

TEST HI6—TAR BASES

This test shall be carried out exactly as described under HI1, using 20 per cent sulfuric acid instead of 10 per cent caustic soda. As there are rarely more than 5 per cent of bases in any coal-tar oil, the tar-acid funnel, type 2, should be used for this purpose.

TEST HI7—DRY SALTS AT 4.5° C. (40° F.)

APPARATUS—Copper beaker, 500 cc., A. H. T. 21,812, E. & A. 750. Buchner funnel (a suitable type is A. H. T. 28,616, E. & A. 3,254). Filter flask (a suitable type is A. H. T. 28,248, E. & A. 3,090). Letter press. Vacuum pump.

METHOD—The whole sample of oil after the extraction of tar acids as in HI1 or HI2 shall be used. (Note that this represents 100 cc. of the original oil.) It shall be placed in the copper beaker and cooled with stirring to 4.5° C. (40° F.) in a suitable bath and held at that temperature for 15 min. The contents of the beaker shall then be quickly filtered off on the Buchner funnel and the oil removed from the solids as quickly as possible. The solid cake shall then be removed from the filter and pressed *repeatedly* in a letter press between strips of blotting paper or filter paper until only a trace of oil is given up to the paper. The solids shall then be weighed. Their weight in grams divided by the specific gravity of the oil gives the per cent by weight of dry solids.

PRECAUTIONS—To quicken the filtering, a spatula should be used to press the solids down in the funnel and avoid channeling.

ACCURACY— ± 1 per cent.

TEST HI8—LIMPID POINT

APPARATUS—Test tube, 5 in. long by 1 in. inside diameter. Thermometer reading from 0° to 80° as used in D6. Distillation apparatus.

METHOD—Fifty cc. of dry oil shall be taken in a clean distilling apparatus such as used for naphthas and light oils and distilled to *dryness*, no thermometer being used. The condenser water shall be kept hot to avoid solidification of the distillate.

The distillate shall be well mixed and 30 cc. transferred to the test tube. This shall then be cooled, using a freezing mixture (3 parts of shaved ice to 1 part of salt) if necessary. During cooling the oil shall be kept agitated by stirring with the thermometer and cooling continued until a strong separation of crystals has taken place. The tube shall now be removed from the cold bath and warmed at the rate of 2° C. per minute, continually stirring, until all crystals disappear. The temperature registered by the thermometer at this moment shall be recorded as the limpid point.

PRECAUTIONS—If free water should be present in the oil, this might be mistaken for crystals, hence dry oil must be used.

ACCURACY— ± 2 ° C.

NOTES—The best method to maintain the rise at 2° C. per min. is to place the tube in a beaker of water or brine 3° to 5° C. above the oil temperature and warm the bath, at about the 2° C. rate.

For oils with limpid points below 0° C. a special thermometer graduated from -30° to 50° C. may be used. The lowest temperature obtainable by the above freezing mixtures is about -20° C. If no crystals separate at this temperature a *very small* amount of powdered naphthalene may be added to seed out the solids. If no separation can be obtained in this manner, report should be made "no separation obtainable."

MIDDLE OIL TESTS

The usual tests made are water, specific gravity, distillation, tar acids, dry salts, tar bases, and limpid point, and these are made in the same manner as the corresponding tests given above under heavy oil.

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THE POLARISCOPE SITUATION AND THE NEED OF AN INTERNATIONAL SACCHARIMETRIC SCALE

By C. A. BROWNE

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Among the many claims which are being made upon industry as a result of the present war there are probably none more pressing than the demand for certain kinds of scientific apparatus.

In the sugar industry alone there is a most serious shortage of polariscopes, refractometers, and colorimeters, and with the inability to obtain certain repairs the number of such instruments available for technical control is constantly growing less.

Seventy years ago practically all of the sugar testing apparatus used in the United States came from France, and although most excellent saccharimetric instruments have always been obtainable from that country, nearly all of the polariscopes used in the sugar and food laboratories of the United States at the present time were manufactured in Germany or Austro-Hungary. There are several explanations for this preference for instruments of German manufacture: (1) Since the time of Liebig the technical schools and universities of Germany have been most frequented by American students, the result being a greater familiarity on the part of scientists in this country with instruments of German origin. (2) At the time when many of our industries were established German emigrants were the most available for certain positions and German methods and apparatus were thus naturally introduced. (3) German manufacturers have been much more active than their French competitors in bringing their instruments to the attention of the American public.

With the entrance of the United States into the present war the importation of scientific apparatus from Germany and Austria came to an end. Those who needed polariscopes were thus obliged, as 70 years ago, to turn to France, the birthplace and original home of this instrument. The optical establishments of France were so taxed, however, with the manufacture of periscopes, field glasses, gun sights, etc., that no time could be spared for manufacturing other apparatus, although the instrument-makers of France

expressed their willingness to supply the needs of foreign customers as soon as conditions permitted.

In a recent letter upon this subject, addressed to the writer, the head of one of the oldest establishments in Paris stated that he was most anxious to bring his polariscopes and other apparatus to the attention of the American public. He expressed himself as even willing to modify the types of his apparatus to satisfy individual preferences, but with one very important exception, *viz.*, that he should not be asked to copy or imitate German instruments. This exception happens, however, in the case of polariscopes, to be a very important one, for nearly all instruments used at present in the United States are provided with the so-called Ventzke or German sugar scale, which requires a normal weight of 26 g. In this connection the French manufacturer just mentioned writes as follows:

Il y a de plus la question de la charge type 26 gr. qui paraît adoptée aux États-Unis.

M. Pellet, qui s'est servi de 26.048 gr., puis de 26 gr., aussi bien que de 16.29 gr., m'assure que 20 gr. est beaucoup plus commode et que c'est 20 gr. la charge type internationale.

Il n'y a pas plus de difficulté pour moi à faire 26 gr. que 20 gr. ou 16.29 gr.—toutes basées sur le même pouvoir rotatoire du sucre.

Je suis néanmoins obligé de dire que je n'aimerais pas faire 26 gr., car j'aurais l'air de copier les Allemands. Or ce sont les Allemands qui en réalité n'ont fait que nous copier, car les instruments à lumière blanche aussi bien que les instruments à lumière jaune ont été étudiés et construits pour la première fois dans ma maison.

The feelings of national and local pride, which this manufacturer expresses so openly, are in every respect praiseworthy. The discoveries of Arago, Biot, Soleil, Laurent, and Duboscq have, without question, placed the contributions of France to the science of polarimetry above those of other nations. Subtract from the sum total of our knowledge in this field the part which France has contributed and the remainder is pitifully small. In certain particulars, however, English and German physicists have made important contributions and nothing is more certain than that the true scientist in the choice of his instruments will always be guided by expediency and not by prejudice or feeling. If the user of a polariscope desires his instrument to be equipped with a Jellet, or a Laurent, or a Lippich polarizing system, manufacturers should meet this wish irrespective of their own feelings of national or personal preference.

But apart from all this the question raised by the French manufacturer of substituting an international scale for the present German standard has at the present time a new and more far-reaching importance in view of the increasing consolidation of interests among the different allied nations. Leaving aside the fact that the Ventzke sugar scale is a German invention, there is much to be said in favor of the United States and all the other allied nations adopting a standard which was proposed as long ago as 1896 and which is known as the international sugar scale.

In 1896, at the Second International Congress of Applied Chemistry, Sidersky and Pellet advocated the adoption of a new international sugar scale, the normal weight of which should be 20 g. Among the advantages suggested for its adoption are the follow-

ing: (1) The 20 g. scale being a compromise between the French 16.29 g. scale and the German 26 g. scale is free from all national bias. (2) The results obtained with the 20 g. normal weight are easily converted into percentages by multiplying by 5, while the results obtained by the French or German normal weights are not thus easily transformed. (3) Aliquot portions of 50, 25, 20, 10, and 5 cc. of the 100 cc. international scale normal solution represent even gram quantities (10, 5, 4, 2 and 1 g., respectively) which is not the case with the French or German standards. (4) The specific rotation of sucrose at a concentration of 20 g. in 100 cc. (18.62 per cent) is about the maximum, while it is perceptibly lower at concentrations above or below this amount. (5) A 20 g. normal weight is always available as a one-piece unit in the analytical set. The French and German normal weights are not always available as one-piece units and to make up the quantity from an analytical set of weights is inconvenient as well as open to error.

No immediate action was taken by the Second International Congress upon the proposition of Sidersky and Pellet, but the matter was again brought up at the third, fourth, and fifth meetings of this Congress, more especially by Dupont, who emphasized the statement made by Sidersky in 1896 "that without revolutionizing or disturbing the sugar industry the adoption of the proposed international scale would mark a decided step in advance. It would remove all the uncertainties which exist in saccharimetric standards as well as all the inconveniences and mistakes which result therefrom, since it would put in the hands of industrial and commercial sugar chemists analytical apparatus, whose graduation, being upon an identical basis, would furnish results that were everywhere alike."

While the various Congresses mentioned realized the numerous advantages of the proposed international sugar scale the influence of established usage was too strong to permit its displacing the national standards then in vogue. The representatives of the Teutonic nations were particularly opposed to the replacement of the German normal weight by the new international standard.

In 1912, at the seventh meeting of the International Congress in New York, Bates reported that investigations conducted at the U. S. Bureau of Standards showed the present German standard to be inaccurate inasmuch as 26 g. of pure sucrose would not polarize 100 upon saccharimeters provided with the Ventzke scale under the prescribed conditions of analysis. A committee was appointed to investigate the question and make a report in 1915, but the outbreak of the war put an end to all further proceedings.

In view of the uncertainty regarding the accuracy of the present German scale and in consideration of the numerous advantages of the proposed international scale, the present would seem to be a fitting time for the adoption of a saccharimetric normal weight of 20 g. by all the allied nations. The increasing shipment of sugar from the United States and

Cuba to England, France, and Italy makes a concerted action of this kind especially necessary just at present, and it is all the more desirable in view of the probability of an economic league in the near future between the various allied countries. If this could be done our sugar and food chemists would have at their disposal a convenient, rational, accurate standard, while our confrères in France, relieved from the embarrassment of having to copy a German scale, would be free to supply the demand for polariscopes, the increasing shortage of which is becoming at present a serious detriment in many industries.

An objection which has been urged against a change in the present sugar scale is that all polariscopes now in use would be rendered valueless. This objection, however, as Dupont pointed out at the Fifth International Congress of Applied Chemistry, is not a serious one. Polariscopes can be equipped with the new scales at little cost and without changing the optical construction of the instruments. If the adjustment of the new scale could be performed by our National Bureau of Standards the various polariscopes of the country would for the first time be placed upon a strictly uniform basis of comparison. Differences of as much as 0.3 have been noticed by the author between the 100° point of different German saccharimeters supplied to the American trade.

Preliminary to the adoption of the proposed international sugar scale a committee of scientists from the different allied countries should agree upon a constant for the angular rotation of a normal quartz control plate which shall read 100° upon a saccharimeter whose 100° point has been established by polarizing 20 g. of dry, chemically pure sucrose under the prescribed conditions of analysis. When this rotation value of the normal 100° quartz plate has been established for sodium, mercury, or other monochromatic light, instrument-makers and users of polariscopes will have an infallible means of verifying the accuracy of their scales.

If instrument-makers will then show a disposition to meet the wishes of their patrons in minor matters of construction there is no reason why the manufacturers of the allied nations cannot win for themselves a share of the market which heretofore has belonged almost exclusively to the Central Powers.

The manufacturers of the United States could find no better time than the present in which to make plans for the manufacture of polariscopes, saccharimeters, refractometers and other instruments that were formerly imported from Germany and Austria. Before entering this field, however, they should make it their aim to adopt only those standards and types which are most convenient in the opinion of the chemists who use them. Heretofore chemists have been obliged to take what the manufacturer was content to offer. It is time to reverse this illogical method of procedure. Let the chemists outline their specifications and give their orders to the manufacturer who is most ready to meet them. The writer is already in consultation with sugar chemists upon specifications for saccharimeters.

As it will probably be many years before commercial and scientific relations are resumed with the Central Powers, it would be the height of folly to wait for the resumption of such relations before restoring our depleted stocks of apparatus. It is time that we made ourselves independent of the Central Powers in this respect as in all others.

Uniformity of standards will make it much easier for one allied nation to supply the wants of another and will greatly help towards preserving that spirit of united action which a common enemy has brought about. The same intimate coöperation which exists between the Allies at the battle front will be necessary in the great work of reconstruction that is to follow. In the recent words of Mr. Lloyd-George, "Let us not make the mistake of dissolving the partnership the moment the fighting is over."

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ADDRESSES

THE POTASH SITUATION¹

By A. W. STOCKETT

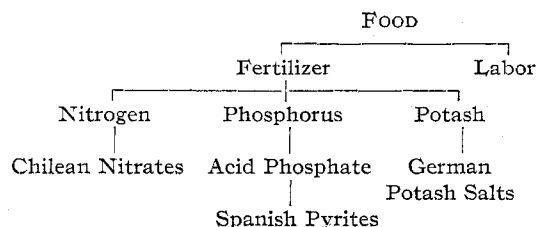
In the last year or two potash has been very prominently before the public, and so much information and misinformation has been published that it is very difficult to present any new facts on the subject. As over ninety per cent of all the potash used before the war was in the manufacture of fertilizer, the reading of this paper before the AMERICAN CHEMICAL SOCIETY may seem somewhat inappropriate.

Our dependence before the war on foreign sources for an important element in our food supply may be shown by the accompanying diagram.

The writer would be prepared to go even further than the above and for the present have our labor also dependent on a foreign source in the form of interned German prisoners of war.

The prospect of becoming independent of these foreign sources after the war is promising. When the nitrogen fixation plants

now being erected by the Government are in full working order, there should be a sufficiency of nitrogen. The development of our pyrite supply and the establishment of sulfuric acid plants should insure a supply at reasonable prices. The potash supply is the only weak link in the fertilizer chain, and the writer is of the opinion that it is possible to develop a domestic potash industry.



It is well known to every one that before the war the entire world was dependent on Germany for its potash supply, and this country was importing annually about 1,000,000 tons of potash salts of various grades, containing approximately 240,000 tons of K₂O.

¹ Paper delivered in the Symposium on Potash held by the Division of Industrial Chemists and Chemical Engineers at the 56th Meeting of the American Chemical Society, Cleveland, September 12, 1918.