were sent to the Imperial Serologist, Calcutta, and he reported 886 of them to be human blood alone. Of the remainder 18 were both human and ruminant blood, 12 were ruminant animal blood only, 6 were non-mammalian blood, and in 102 the origin of the blood could not be determined.

**MISCELLANEOUS MEDICO LEGAL CASES.**—There were 21 cases with 211 articles, as against 34 cases with 133 articles in 1920. Five cases were concerned with the identification of supposed murdered persons from bones.

In one case of counterfeit coining the metal of the spurious coins was an alloy of the same composition as that found in bulk and in melting pots in the house of the suspected coiners.

**GENERAL ANALYSES.**—The substances analysed for various Government departments and for private persons were 556, as compared with 479 in 1920. They included 15 samples of explosives, 63 samples (including 11 of dyestuffs) for the Customs, 175 samples (with 115 of stomach washings and 23 of urine) for the Government General Hospital, 76 samples (with 12 of acetylsalicylic acid and 16 of chloroform) for the Medical Stores Department, and 35 samples of inks and ink powders for the Stationery Department.

There was a suspicion that supplies of chloroform sent out to the Government of India were unsafe for anæsthetic purposes, but all the samples complied with the tests of the B.P.

It has been found that over a range of temperature from 5° to 30° C. the density of mixtures of chloroform and a small percentage of alcohol is a linear function of the temperature within about  $\pm 0\cdot0005$ , so long as the mixture is not allowed to absorb moisture from the air, and nearly a linear function of the percentage of alcohol.

Small amounts of nitrogenous substances in sodium morrhuate may be accurately estimated by means of Kjeldahl's method, with colorimetric estimation of the ammonia.

## DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

### FIRST REPORT OF THE ADHESIVES RESEARCH COMMITTEE.\*

**INTRODUCTION.**—At the outset the following lines of enquiry were adopted: (a) An attempt to evolve physical and mechanical glue tests (to supplement those of the Aircraft Inspection Department), such as would differentiate between samples of tolerable merit. (b) To ascertain to what substance or substances and to what properties of such substances, the adhesive strength of the gelatin base glues is due. (c) To discover whether and where wastage of raw material occurred in manufacturing processes, and if so, to suggest a remedy. (d) To examine, from the point of view of their adhesive power, the physical properties of substances obtainable from sources other than bone, hide or casein, and, if possible, from waste products of which supplies exist in this country.

It would seem that, with few exceptions, the manufacturing processes used in this country are purely empirical, and that, consequently, there is frequently an output of lower yield and grade than should be the case. Experiments have indicated that it is not improbable that valuable adhesives should be obtainable from vegetable sources, other than the common gums.

\* H. M. Stationery Office, Kingsway, London, W.C.2, 1922. Pp. 129. Price 4s. net.



The problem of the nature of adhesion is under constant investigation; there is still no generally acceptable explanation of the action by which glues, etc., cause surfaces to stick together.

**MECHANICAL TESTS OF ADHESIVES FOR TIMBER.**—Much investigation is still required before a standardised method can be devised and accepted, although it would seem to be generally agreed that the most useful information is to be obtained from wood joints made up with the adhesive in question.

A report on the subject by Major Robertson was submitted to the Committee in 1919, and has since been issued by the Aeronautical Research Committee.\* In that report the various mechanical tests are described and criticised, and a routine method of testing adhesives outlined. Other investigations have since been made, and it is hoped to return to the subject.

**CASEIN ADHESIVES.**—The factors influencing the uniformity of commercial casein are discussed, and it is shown that these are the presence of fat, the presence of traces of acid, and the state of division of the substance.

**COMPOSITION OF CASEIN CEMENTS.**—As the result of a large number of trials the following formula was evolved for a cement with good keeping qualities as well as good adhesive properties: Casein, 78; dry sodium carbonate, 4.5; sodium fluoride, 4.0; freshly slaked lime, 12.5; and sodium arsenate, 1.0 per cent. All the ingredients must be ground to pass a 90-mesh sieve.

**GELATIN ADHESIVES.**—The general conclusions drawn from the investigations were as follows:—(1) Excessive heating of glue or gelatin solutions is to be avoided. The concentration of gelatin solutions at relatively low temperatures *in vacuo* yields a superior product. (2) Digesting liquids should be as nearly neutral as possible. (3) The strength of the alkali solution used for cleaning skins should be less than 2 per cent. (4) A gelatin can be obtained from ground undecalcified bones by digestion at a temperature not exceeding 100° C. (5) Acids or alkalis used for the preparation of bones, tendons and skins must be removed, as completely as possible, before digestion.

**THE CLASSIFICATION OF GLUES.**—A critical summary is given of the various mechanical and chemical tests, with references to the original papers. The following standards have been fixed by the British Engineering Standards Association:

Class	Breaking Stress	Use
Propeller glues	1100 lbs. per sq. in.	Air-screw manufacture.
Class I.	1000 lbs. „	Important stress-bearing work.
Class II.	900 lbs. „ and under.	No stress-bearing work.

**Diffusible Nitrogen Test.**—Results are tabulated which show the relationship existing between the amount of diffusible nitrogen and the tensile strength; the latter is roughly inversely proportional to the former.

**STUDY OF THE FORMATION OF GELATIN.**—A synthetic examination of glue has been undertaken, and an attempt is being made to prepare a standard gelatin from a known source by scientifically controlled methods.

The dynamics of the formation of gelatin from its precursors, and of the conversion of gelatin anhydride into gelatin, have been examined, and the results, illustrated by curves, are given in detail.

**EFFECT OF HEAT ON GELATIN.**—Experiments, described in detail, have shown that prolonged heating of 20 per cent. solutions of gelatin at 80° and 100° C. have a pronounced deteriorating effect upon both the melting point and the jelly strength.

\* Report on the Materials of Construction used in Aircraft and Aircraft Engines, Chap. XI., p. 132. H.M. Stationery Office. Price 21/- net.

VEGETABLE ADHESIVES.—The most promising results were obtained with castor bean residues. The protein was extracted with 0·4 per cent. sodium hydroxide solution for 3 to 4 hours, the extract neutralised with hydrochloric acid, and the precipitate separated, washed and dried. A cement was prepared in accordance with the following formula: Castor bean protein (reprecipitated after treatment with fluoride and lime), 78; sodium carbonate, 4·5; sodium fluoride, 4; sodium arsenate, 1; slaked lime, 12·5; and water, 250 parts.

The average tensile strength (178·5 lbs. per sq. inch) was well above the standard figure (150 lbs. sq. in.) for plywood.

PHENOL-FORMALDEHYDE CONDENSATION PRODUCTS.—By using excess of phenol to formaldehyde a soluble product was obtained, which was transformed into the second, insoluble (and adhesive) compound at a lower temperature than when equimolecular proportions were used. Details of the preparation of a cement on these lines are given. On cooling, this cement sets to a jelly.

APPENDIX I. (75 pp.) contains a descriptive bibliography of gelatin, and APPENDIX II. (3 pp.) deals with the bearing of results obtained in recent investigations of soap systems upon the structure of gelatin gels.

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## MILK AND DAIRIES (AMENDMENT) ACT, 1922.

THE subjoined circular (No. 335) has been sent to the Clerks of County Councils and Sanitary Authorities:—

MINISTRY OF HEALTH, WHITEHALL, S.W.

28th August, 1922.

SIR,

I am directed by the Minister of Health to draw the attention of the Council to the Milk and Dairies (Amendment) Act, 1922, the provisions of which, except section 3, will come into operation on the 1st September, 1922.

SECTION 1 of the Act provides for the postponement of the Milk and Dairies (Consolidation) Act, 1915, until the 1st September, 1925, except in so far as that Act repeals the Act of 1914 and the Postponement Act of 1915.

SECTION 2 empowers a Local Authority under certain conditions to refuse to register a retail purveyor of milk, or to remove such a person from the register. In considering the effect of this section, reference should first be made to Article 6 of the Dairies, Cowsheds and Milkshops Order of 1885 and to subsection (3) of the present section.

The Order in question requires every Sanitary Authority to keep a register of persons from time to time carrying on the trade of cowkeepers, dairymen or purveyors of milk and provides that a person may not carry on the trade unless he is registered. This Order required the Authority to register every person carrying on the trade and gave them no power to refuse to register any person or to remove him from the register.

Section 2 (3) of the new Act provides that the Order is to have effect so as to require two registers to be kept, the one being restricted to retail purveyors and the other containing all other persons registered under the Order (*i.e.* wholesale traders and producers who do not sell milk by retail); and section 2 (1) empowers the Local Authority to refuse to enter any person on the first of these registers or to remove him from that register if they are satisfied that the public health is or is likely to be endangered by any act or default of his in relation to the quality, storage or distribution of milk. It is to be observed that the act or default on which action may be taken is not necessarily one which is an offence against any statute, order or regulation, but it would no doubt be advisable in taking action to note whether any specific offence has been committed.

The course which will be taken in removing a retailer from the register will generally be as follows:

(1) A report will be presented by the Medical Officer of Health or the Sanitary Inspector drawing attention to any act or default on the part of the retailer and showing in what respect the public health is or is likely to be endangered thereby. (2) The Authority will then serve a notice on the retailer setting out the reasons (which will generally be those given in the report referred to above) why it is proposed to remove him from the register and requiring him to appear before them to show cause to the contrary. At least seven days'

notice must be given of the time of hearing. (3) If the Authority are not satisfied with the explanation given they may decide to remove the retailer from the register and they will notify him of that decision. (4) The retailer may within 21 days appeal to a Court of Summary Jurisdiction. (5) Either the retailer or the Local Authority may appeal further to a Court of Quarter Sessions.

Provision is made for the removal not to take effect pending appeal. The procedure in the case of a proposed refusal to register is similar and in that case the provisions of the Order which prohibit a person from carrying on the trade of a dairyman unless he is registered are not to take effect until the appeal is finally determined.

Section 2 (2) empowers the Court before whom any retailer is convicted of an offence relating to milk or dairies, in addition to any other penalty, to remove him from the register for such period as the Court may think fit.

It will be observed that in any case the removal from the register may be absolute or in respect of specified premises; this will enable the Authority or the Court to distinguish between cases in which the defect is one of general methods and those in which it has relation only to the suitability of particular premises or the methods practised thereat.

SECTION 3 continues, with modifications, the provisions as to the grading of milk which are at present contained in Orders made by the Food Controller and this Department under the Ministry of Food (Continuance) Act, 1920. These Orders are continued in force until the 1st January next, when the provisions of Section 3 will come into operation. The section provides that milk may not be sold as "Certified," "Grade A," "Pasteurised," or under any other prescribed designation, except in accordance with a licence granted by the Minister or with his authority. The conditions governing the use of these designations will be laid down in an Order and will include conditions as to the payment of fees for the licences.

It is contemplated that the conditions as to Certified milk will be substantially the same as those at present applying to Grade A (Certified) milk, and that the licences for this Grade will continue to be issued directly by the Department.

In view of the fact that it is necessary at times for licensees to obtain substantial stocks of printed bottle caps, advertisements, and other notices, no objection will be offered by the Department if any licensee finds it convenient to adopt the designation "Certified" instead of "Grade A (Certified)," at any time before the 1st January.

It is contemplated that the conditions as to Grade A milk will be substantially modified, and that Local Authorities will be empowered to issue licences for this grade of milk. Representative Associations of the Local Authorities and of the trade will, however, be consulted before the Order is issued.

It is also contemplated that Local Authorities will be empowered to issue licences as to the use of the designation "Pasteurised," the general conditions governing the issue of licences being laid down in an Order.

It is not at present proposed to prescribe any additional designations.

SECTION 4 continues and extends the provisions of an existing Order of the Food Controller. The section prohibits the addition of any colouring matter or water, or re-constituted milk, or skimmed or separated milk, to milk intended for sale. This will enable Local Authorities to deal with cases in which such additions are made for fraudulent purposes but difficulty is experienced in proving that the mixture is sold as milk.

The section also prohibits the sale of re-constituted milk as milk.

SECTION 5 imposes a heavy penalty on any person who sells the milk of a cow suffering from tuberculosis of the udder where it is proved that he knew, or could have ascertained by ordinary care, that the cow was suffering from that disease. The maximum penalty for a second or subsequent offence is a fine of 100*l.* or imprisonment with or without hard labour for a period of six months, or both such fine and imprisonment.

SECTIONS 6 and 7 lay down procedure as to the making of Orders.

SECTION 8 requires the Minister to make regulations as to imported milk under the Public Health (Regulations as to Food) Act, 1907. It also empowers the Minister to make regulations prescribing standards for dried and condensed milks, and the manner in which receptacles containing dried, condensed, skimmed or separated milk are to be labelled or marked.

SECTION 9 deals with penalties and proceedings. Under subsection (2) where the Local Authority are reasonably satisfied that an offence committed by a purveyor of milk is due to an act or default of a servant or agent, without the knowledge, consent, or connivance of his employer they are required to take proceedings against the servant or agent, without first proceeding against his employer. Subsection (3) protects a person against conviction in respect of a sample of milk taken after the milk has left his custody and control, if it is proved that the churn or other receptacle in which the milk was contained was effectively closed and sealed when it left his custody and control, but was not so closed and sealed when it reached the person by whom the sample was taken.

SECTION 10 specifies the Local Authorities for the enforcement of the various sections of the Act. The enforcing authorities are the same as those at present concerned with the enforcement

of similar provisions in the existing law. The section also provides out of what rate or fund the expenses of the Local Authority shall be paid.

SECTION 11 deals with the case of failure of a Local Authority to perform any of their duties under the Act, and makes provision for the transfer of powers or duties from a defaulting District Council to the County Council.

SECTION 12 exempts the retailer from actions for breach of contract if he is refused registration or removed from the register under Section 2 by reason of the quality of milk supplied to him.

SECTION 13, which follows the lines of Section 21 of the Sale of Food and Drugs Act, 1875, provides that the certificate of a Public Analyst shall be sufficient evidence of the facts stated therein unless the defendant shall require that the analyst shall be called as a witness.

The Minister desires to take this opportunity of drawing the attention of Sanitary Authorities to the very wide powers which they already possess for the sanitary control of dairies and cowsheds under the existing Dairies, Cowsheds and Milkshops Orders of 1885, 1886, and 1899, and the detailed Regulations which have been made by most Authorities under the first of those Orders. It seems to the Minister that by the careful and systematic exercise of existing powers together with the additional powers conferred under the new Act, Local Authorities should be able to take all necessary steps for the protection of the milk supply from contamination.

I am, Sir, your obedient servant,

L. V. BROCK (*Assisiant Secretary*).

## Pasteur Commemoration Fund.

THE Registrar and Secretary of the Institute of Chemistry has sent the following letter to the press:

“DEAR SIR,

“I am desired by Mr. A Chaston Chapman, Hon. Treasurer (in this country) for the Pasteur Commemoration Fund, to inform you that the sum of £848 14s. 6d. has been subscribed to the Fund, and to send you a list of subscribers, to whom the British Committee have tendered their best thanks.

“A draft for the sum mentioned has been forwarded to Mons. Th. Héring, the General Treasurer at Strasbourg. —Yours faithfully,

“RICHARD B. PILCHER, *Registrar & Secretary.*”

## United States Department of Agriculture.

### FOOD INSPECTION DECISION 184.

#### COLOURS IN FOOD.

(AMENDMENT TO FOOD INSPECTION DECISIONS 76, 117, 129, 164, 175, AND 180.)  
JUNE 5, 1922.

Food Inspection Decision 180 is amended by adding 433 Guinea Green B to the list of permitted dyes contained therein.

Hereafter the coal-tar dyes which will be accepted for certification, subject to the provisions of Food Inspection Decisions 76, 77, 106, 129, and 159, shall be the following:—*Red shades*: 56 Ponceau 3 R, 107 Amaranth, 517 Erythrosine. *Orange shade*: 85 Orange I. *Yellow shades*: 4 Naphthol yellow S, 94 Tartrazine, Yellow A. B. (Benzeneazo- $\beta$ -naphthylamine), Yellow O. B. (Ortho tolueneazo  $\beta$ -naphthylamine). *Green shades*: 433 Guinea green B., 435 Light green S. F. yellowish. *Blue shade*: 692 Indigo disulphoacid.

The numbers preceding the names refer to the numbers of the colours as listed in A. G. Green's edition of the Schultz-Julius Systematic Survey of the Organic Colouring Matters, published in 1904.

## ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

## Food and Drugs Analysis.

**Philippine Rice.** A. H. Wells, F. Agcasili and R. T. Feliciano. (*Philippine J. Sci.*, 1922, 20, 353-361.)—The average percentage composition of different varieties of Philippine rice, compared with that of rice grown in the United States, was as follows:—

	Weight of 100 Kernels Grms.	Moisture	Protein	Ether Extract	Crude Fibre	Other Carbo- hydrates	Ash	Phosphorus pent- oxide
Philippine Islands	1.97	12.26	7.93	2.03	1.18	75.89	1.46	0.75
United States	2.46	11.88	8.02	1.96	0.93	76.05	1.15	0.4

**Food Value of Philippine Bananas.** W. Salvador. (*Philippine J. Sci.*, 1922, 20, 363-366.)—The following percentage results were obtained in the analysis of edible portions of two varieties of *Musa sapientum*, two varieties of *M. paradisiaca*, and one variety of *M. errans*:—

	Water	Ether Extract	Protein	Sucrose	Reducing Sugars
<i>Musa sapientum</i>	66.56-73.69	0.69-0.41	1.07-1.42	2.03-16.95	25.0-4.09
<i>M. paradisiaca</i>	68.66-69.97	0.8-0.59	1.48-1.03	1.33-3.16	22.7-18.52
<i>M. errans</i>	83.08	0.40	1.01	0.15	10.75

	Starch, etc. (by difference)	Crude Fibre	Ash	Acidity as H <sub>2</sub> SO <sub>4</sub>	Calorific value per 100 Grms. of food
<i>Musa sapientum</i>	3.41-2.06	0.31-0.61	0.77-1.04	0.93-0.77	136.9-106.9
<i>M. paradisiaca</i>	3.49-5.49	0.35-0.32	1.16-0.92	0.53-0.54	127.9-122.4
<i>M. errans</i>	3.03	0.50	1.08	0.22	67.0

The acidity was due to a mixture of butyric and citric acids, but was calculated as sulphuric acid, in accordance with the method of expression adopted in other laboratories.

**Spined Dog-Fish Oil.** T. Lexow. (*Chem. Umschau*, 1922, 29, 59.)—The liver oil obtained by rendering under a vacuum from a specimen of *Acanthias vulgaris*, Kisso, weighing 3.14 kilos, gave the following analytical figures:—Sp. gr. 15°/15° C., 0.9125; acid value 0.0 (?); saponification value, 156.4; unsaponifiable matter, 12.3 per cent.; iodine value (Wijs), 110.1; combined fatty acids, 79.28 per cent.; and glycerol, 8.18 per cent. The fatty acids, freed from unsaponifiable matter, gave: Melting point, 27.8° C.; acid value, 177.8; saponification value, 189.5; and mean molecular weight, 296.1. The unsaponifiable matter, which was a pale yellow semi-solid substance made up of leaf-like crystals, gave an iodine value (Wijs) of 72.9 and crystallised from alcohol at -5° C. There was no evidence of the presence of squalene or alcohols of high molecular weight.

D. G. H.

**Copal Oil. A New Fat from the Belgian Congo. J. Pieraerts.** (*Mat. Grasses*, 1922, **14**, 6094.)—An oil termed "m'Pafu oil" by the natives, was obtained from the fruits of the copal tree, probably *Copaifera Demeusei*, and found to give the following analytical figures: Sp. gr., 19.5°/19.5° C., 0.9165;  $n_D^{40}$ , 1.4601; saponification value, 196.2; iodine value, 59.5; Reichert-Meissl value, 0.67; Polenske value, 0.3; and Hehner value, 94.6. Fatty acids: Solidifying point, 42° C.;  $n_D^{51}$ , 1.4488; neutralisation value, 196.1; saponification value, 207.5; mean molecular weight, 270.4; iodine value, 62.9; solid acids, 55 per cent.; and liquid acids, 45 per cent. The solid acids gave: Solidifying point, 58° C.; iodine value, 40.2; neutralisation value, 153.9; and saponification value, 171.2; and the liquid acids had an iodine value of 138.9. The oil was non-drying and most probably non-poisonous, and might prove useful, especially as large quantities are likely to be available, for soap, or, after suitable refining, for edible purposes.

D. G. H.

**Method for the Preparation of Crystalline Iodomercuriates of Alkaloids. M. François and L. G. Blanc.** (*Compt. rend.*, 1922, **175**, 169–171.)—

Under ordinary conditions the precipitates produced by solutions of mercuric iodide in potassium iodide with alkaloid salts are amorphous; they may, however, be obtained in the form of crystals, having the general formula  $(\text{HgI}_2)_m(\text{Alk.HI})_n$ , by cooling a hot solution of the alkaloidal iodomercuriate, obtained by adding much hydrochloric acid to the mixture and heating it nearly to the boiling point. It is best to add a hot solution of the alkaloid containing much hydrochloric acid to a hot solution of potassium mercuriiodide; a clear solution must be obtained at this stage. The alkaloid iodomercuriate will then be precipitated in the form of brilliant yellow crystals which do not contain chlorine or water of crystallisation in their molecule. The crystals are decomposed by water and therefore must not be washed. Crystalline iodomercuriates were obtained from the following substances: Caffeine, theobromine, quinine, morphine, codeine, cocaine, strychnine, pilocarpine, sparteine, pyridine, and quinoline.

H. E. C.

**Method for the Preparation of Crystalline Iodobismuthates of Alkaloids. M. François and L. G. Blanc.** (*Compt. rend.*, 1922, **175**, 273–274.)—

Crystalline iodobismuthates of the alkaloids may be prepared in a manner similar to that used for the iodomercuriates (*cf.* preceding abstract). A hot solution of the bismuth potassium iodide is added to a hot solution of the alkaloid in the presence of much hydrochloric acid. It sometimes happens that, on cooling, transparent globules form instead of crystals, but by changing the conditions of concentration, crystals can always be obtained. The crystals are less highly coloured than the amorphous precipitates usually obtained with this reagent; they are voluminous and of characteristic microscopic form; they do not contain chlorine or water of crystallisation, and have the general formula  $(\text{BiI}_3)_m(\text{Alk.HI})_n$ . Crystals of the iodobismuthates of the following substances have been obtained: Caffeine, theobromine, morphine, codeine, quinine, atropine, arecoline, pilocarpine, sparteine, nicotine, aniline, pyridine, and quinoline.

H. E. C.

**Toxicity of Commercial Caffeines.** (*J. Pharm. Chim.*, 1922, 26, 115-116.)—Numerous samples of caffeine with ordinary chemical and physical properties were found, during a year's work, by the Pharmacie Centrale de France to have an abnormally high toxicity. After an exhaustive investigation it was found that if 0.3 grm. of the caffeine were treated in a porcelain crucible with 2.5 c.c. of fuming nitric acid, evaporated at 100° C., and the residue, spread well over the walls of the crucible, submitted for 10 minutes to the action of the vapour given off by boiling ammonia solution, and then treated with 10 c.c. of potassium hydroxide solution (30° Bé.), and the liquid filtered through glass wool into test tubes of standard diameter, the filtrate obtained from pure caffeines was of a yellowish brown colour, whilst that from hypertoxic samples had a distinct violet colour.  
D. G. H.

**Abnormal Toxicity of Certain Caffeines.** (*Ann. Chim. anal.*, 1922, 4, 243-244.)—The normal toxicity of commercial caffeine fluctuates between 0.24 and 0.30 grm. per kilo. of animal, whereas certain abnormal caffeines have shown a toxicity of 0.10 to 0.12 grm., or even 0.08 grm. per kilo. Experiments on caffeine extracted by various methods from tea, coffee, roasted coffee, kola nut and guarana, gave the normal results of 0.24 to 0.30 grm. per kilo. of animal. On the other hand, synthetic caffeines, whether derived from uric acid or from theobromine (by methylation) were all hypertoxic. They contained from 25 to 27 per cent. of nitrogen (theoretical value for caffeine = 26.4 per cent.), and gave the murexide colour reaction for xanthic bases (see preceding abstract). The residue left by pure caffeine in that test would be tetramethylalloxanthine, whereas that left by uric acid products would be murexide. Caffeines prepared in the laboratory and mixed with a trace of uric acid also gave the reaction. The abnormal toxicity of these commercial caffeines is therefore to be attributed to the presence of purine bases akin to uric acid.

**Composition of Emmenagogues and similar Preparations.** C. Griebel. (*Zeitsch. Nahr. Genussm.*, 1922, 43, 361-368.)—Most emmenagogue powders formerly consisted of finely ground ordinary or Roman chamomile. The former, *Matricaria chamomilla*, is recognisable by the many spherical pollen grains, furnished with small spines and with three exits for the pollen-tube. Roman chamomile, *Anthemis nobilis*, contains only isolated pollen grains, but shows fragments of tissue composed externally of colourless, elongated, prosenchymatous cells, and internally of sclerotised fibres. Nowadays most emmenagogue powders consist of ground rosemary leaves, sometimes labelled "Folia Anthos pulv.;" with old samples the characteristic smell may be lacking, but identification is rendered possible by the presence of (1) numerous fragmentary and a few uninjured specimens of the monopodial branched hairs, and (2) portions of the thick-walled, hypodermatous tissue serving for the storage of water, this tissue being mostly still united to assimilation parenchyma and epidermis.

Powders of the yarrow plant (*Achillea millefolium*) or its flower and of the blessed thistle (*Cnicus benedictus*) are used more rarely as emmenagogues. The most

characteristic feature of yarrow powder consists of peculiar hairs, which are composed of a raised, thick-walled epidermal cell, a stem of four short cells, and a long, thick-walled, straight or sinuous terminal cell with a very narrow lumen; these long cells are mostly broken during the disintegration of the leaves. Yarrow flower powder contains (1) numerous round pollen grains furnished with five spines, and with three exits for the pollen tubes; (2) fragments of the characteristic hairs; and (3) morsels of involucre leaves, consisting internally of several series of cells, and, at the edge, of a layer of thin-walled prosenchymatous cells. *Cnicus benedictus* powder is characterised chiefly by the forms of its various hairs, which are, however, not present in any great abundance; the hairs of the flower-base form broad structures, composed of numerous elongated, air-containing cells, and are mostly broken; those of the leaves and stem, also usually broken, are made up of a series of short cells, often more or less crumpled, whilst the downy hairs of the perianth consist each of an extremely long, narrow cell, sometimes furnished with a short stem.

Wormwood powder, often occurring as a component of emmenagogues, contains: many narrow, thin-walled T-shaped hairs, which are mostly broken, but may be observed intact in the narrow end-cells normal to the stalk at the points of attachment; very long, wide, ribbon-like hairs, usually with stout walls showing delicate striation; glandular hairs of the form characteristic of the *Compositæ*, these occurring on the larger fragments of the leaves and petals; small, roughly spherical pollen-grains with three exits for the pollen-tubes. Parsley root powder, which was found in a single emmenagogue powder, contains a considerable proportion of starch in small granules, either single or in aggregates of two, three or four granules.

So-called foot-bath powders, often used in conjunction with emmenagogues, consist frequently of mixtures of powdered oak bark with white mustard and sometimes of white or black mustard alone. Oak bark shows numerous irregularly polygonal cells, mostly thickened and liberally spotted, and also fragments of long, narrow, thickened, bast-fibres, either single or in bundles, and often with a covering of cells each containing an oxalate crystal. In one preparation the oak bark was replaced entirely by red ferric oxide. These powders often contain powdered raspberry or blackberry leaves or heather. The first of these is recognisable by the numerous sinuous, whip-like, thick-walled, unicellular hairs from the underside of the leaves, whilst blackberry leaves carry large, thick-walled, unicellular bristle hairs and, in some cases, stellate hairs; the mesophyll of *Rubus* contains drusy masses of oxalate of various sizes. Heather powder may show red flower particles and fragments of three- or four-edged leaves, furnished on the lower side with a furrow lined with unicellular hairs; the pollen-grains form characteristic tetrads.

In most cases, however, foot-bath powders are mixtures of a number of weeds, including almost always shepherd's purse, which is characterised by the presence of 3-4- or 5-rayed hairs, often resembling antlers; the structure of the fruit-wall is also characteristic.

T. H. P.



## Bacteriological, Physiological, etc.

### Effect of Cold Storage upon the Carnosine Content of Meat.—

**W. M. Clifford.** (*Biochem. J.*, 1922, 16, 341–343.)—The colorimetric estimation of carnosine in meat (ANALYST, 1921, 46, 507) has indicated that cold storage causes a diminution of this compound, which may account for the inferior flavour of imported compared with home-killed meat. Results obtained with various meats show the carnosine content in imported material to be about one-third of that found in freshly-killed meat.

Meat	AVERAGE FIGURES.	
	English	Imported
Beef	1·03 per cent.	0·36 per cent.
Veal	1·08 „	0·35 „
Mutton	0·37 „	0·14 „
Lamb	0·41 „	0·15 „

Further experiments made upon beef-steak, examined at intervals of one month during storage at a temperature slightly below 0° C., showed a variable rate of diminution of carnosine content from 0·99 per cent. before chilling to 0·35 per cent. at the end of 9½ months. Similarly, in the case of seven rats which had been killed with coal-gas and then kept in the same cold room, the percentage of carnosine diminished from 0·11 to none after a period of 6½ months. Further investigation is being carried out to elucidate the cause of the loss of carnosine, and to deduce a curve from which the time of cold storage of meat may be determined from an estimation of the carnosine present.

T. J. W.

### Decomposition of Immature Feeding Salmon. A. C. Hunter. (*Amer.*

*J. Hyg.*, 1922, 2, 368–378.)—The practice of catching small immature salmon, not on the spawning migration, and the stomach and intestines of which are usually full of food, has recently been established in the salmon industry on the Pacific Coast. It is well known that salmon on spawning migration do not consume food of any kind, and it has also been shown that the alimentary tract of such fish is sterile when no food is present. Hence, bacterial infection being solely from the outside, there is a more or less definite correlation between the total counts of the bacteria present in the flesh and the physical condition of the salmon. A number of the immature feeding fish were examined immediately after delivery at the cannery, and then at intervals of 24 hours. It was observed that there was something present in these salmon, and not present in the mature non-feeding fish, which caused a softening of the flesh and a disintegration of the viscera, giving all the appearance of a markedly decomposed fish. Total counts of bacteria were made in the muscular tissue of the back and belly, around any wound or bruise, and in the stomach and intestines, but it was not found possible to correlate the total count with the physical condition of the fish. This rapid softening of the flesh was not observed in mature salmon which contained no food, but the tissue of which contained many more bacteria than were found in the immature fish.

The results indicated that autolysis, due to enzymic action, may play a part in the decomposition. The determination of the total count is only of value in judging the quality of salmon when the fish are not feeding and the alimentary tract is devoid of food. During the first 48 hours out of water under ordinary conditions immature, "feedy" salmon show but little physical evidence of decomposition. From that time on, the flesh begins to soften, and decomposition is manifest.

**Digestive Properties of Philippine Papain.** H. C. Brill and R. E. Brown. (*Philippine J. Sci.*, 1922, 20, 185-191.)—The following modification of Pratt's method (*Philippine J. Sci.*, 1915, A10, 1) of measuring the proteolytic power of papain and similar enzymes was used: A 10 per cent. solution of skimmed milk powder was mixed with a 0.5 per cent. aqueous solution of papain, and after digestion at the definite temperature, the undigested casein was precipitated by the addition of 0.5 c.c. of copper sulphate solution (60 grms. per litre), followed by 0.5 c.c. of glacial acetic acid, the liquid being meanwhile vigorously stirred. The precipitate was broken up, washed several times on the filter, dried in the oven, and weighed. A blank estimation was also made and the difference between the results gave the proportion of casein digested. Two preparations of papain were thus examined, one sun-dried and the other prepared by precipitation with alcohol. The latter was practically white and showed greater digestive powers. It was found that papain underwent autolysis at temperatures as low as 0° C. when left in aqueous solution, with toluene as preservative. Air-dried samples in sealed glass containers had lost their activity at the end of seven years. Sodium chloride had first a slightly activating influence, followed, in the case of more concentrated solutions, by an inhibiting effect. Potassium chloride and sodium citrate had a pronounced stimulative action, whilst acetic acid and lactic acid had a strong inhibiting effect.

**Glacial Acetic Acid as Solvent for Water-Soluble Vitamin B.** V. E. Levine, E. V. McCollum and N. Simmonds. (*J. Biol. Chem.*, 1922, 53, 7-11.)—Raw ground navy beans were heated on a water-bath for three hours with glacial acetic acid, and, after filtration of the extract, the residue was again extracted in a similar manner. The reddish-brown extracts were mixed and distilled under reduced pressure at 70° C., and the solid residue dried in a current of air. The resulting extract consisted of a readily powdered solid amounting to 2.75 per cent. of the original material. This substance was dissolved in hot glacial acetic acid, and the solution treated with five volumes of ether, a chocolate-coloured precipitate being thrown down. This amounted to 1.55 per cent. of the weight of navy beans used, and, when added to a basal diet given to rats, did not induce recovery from polyneuritis or cessation of decrease in weight. The filtrate from this precipitate was evaporated to dryness in a current of air, and the dry residue, when administered in an amount equivalent to 50 per cent. of beans added to the diet, caused rapid recovery of the rats. Acetic acid possesses many advantages over other solvents for the extraction of vitamin B, and retains the vitamin in an active condition after long standing.

T. J. W.

**Preparation of Cod Liver Oil and its Effect upon the Vitamin Content.**

**J. C. Drummond and S. S. da Zilva.** (*J. Soc. Chem. Ind.*, 1922, **41**, 280–284T.)—This paper is based upon a visit made by the authors to the chief Norwegian centres of the cod liver oil industry, and subsequent examination of the samples then collected. The oil is obtained from the livers by three chief methods: (a) The old-fashioned rotting process, in which the livers are stored in wooden vats for long periods, when the oil separates and collects upon the surface; (b) heating in steam-jacketed pans; and (c) heating by direct steam, in which process live steam is blown into a mass of livers, and the oil is skimmed off after separating. The small amount of crude oil produced by the first process is rarely used for medicinal purposes, but that obtained by the other methods is refined by freezing and the removal of "stearine," this being occasionally followed by treatment with an adsorbent for the removal of pigment. Whichever method of preparation and refining is adopted, the vitamin A content is practically unaffected, excepting during the bleaching of dark coloured oils, which is however rarely done. The variations observed in the vitamin content are believed to depend upon the changes in diet or the physiological condition of the fish at different seasons. (Cf. ANALYST, 1922, 341.) The stearine removed during refining was found to possess a high vitamin content, but is generally used for technical purposes. Oils obtained from the livers of other fish, such as the haddock and coal fish (*Gadus virens*), have also a high vitamin content, the proportion in some cases exceeding that of cod liver oil.

T. J. W.

**Colorimetric Estimation of Hæmoglobin.** **E. H. Terrill.** (*J. Biol.*

*Chem.*, 1922, **53**, 179–191.)—Methods are given for the preparation of stable acid-hæmatin standards from blood, as (a) solutions preserved by the addition of glycerol, (b) a dry powder, or (c) as gelatin film. These preparations show little deterioration if kept in the dark for a period of ten months. The estimation of hæmoglobin is carried out by collecting 50 c.mm. of blood (from a finger prick) by means of a pipette, mixing this with 5 c.c. of water, and after at least 30 seconds diluting the mixture to 10 c.c. with 0.2 N hydrochloric acid. The mixture is left for 10 or 15 minutes, and its colour is then compared with a standard by means of a colorimeter. Objections are raised to the use of heat for the rapid development of colour, and suggestions are given for the elimination of the turbidity frequently noticed in the usual preparation of acid hæmatin.

T. J. W.

**Estimation of Calcium in Blood.** **A. R. Ling and J. H. Bushill.** (*Bio-*

*chem. J.*, 1922, **16**, 403–406.)—The method described is based upon those previously published by McCrudden and others. From 2 to 5 c.c. of blood are slowly evaporated to dryness in a platinum dish, after which the residue is heated to a red heat until free from carbon. The ash is treated with three 0.5 c.c. portions of concentrated hydrochloric acid which are then transferred to a centrifuge tube having a narrow cylindrical portion at the lower end. The dish is rinsed with water, the rinsings being added to the contents of the tube, which are then treated with a slight excess of ammonium hydroxide (sp. gr. 0.88), and neutralised to alizarin by the

addition of 0.5 *N* hydrochloric acid, when a further 2.5 c.c. of this acid are run in, followed by 2.5 c.c. of 2.5 per cent. oxalic acid solution, and the whole is diluted to 25 c.c. and heated in a water-bath to the boiling point. To the hot solution 5 c.c. of 3 per cent. ammonium oxalate solution are added, and the mixture is maintained at 100° C. for 15 minutes, after which it is placed in ice-water, and 5 c.c. of 20 per cent. sodium acetate solution are run in, and the calcium oxalate is allowed to precipitate overnight. After centrifuging, the supernatant liquid is removed, and the precipitate is washed twice with 23 c.c. of water, treated with 4 c.c. of 5 per cent. sulphuric acid, heated to 65° C., and titrated with 0.01 *N* potassium permanganate solution, 1 c.c. of which is equivalent to 0.02 mgrm. of calcium. Results obtained with solutions containing known amounts of calcium show a maximum error of about 1.5 per cent., and duplicate estimations agree to within 0.1 per cent.

T. J. W.

**Estimation of Lipoid Phosphoric Acid ("Lecithin") in Blood.** F. S. Randles and A. Knudson. (*J. Biol. Chem.*, 1922, **53**, 53-59.)—The method described is an application of that devised by Bell and Doisy (*ANALYST*, 1921, **46**, 13): Five c.c. of whole blood or plasma are slowly pipetted into about 75 c.c. of a mixture of three volumes of alcohol, and one volume of ether, with continuous shaking, after which the liquid is heated to the boiling point, and then immediately cooled, diluted to 100 c.c. with the alcohol-ether mixture, and filtered. Ten or fifteen c.c. of the extract are transferred to a digestion tube and evaporated to dryness, and the residue is heated with 6 drops of sulphuric acid and 1 c.c. of nitric acid until the latter is driven off, after which about 5 c.c. of water are added and 2 c.c. each of the molybdic acid and hydroquinone solutions are run in. After the mixture has stood for 5 minutes, 10 c.c. of the alkaline sulphite solution are added, and the mixture is again left for 5 minutes and is then diluted to 25 c.c. The colour produced is compared with that obtained by using 5 c.c. of a monopotassium phosphate solution containing 0.03 mgrm. of phosphoric acid per c.c., to which 6 drops of sulphuric acid have been added. The colour produced appears to be altered by mechanical agitation, and the colorimeter cups should be filled with the two solutions at approximately the same time, or allowed to stand 5 minutes before a reading is taken. In order to secure the most accurate results it is advisable to standardise the method even in its smallest details. A comparison of the results obtained with those given by the Bloor method (*J. Biol. Chem.*, 1918, **36**, 33) shows a maximum difference of 5 per cent.

T. J. W.

**Estimation of Non-Protein Nitrogen in Blood.** E. Ponder. (*Biochem. J.*, 1922, **16**, 368-369.)—The following method requires only a small volume of blood, and no cloudiness or precipitate is formed on Nesslerisation. The solutions required are those described by Folin (*J. Biol. Chem.*, 1919, **38**, 106) for the preparation of blood filtrates, and a digestion mixture prepared by the addition of 100 c.c. of 85 per cent. phosphoric acid and 300 c.c. of concentrated sulphuric acid to 50 c.c. of 5 per cent. copper sulphate solution. Blood is collected from the finger or from an animal's vein by means of a 0.2 c.c. pipette and run into 1 c.c.

of water, the pipette being rinsed with two 0.2 c.c. portions of water. To the diluted blood 0.2 c.c. of sodium tungstate solution and a similar volume of 3.27 per cent. sulphuric acid are added and the mixture is left to stand five minutes with occasional shaking. The precipitate is filtered off on a micro-filter, with gentle suction, and 0.5 c.c. of the filtrate is transferred to a boiling tube, to which is added 0.2 c.c. of the digestion mixture diluted with three volumes of water. The mixture is boiled gently for two minutes, a few drops of water are added, and after cooling, the volume is made up to 3.5 c.c. A standard solution is prepared by adding 0.15 c.c. of 0.047 per cent. ammonium sulphate solution to 3.15 c.c. of water, followed by 0.2 c.c. of the diluted digestion mixture. To each tube 1.5 c.c. of Nessler solution is added, and the colours matched in a colorimeter. Test estimations made on substances of known nitrogen content have shown the method to yield accurate results, and experiments on the blood of various animals and of man have shown the non-protein nitrogen content to vary from 25 to 93 mgrms. per 100 c.c.

T. J. W.

## Organic Analysis.

**Preparation of Alcohol remaining clear with Alkali Hydroxide. H. Dubovitz.** (*Chem. Zeit.*, 1922, 46, 654.)—The darkening produced when alkali hydroxide is dissolved in alcohol is shown to be due to the presence of acetaldehyde, which may be removed as follows: If more than a faint brown coloration is obtained when 25 c.c. of the alcohol are boiled for 10 minutes in a reflux apparatus with 2 c.c. of 50 per cent. potassium hydroxide solution, the spirit is distilled with a little of the latter and the first fractions of the distillate discarded; with denatured alcohol, only the last quarter is collected, and this again fractionated. The alcohol thus obtained is mixed with 5 c.c. of 50 per cent. sodium hydroxide solution and 5 grms. of zinc dust per litre and boiled under a reflux condenser for 30 minutes, subsequent distillation yielding a spirit which remains colourless and clear when boiled for hours with concentrated alkali hydroxide solution. A similar result may be attained by shaking the crude alcohol with a little concentrated sodium hydroxide solution and a few drops of perhydrol, heating the mixture after 30 minutes, and then distilling off the alcohol.

T. H. P.

**Erucic Acid. D. Holde and C. Wilke.** (*Zeitsch. angew. Chem.*, 1922, 35, 289–291.)—Pure erucic acid was prepared by fractional distillation of the methyl esters yielded by rape oil, and further purification of the crude acid separated from the methyl erucate. For this purpose the erucic acid, which contained a considerable amount of solid fatty acids, was recrystallised from alcohol, first below 0° C., to separate liquid unsaturated fatty acids, and then above 0° C., and was then treated with a saturated alcoholic solution of lithium acetate to precipitate the residual amount of solid fatty acids. The pure erucic acid, recovered from the filtrate, melted at 33.5° C. and had an iodine value of 75. When heated with acetic anhydride for 7 hours under pressure it yielded erucic anhydride in white crystals melting at 46° C.

**Colorimetric Method for Estimating Small Quantities of Furfural.** P. Fleury and G. Poirot. (*J. Pharm. Chim.*, 1922, 26, 87-96.)—Since the reaction of orcinol with pentoses has been found to be due to furfural, it has been studied from every point of view in order to establish, if possible, a reliable colour reaction for the estimation of small quantities of furfural. After consideration of the properties of the colouring matter, choice of solvent, concentration of reagents, influence of iron, method of operating and sensibility, the following method has been devised: A Duboscq colorimeter is used for the actual readings, and minute details are given in connection with its use. The reagents required are: (1) A solution of ferric chloride (0.2 c.c. of the French Codex solution in 1 litre of hydrochloric acid of sp. gr. 1.19), (2) a solution of 1 grm. of orcinol in 1600 c.c. of acetic acid, and (3) a standard solution of furfural (1 grm. in 10 c.c. of pure acetic acid made up to 1 litre). To two tubes containing respectively 1 c.c. of standard solution (=0.1 grm. of furfural) and 1 c.c. of solution to be estimated are added 4 c.c. of the orcinol reagent and 5 c.c. of ferric chloride, and the tubes placed in a water bath for exactly 1 minute. They are then taken out and left at laboratory temperature for half an hour before taking the colour reading, the colour remaining unchanged for one hour after leaving the water bath. The dilution of the solution under investigation should be so arranged that, compared with the standard solution at a depth of 10, the reading is between 8 and 12. The error of experiment is found to be not greater than  $\pm 1$  per cent. D. G. H.

**Contribution to the Method of Tannin Analysis.** J. Schneider, jun. (*J. Soc. Leather Trades' Chem.*, 1922, 7, 234.)—The author suggests weighing the various aliquot parts instead of the usual measurement by pipette, thus eliminating errors due to different viscosity of solutions, variations in laboratory temperature, etc. He also makes an appeal for the general introduction of a fine balance capable of weighing the litre of unfiltered tannin solution. An example is given comparing his method with the usual procedure, and he claims for the former much greater accuracy and concordance in duplicate estimations. He further recommends the use of a standard dried chromed hide-powder, which would avoid the necessity of freshly chroming, for every analysis. R. F. I.

**Estimation of Sulphur in Vulcanised Rubber.** J. W. W. Dyer and A. R. Watson. (*J. Soc. Chem. Ind.*, 1922, 41, 251-252T.)—Modification of the nitric acid process renders it suitable for the estimation of the sulphur in vulcanised rubber or proofed fabric. For the estimation of the combined sulphur 0.5 to 3 grms. of the sample are warmed in an open flask with 30-40 c.c. of nitric acid (sp. gr. 1.42), and after boiling, it is slightly cooled, and potassium permanganate is added in small quantities, with intermittent heating, until a permanent black precipitate is obtained. The liquid is evaporated to dryness, and the residue moistened with hydrochloric acid and again evaporated; the residue is then taken up with water, the liquid filtered, and the filtrate made up to 100 c.c., faintly acidified and treated with barium chloride at the boiling point. The method may also be used for the estimation of the total sulphur, if the amount of free sulphur is

not large. For the estimation of the free sulphur, *i.e.* the sulphur extracted with boiling acetone, 1 to 2 grms. are extracted with 50 to 60 c.c. of boiling acetone; to the acetone solution is added 0.5 to 1 grm. of potassium permanganate, and the mixture allowed to stand for half an hour, with the addition of more permanganate, if necessary, to retain the purple colour. After distilling off the acetone and drying the residue at 100°–110° C., a slight excess of hydrochloric acid is added, and the mixture warmed until a colourless solution is obtained; this is diluted, filtered, and rendered only faintly acid, and the sulphuric acid precipitated as usual. H. E. C.

**Comparison of the Standard Gas Furnace and Micropyrometer Methods for Determining the Fusibility of Coal Ash.** A. C. Fieldner, W. A. Selvig and W. L. Parker. (*J. Ind. Eng. Chem.*, 1922, 14, 695–698.)—The standard gas furnace method has been adopted tentatively by the American Society for Testing Materials, and is employed for determining the temperature at which a triangular pyramid of the ash of definite dimensions fuses to a spherical lump in a reducing atmosphere under definite conditions. The micropyrometer consists of a platinum strip connected with iron rods, and enclosed in a small alundum furnace, the upper half of which is removable, and is provided with an observation hole covered by a microscope cover glass. For use with a reducing atmosphere an air-tight furnace of brass is employed through which a current of gas is passed. The temperature of the ash under examination is determined by comparison of the colour of the hot platinum with the filament of a small electric lamp situated in the image plane of the eyepiece of the observation microscope. The current supplied to the lamp is measured by means of a milliammeter, and the corresponding temperature is found by calibration with substances of known melting point in the furnace. The ash under examination is finely ground in an agate mortar, and a small quantity is transferred to a piece of platinum foil 3 mm. square, this being placed upon the platinum strip in the furnace, which is heated by passing a gradually increasing electric current, while the ash is continuously observed through the microscope. Meanwhile the current passing through the eyepiece lamp is adjusted to agree in luminosity with that of the platinum strip in the furnace, and when the particles of the ash show a well-defined rounding the current passing through the lamp is read, and the melting point deduced from the calibration curve. The results obtained by both methods are in excellent agreement with ashes fusing below 2600° F., but more refractory specimens may show a melting point 100° to 500° F. higher by the standard gas furnace than by the micropyrometer method when a reducing atmosphere is used. Higher results are given by the micropyrometer method when an oxidising atmosphere is employed. The newer method has several advantages over the standard method; only a small amount of ash is required, the time occupied is considerably reduced, and the operator works in greater comfort. T. J. W.

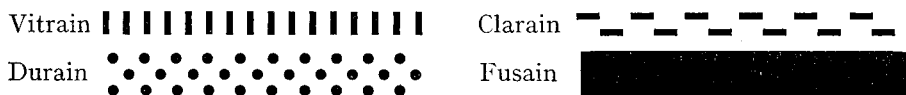
**Short Method for the Ultimate Analysis of Coal.** S. W. Parr. (*J. Ind. Eng. Chem.*, 1922, 14, 681.)—For several years the following method has been used for testing boilers and has given satisfactory results: The coal is burnt

with sodium peroxide in a calorimetric bomb or similar apparatus, and the carbonate formed is decomposed by acid in an apparatus which allows the carbon dioxide formed to be accurately measured. The results are calculated according to the following scheme: (1) Weight of sulphur  $\times 2777$  = Calories from sulphur as iron pyrites. (2) Weight of carbon  $\times 8080$  = calories from carbon. (3) Total calories  $-(1+2)$  = calories from available hydrogen. (4) Calories from available hydrogen  $\div 34,450$  = weight of available hydrogen. (5) Nitrogen present may be assigned a constant value of 1.25 per cent. (6) By difference,  $100 - (\text{sulphur} + \text{carbon} + \text{available hydrogen} + \text{nitrogen} + \text{ash})$  = Total oxygen + hydrogen necessary to form water. (7)  $(\text{Oxygen} + \text{combined hydrogen}) \times \frac{8}{9}$  = total oxygen. (8)  $(\text{Oxygen} + \text{combined hydrogen}) \times \frac{1}{9}$  = combined hydrogen. (9) Combined hydrogen + available hydrogen = Total hydrogen. The figures for moisture-free material are used in the calculation, and the results obtained agree satisfactorily with the complete ultimate analysis made in the usual manner.

T. J. W.

### Method of Representing the Structure of Coal Seams. F. S. Sinnatt.

(*Trans. Inst. Mining Eng.*, 1922, 63, 307-317.)—The composition of coal seams in terms of Stopes' vitrain, clarain, durain, and fusain, are shown by drawing to scale a section of the seam in which the components have been accurately measured, and representing them by conventional shading:—



The four components are easily recognised and have the following characteristics:—Fusain, or "mother of coal," occurs in the form of thin bands, sometimes pulverulent; it is non-caking, and reduces the coking property of the coal in which it occurs. Durain is granular, dull, hard, and homogeneous, consisting microscopically of spores. Vitrain occurs as definite narrow bands of bright coal, frequently of uniform thickness, entirely devoid of preserved plant structure. Clarain possesses a definite and smooth surface when broken at right angles to the bedding plane, and these surfaces have a pronounced gloss which is inherently banded, often with fine durain intercalated between its bands. The percentage of these components in certain seams is as under:—

Seam	Vitrain	Clarain	Durain	Fusain	Foreign Matter
Arley	14.6	65.9	18.1	1.4	—
Wigan Five Feet	9.8	53.1	35.2	1.9	—
Trencherbone	7.0	70.0	21.2	1.8	—
„ Tops	7.2	55.8	35.5	1.5	—
„ Bottoms	6.8	85.6	5.6	2.0	—
Wigan Yard	25.1	51.9	20.2	1.0	1.8
Arley	21.3	65.4	12.8	0.5	—
Queen Mine	1.3	98.7	nil	nil	—

The main analytical features of these substances are:—Vitrain has the highest moisture content and the lowest ash; clarain evolves a high percentage of volatile



matter and has a slightly higher ash than vitrain; durain has a high ash content with a low moisture and volatile matter lower than vitrain and durain; fusain has a high ash and low volatile matter content. The agglutinating values (*cf. J. Soc. Chem. Ind.*, 1920, 83T) are exemplified by the following figures:—

	Coal	Vitrain	Clarain	Durain	Fusain
Arley	15	9	17	6	nil
Wigan Five Feet	4	3	7	5	nil

The powdering of coals improves the coking properties because it disseminates the highly caking clarain.

H. E. C.

**Separation of *m*- and *p*-Cresols from Coal-Tar Crude Carboic Acid**  
**A. F. Campbell.** (*J. Ind. Eng. Chem.*, 1922, **14**, 732–737.)—By fractional distillation of crude carboic acid a product containing from 59 to 60 per cent. of *m*-cresol was obtained. This product was sulphonated by heating it for 6 hours at 40° C. with a quantity of 96 per cent. sulphuric acid insufficient for complete sulphonation, after which the mixture was poured into water and extracted with pure benzene to remove the non-sulphonated phenols. Eighty per cent. of the phenols present in the aqueous solution consisted of *m*-cresol combined as the mono-sulphonate. This was converted into the ammonium salt, and by fractional crystallisation from water, crystals containing from 98 to 100 per cent. of *m*-cresol were obtained in the first crop. The benzene extract of the non-sulphonated phenols was again sulphonated under the above conditions, after removal of benzene, and the product was extracted with benzene. The extract was shaken with sodium hydroxide solution, from which the hydrocarbons were then removed by distillation with steam. The phenols were liberated in the usual manner, frozen and drained *in vacuo*, and a product was obtained containing approximately 89 per cent. of *p*-cresol and 6 to 7 per cent. of *m*-cresol.

T. J. W.

## Inorganic Analysis.

**Estimation of Hydrogen and its Separation from Paraffins by means of Palladium Chloride.** **J. A. Müller and A. Foix.** (*Bull. Soc. Chim.*, 1922, **33**, 713–717.)—The estimation depends upon the reaction  $\text{PdCl}_2 + \text{H}_2 = 2\text{HCl} + \text{Pd}$ ; palladium chloride being decomposed by hydrogen, but unaffected by methane or ethane. About 15 c.c. of the hydrogen or gaseous mixture are collected over boiled distilled water in a 100 c.c. stoppered flask, into which is afterwards introduced a small tube containing a solution of 0.138 gm. of palladium chloride in 1 c.c. of water. The flask is closed, the contents of the tube are mixed with the liquid in the flask, and the whole is immersed up to the neck in water maintained at 50° to 60° C. until absorption is complete. The time required is about a week, and the flask must be shaken periodically in order to cause the film of palladium, which forms on the surface, to sink. When the absorption is complete the palladium is filtered off, dried in the cold over sulphuric acid and weighed. Any palladium oxide which may be formed is collected separately, washed, dried, and gently ignited, and its weight calculated to the metal. One mgrm. Pd = 0.24 c.c. of hydrogen at 0 C. and 760 mm.

H. E. C.

**Colorimetric Estimation of Small Quantities of Gold as Colloid.** J. A. Müller and A. Foix. (*Bull. Soc. Chim.*, 1922, 33, 717-720.)—Small quantities of gold precipitated in the colloidal form by formaldehyde may be estimated colorimetrically if the solution contains less than 1 in 40,000 of gold, in which case the intensity of the colour is proportional to the amount of the metal present. The solution is prepared by adding to the gold chloride solution 1 c.c. of a 20 per cent. solution of sodium hydroxide and 1 c.c. of formalin (40 per cent.). A convenient standard is made up by adding the above quantities to 0.1 c.c. of gold solution containing 1 mgrm. of gold, diluted to 38 c.c. with water. As the solutions to be compared are frequently not exactly similar, the size of the particles, and therefore the tints, may not be exactly the same; this may be compensated without serious error by the use of coloured glasses. Small amounts of lead, zinc, or aluminium do not interfere, but arsenic or mercury must be removed by calcination. Silver may be separated by means of a very slight excess of sodium chloride without affecting the accuracy of the colorimetric comparison; platinum should be separated as platino-chloride and palladium by the electrolytic method of Treadwell (*cf.* ANALYST, 1921, 46, 298). The elements of the gold group can be separated by heating the mixed sulphides in chlorine in the usual way, if care be taken to displace all the air in the tube by chlorine before heating; the residue is taken up in *aqua regia*, and the solution made alkaline and treated with formalin. Good results are obtained in the separation from arsenic, antimony, tin, molybdenum and tungsten, but not in the presence of vanadium.  
H. E. C.

**Electrolytic Estimation of Sodium in Aluminium and Alumina.** R. Geith. (*Chem. Zeit.*, 1922, 46, 745.)—The estimation of the small quantities of sodium in commercial aluminium and the purified calcined oxide used as raw material for the metal is very difficult by the ordinary methods. A process is described in which the neutral solution of the material is electrolysed with a mercury cathode communicating with an outer cell in which the sodium amalgam formed is converted into sodium hydroxide, which latter is estimated volumetrically. For diagram of apparatus and full details the original article should be consulted.  
W. R. S.

**Analysis of Monazite.** P. Wenger and P. Christin. (*Ann. Chim. anal.*, 1922, 4, 231-232.)—The decomposition of monazite is best effected by means of strong sulphuric acid. One grm. of the finely-ground mineral is heated with 5 c.c. of sulphuric acid to 230° for 5 hours. The pasty mass is gradually introduced into ice-cold water, the solution filtered, and the insoluble matter heated with hydrofluoric and sulphuric acids; the fixed residue is fused with 6 parts of sodium carbonate, and any tantalum goes into solution when the fused mass is leached. The insoluble residue from the last fusion (if any) is fused with bisulphate, and the solution thus obtained added to the first. The best conditions for the precipitation of the rare earths by means of oxalic acid were ascertained. The solution should contain 0.75 to 0.15 per cent. of free sulphuric, and an excess of 3 per cent. of oxalic acid; precipitation temperature, 55° C. The precipitation of thorium,

cerium, praseodymium, neodymium, and yttrium by this method may be considered quantitative, whilst lanthanum—the oxalate of which is the most soluble of the rare earth metals—is soluble to the extent of 0.0022 per cent.

W. R. S.

**Conductivity Titrations by means of Lead Nitrate. J. M. Kolthoff.** (*Zeitsch. anal. Chem.*, 1922, **61**, 369–377.)—The applicability of the electrometric method to precipitation analysis of anions by means of lead nitrate was investigated. *Iodide* can be estimated, provided the concentration is greater than 0.05*N*. Equilibrium is obtained immediately after the precipitant has been added; the first break, which is not very sharp, corresponds with the point  $\text{KPbI}_3$ . Several additions should be made after the end-point is passed, to obtain a more accurate location. Chloride and bromide hardly interfere. *Ferrocyanide* yields a precipitate ( $\text{Pb}_2\text{Fe}(\text{CN})_6$ ) of well-defined composition, and the end-point is accurately ascertainable, as beyond it the conductivity increases more rapidly. *Ferricyanide* under the same conditions gives no precipitate, and ferrocyanide can be estimated in its presence. *Thiocyanate* gives an irregular curve, probably due to the formation of complex ions. *Sulphate* is readily estimated: the conductivity remains almost constant until the end-point is reached, after which a sharp rise occurs. Addition of alcohol causes a less decided break; chloride does not interfere, but hydrochloric acid is very harmful, as well as ferric and aluminium salts. With *thiosulphate* the conductivity drops until, after addition of one-fifth of the required amount of lead nitrate, the precipitate ceases to re-dissolve; it then remains almost constant to the end-point, which corresponds with the formation of  $\text{PbS}_2\text{O}_3$ . *Pyrophosphate* cannot be estimated accurately. *Organic acids*: Formate, acetate, butyrate, lactate, citrate, benzoate, and salicylate give unsatisfactory titration figures, but the results are good in the case of oxalate, tartrate, and succinate. With succinate, several points on the curve should be determined after the reaction has proceeded to completion, as the curve is rounded off in the neighbourhood of the end-point.

W. R. S.

**Potentiometric Titration of Ferrocyanide. E. Müller and H. Lauterbach.** (*Zeitsch. anal. Chem.*, 1922, **61**, 398–403.)—Ferrocyanide can be estimated very accurately by the potentiometric method by means of permanganate, in 200 c.c. of solution acidified with 25 c.c. of 4*N* sulphuric acid. In the neighbourhood of the break, the potential becomes constant only after an interval of several minutes, but the readings can be taken at equal intervals before constancy is attained without affecting the results. The resistance curve shows a vertical rise when the end-point is reached; this occurs just before the colour-change; hence the potentiometric is more accurate than the volumetric method. No marked influence of the variation in acidity and dilution is recognisable within wide limits.

W. R. S.

**Analysis of Commercial Sodium Sulphide. W. R. Allen.** (*J. Soc. Leather Trades' Chem.*, 1922, **7**, 239.)—Twenty-five c.c. of a solution of the sodium sulphide, containing 8 to 10 grms. per litre, are titrated with 0.1*N* hydrochloric acid

to  $P_H=10$  in a comparator, thymol-phthalein being used as indicator. This neutralises the sodium hydroxide formed by hydrolysis, without decomposing the sodium sulphhydrate. The solution is now treated with 20 c.c. of neutralised formaldehyde solution (20 per cent.), which liberates sodium hydroxide, and this can be titrated with 0.1N hydrochloric acid (1 c.c. 0.1N HCl = 0.0078 grm.  $\text{Na}_2\text{S}$ ). If the original solution of the sodium sulphide is treated with a little milk of lime, and filtered, the filtrate will be perfectly colourless, and free from the green ferrous sulphide invariably present in commercial products.

R. F. I.

## Physical Methods, Apparatus, etc.

**Measurement of the Surface Pressure of Liquids.** A. Marcellin. (*Compt. rend.*, 1922, 175, 346-348.)—A "surface manometer" has been designed for the rapid measurement of the surface pressure exerted by thin films spread on the surface of water. Rapidity of measurement is necessary, because the pressure changes very quickly owing to impurity in the air or water. The pressure is measured by the flexion of a thin band of mica (12 cm. by 12 mm., thickness 0.05 mm.) The ends of a brass strip, 2 mm. thick and twice bent at right angles to form a U, are extended by two bands of rubber, 1 mm. thick, and to these the mica is bound. The stirrup of brass is held horizontally by a support provided with an adjusting screw and half immersed in the water. The plane of the mica is then perpendicular with the surface of the water, and together with the stirrup, encloses an area of 40 sq. cm. The bending of the mica is amplified and measured by the deflection of a spot of light reflected from a small mirror, and will show variations of pressure of the order of 0.1 dyne/cms. A detailed account of surface films of oleic acid is also given.

H. E. C.

**Determination of Molecular Weights by means of Osmotic Pressure.** A. Foix. (*Bull. Soc. Chim.*, 1922, 33, 653-654.)—The difficulty of preparing a truly semi-permeable membrane may be obviated by taking advantage of the fact that when an osmotic column is established in a constant temperature enclosure there is equilibrium between the vapour and solution above the column, and between the vapour and solvent at the foot of the column. If, then, a vessel containing the solution is placed in a constant temperature enclosure above a vessel containing the pure solvent, at such a height that there is no change in weight of the solution due to evaporation, the difference in level between the surface of the two liquids is equal to the height of the corresponding osmotic column, and is a measure of the osmotic pressure. The height for the zero rate of evaporation may be conveniently obtained by interpolation on plotting the rates of evaporation against the heights. Experiments on sugar solutions maintained in a constant temperature enclosure for a month are found to agree with results calculated from van't Hoff's law. The only practical difficulty lies in the maintenance of a constant temperature enclosure over long periods of time.

H. E. C.

**The Nephelectrometer.** I. N. Kugelmass. (*Compt. rend.*, 1922, 175, 343-345.)—The transparency of a colloidal system is proportional to its state of aggregation or degree of dispersion. Different colloidal solutions may therefore be compared by measuring their transparency, and for this the nephelectrometer is designed. It consists of a glow lamp, thermo-electric cell, and a trough for the solution to be observed, all enclosed at a constant temperature. The lamp is connected with a switch to a 110 volt circuit and is enclosed in a small metal box blackened on the inside; on the inside wall of the box is a groove for a monochromatic filter for use with coloured solutions, and on the outside a convex lens adjusted for parallel rays. The observation cell has two parallel sides with transparent discs through which the rays of light to be examined pass. The thermo-electric cell is of similar size to the observation cell, the sensitive part having the same diameter as the transparent part of the cell, and is connected with a millivoltmeter. The time in seconds necessary for the lamp to be switched on to obtain a deflection of 100 divisions of the voltmeter when the observation cell is full of water is noted as I. The deviation of the voltmeter ( $I'$ ) is now noted when the light is switched on for the same time interval with the colloidal solution in the cell; then  $I'/I$  is the "index of transparency." For the thermo-couple, iron-constantan of 0.1 mm. diameter is suitable. The apparatus is useful for observing the rate of coagulation of proteins or the stability of colloidal solutions. H. E. C.

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## Reviews.

THE CHEMICAL EXAMINATION OF WATER, SEWAGE AND FOODS. J. E. PURVIS, M.A., and J. R. HODGSON, M.A. Cambridge University Press. 1922. Price 20s. net.

The first edition of this book was issued in 1914, and the second edition, now being reviewed, contains many additions of importance. It appears to be intended for students desiring degrees or diplomas in public health, and for candidates for certain diplomas granted by the Institute of Chemistry. The subjects are dealt with purely from the chemical point of view, microscopical and bacteriological examinations not being included; neither are there any references to the question of the influence of impurities or adulterants upon health. The issue of works of this character, and they are becoming numerous, raises the question whether there is any necessity for Medical Officers of Health to make a special study of work which falls chiefly within the province of the Public Analyst. As a matter of general knowledge, the Medical Officer of Health has such multifarious medical duties that it would be of immensely greater service to him to be able correctly to interpret the results of analyses made by competent chemists than to obtain them himself, and to devote the extra time to considering the bearing of the results upon health. Very few Medical Officers have laboratories, and, where they have, it is fairly certain that the time devoted thereto could, in the majority of

cases, be better employed in the public interest in the discharge of administrative and medical duties. Even water analysis, which does not come within the duties of Public Analysts, is better left to the skilled analyst, the Medical Officer being trained to interpret the results from his special knowledge of the source of the sample and its surroundings.

A text-book of this character should also be written or compiled by some person or persons of lengthy and varied experience, who, having tried various processes for the determinations they describe, could give opinions as to the best test under varied circumstances, opinions which students and others could depend upon. In this book two or more methods may be described for some given determination, but the reader is left in doubt as to which he should employ. For example, several methods are described for determining the nitric nitrogen in potable waters and sewage effluents, yet the simplest and best, when properly applied, is the only one which is criticised, and the authors say should "be rejected." In an example given of this determination the calculated result is erroneous. In fact, the section on water analysis is the weakest in the whole book, there being scarcely a page which is not open to criticism, from the collecting of the samples to the tabulation of the results, which, by the way, are sometimes given to the third and fourth place of decimals when the accuracy of the first place may be doubtful. Out of the 100 pages devoted to water and sewage some 30 pages are taken up by matter which might have been dealt with in a few lines, with a reference to the original articles, its general interest and utility being so slight.

Food analysis occupies about 160 pages, is brought well up-to-date, and the references are very numerous. These are very useful, as in many cases the originals must be consulted to obtain sufficient detail. Tests are given for the detection of "green butter" in cacao butter, but there is no note on the source of its origin. Most readers would like to know what it is. In the chapter on meat there is no mention of Schryver's method for detecting treatment by formaldehyde, nor is horse-flesh mentioned; yet in the public health laboratory the identification of horse-flesh is not an unusual problem.

There is a chapter on the Analysis of Air and Coal Gas, but Haldane's method of estimating carbonic acid is not referred to. An incursion into the domain of pathological chemistry is made in the heterogeneous chapter on "Rag Flock—Urine." Toxicological chemistry is touched on in the final chapter, and caffeine, quinine and cinchonine are included apparently as poisons. The method for the detection of arsenic only occupies about a dozen lines; a page and a half is devoted to the detection of "Blood," and a few lines to the detection of semen—these in the section on Toxicology. A series of useful tables and a good index bring the compilation to a conclusion.

It is a work which may be useful to the student if supervised by a competent and experienced teacher, and the professional chemist may occasionally find references useful to him, but, on the whole, it can scarcely be said that it adds to the reputation of the University under whose ægis it is published.

JOHN C. THRESH.

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY. Vol. VI. 1921. Issued by the Society of Chemical Industry. Price 7s. 6d. to members, 12s. 6d. to non-members, post free.

These Reports have now established themselves so firmly as a vigorous annual that there is scarcely call for their review. When it is stated that the high standard set in previous years has been at least fully maintained in the present volume, but little further comment is necessary.

The present issue differs, however, from its predecessors in one particular, which will hardly meet with the approval of the members of our own Society—it contains no separate section dealing with analysis. Whether this is a permanent or only a temporary loss is not revealed. The references made to analytical processes in the different chapters are, on the whole, somewhat fuller than usual, and these, in conjunction with the section on analytical chemistry, compiled by Mr. C. A. Mitchell for the *Annual Report of the Progress of Chemistry for 1921*, published by the Chemical Society, are perhaps regarded as sufficient.

As in previous volumes, the divisions follow mainly the groupings of the abstracts published in the *Journal of the Society of Chemical Industry*. The effects of the prevailing condition of financial strain and general depression on the world's chemical industries and on the output of scientific work connected therewith are referred to by several of the contributors, in some cases in pessimistic vein. In this connection, Dr. Atack's reasoned statement of the position in the dye-making industry is one worthy of careful consideration. That "no fundamental research of importance is in progress with a view to the production of new colours" is not pleasant reading; and so it is cheering to learn from Professor Desch that, although many important plants have been standing idle and projected developments have been postponed, "the scientific study of non-ferrous metals and alloys has been progressing rapidly."

The book will well repay perusal, not only by chemists, but by all works' managers, directors, and the like, connected with chemical industries. It is well printed, has good indexes, and is supplied at a slightly lower price than that issued twelve months ago.

T. H. POPE.

COAL-TAR COLOURS IN THE DECORATIVE INDUSTRIES. By A. CLARKE. Pp. xiii. + 166. London: Constable & Co. 1922. Price 6s.

The object of the book is to deal "with the use of coal-tar dyestuffs in lake-making, and in leather, fur, wood, paper, etc., colouring."

The author quite correctly states "that the general utility of coal-tar dyestuffs and their future possibilities in the decorative industries have not been realised to the full, even by workers engaged in those industries." The general belief that these dyestuffs and their lakes do not resist exposure to light and to weather conditions is chiefly responsible for this.

This objection, however, applies to a limited number only. Among the many coal-tar dyestuffs at our disposal at present, it is by no means difficult to "obtain dyes of excellent fastness and perfectly insoluble lake-pigments," covering

a very wide range of shades. The difficulty which the user will experience is in the selection of the dyestuffs best suited for his special requirements. In this, the examples given in the book should form a very useful guide.

After a short historical sketch and an outline of the application and the testing of dyestuffs and the principal mordants, Chapter III. deals with the manufacture of lakes and pigments. In this the author very clearly describes the preparation of lakes with the basic, the acid, the direct, the eosine, the alizarine and other dyestuffs. Examples and lists of dyestuffs are given in each case from which the user can make his selection.

Testing lakes for fastness and the application of lakes are briefly referred to in Chapter IV., and Chapter V. deals with "fillers," such as starch, china clay, etc., and with the staining and dyeing of wood. The application of coal-tar dyestuffs in the preparation of oil colours, spirit colours and French polishes is discussed in Chapter VI., an outline of the dyeing of paper pulp, of paper staining and of dyeing paper yarn and fabrics is given in Chapter VII. Whilst the last two materials have been fairly extensively used during the war, we do not agree with the statement that "the production of fabrics from this material has assumed very large proportions in Germany."

An introduction to the dyeing and staining of leather and furs is given in Chapter VIII., and in the final chapter the author briefly describes the use of coal-tar dyestuffs in colouring substances such as galalith, horn, ivory, mother of pearl and celluloid, and the dyeing of fibres of minor importance, such as jute, coconut fibre, kapok, etc.

The book is carefully written and is well printed on a good paper. It contains a large amount of useful information, and although the subjects cannot be exhaustively dealt with in the space available, it clearly shows the direction in which profitable work may be carried out.

The investigator will find the short bibliography given after every chapter very useful.

J. HUEBNER.

## Publications Received.

- DOCUMENTS AND THEIR SCIENTIFIC EXAMINATION. (With especial reference to the Chemistry involved in Cases of Suspected Forgery, Investigation of Disputed Documents, Handwriting, etc.) By C. AINSWORTH MITCHELL. Pp. xii. + 215. London: Charles Griffin & Co. 1922. Price 10s. 6d. net.
- CORNELL UNIVERSITY EXPERIMENT STATION.
- MEMOIR 46. A CLASSIFICATION OF THE CULTIVATED VARIETIES OF BARLEY. By R. G. WIGGANS. Sept., 1921.
- MEMOIR 50. THE RELATIVE GROWTH-PROMOTING VALUE OF THE PROTEIN OF COCONUT OIL MEAL. By L. A. MAYNARD and F. M. FRONDA. Dec., 1921.
- MEMOIR 52. STUDIES IN POLLEN, WITH SPECIAL REFERENCE TO LONGEVITY. By H. E. KNOWLTON. Jan., 1922.
- TECHNICAL PAPERS: DEPT. OF THE INTERIOR BUREAU OF MINES, U.S.A.
- No. 282. ANALYSIS OF DETONATING AND PRIMING MIXTURES. By C. A. TAYLOR and W. H. RINKENBACH. Pp. 33. 1922.