

by experimenters, that by a suitable combination of solvents solutions could be produced that would flow fast or slow, set rapidly or slowly, and produce the varied products desired, that the industry has developed so rapidly.

Hyatt's discovery that a mixture of camphor and pyroxylin when heated could be worked like rubber was the beginning of the success of the celluloid industry. Hyatt discovered the latent solvent action of camphor.

RECENT WORK ON THE SUGARS.

By B. B. ROSS.

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THE ESTIMATION OF INVERT SUGARS.

Bauman (*Ztschr. des Ver. f. Rubenzucker Ind.*, **42**, 824) gives a new table, based upon the original table of Herzfeld, for the calculation of invert sugar percentages in solutions containing considerable proportions of sucrose. The table is quite similar to that of Herzfeld, but provides for the employment of only five grams of material instead of ten grams, as in the old table.

Ehrmann (*Bull. Assoc. Chim., France*, **10**, 537) describes a method for the indirect gravimetric estimation of glucose by means of the reduction of one of the double platinum chlorides by the copper suboxide thrown down by the invert sugar.

The suboxide, precipitated in the usual manner is brought upon the filter and washed thoroughly; the reduction of the precipitate is next effected by pouring upon the filter a small amount of a concentrated solution of potassium platino or sodium platino-chloride, the red precipitate of suboxide being superseded by a black deposit of platinum.

After washing and igniting the residue, the amount of invert sugar corresponding to the weight of platinum obtained, can be readily calculated.

The author claims that this method is more rapid and easy of execution than the reduction of cuprous oxide in a current of hydrogen, and that it is also more exact, for the reason that the atomic weight of platinum is much higher than that of copper.

Nihoul (*Chem. Ztg.*, **17**, 500) refers to the gravimetric

method dependent upon the reduction of the copper suboxide in a current of hydrogen, and offers the objection that the process, though accurate, is both tedious and time-consuming.

The process of Holdefleiss, involving the oxidation of the cuprous to cupric oxide with nitric acid, is also noted, as well as the objection of Soxhlet that a loss occurs from the formation of basic copper nitrate and that an error is occasioned by the retention of copper in the filters. The author reports results of tests refuting the first claim of Soxhlet and recommends the employment of double filters in order to obviate the slight error resulting from the presence of the small amount of copper retained in the filter papers. The inner filter containing the precipitate, and the outer filter are separately treated with nitric acid, ignited and weighed, the differences in the weights secured giving the weight of cupric oxide, and this multiplied by the factor 0.889 gives the amount of cuprous oxide corresponding thereto. From this the proportion of glucose can be readily obtained by reference to Allihn's tables.

Blank experiments with double filters showed that practically the same amounts of copper solution were absorbed and retained by each filter.

On account of the passage of small quantities of the suboxide through the first filter (as sometimes happens), it is recommended that quadruple filters be employed, the filters being ignited and weighed in pairs instead of individually.

By the observance of these directions, it is claimed that satisfactory results can be quickly and easily secured.

The author also reports the result of experimental tests of the gravimetric method which provides for the bringing of the suboxide upon tared filters, drying and weighing.

Two sets of double filters were employed in the filtrations, and in order to determine whether or not oxidation of the precipitate occurred during the drying process, some of the precipitated suboxide was maintained at a temperature of 75°-100° C. for two days without perceptible variation in weight.

It was found on investigation, however, that the precipitate obtained did not correspond precisely, in composition, to the formula Cu_2O , being contaminated to a slight degree with organic matter.

In following this method, which in other particulars is said to be highly satisfactory, it is therefore necessary to make a correction for the proportion of organic matter contained in the precipitate, this correction being generally about 0.3 to 0.4 per cent. of the weight of the cuprous oxide.

INVERT SUGARS IN THE BEET.

Classen (*Deutsche Zucker, Ind.*, 1893, *Sucr. Ind.*, 41, 242) recommends that in the estimation of invert sugars in the beet, the juice obtained by pressure from the beet be not employed and that, instead, the direct aqueous method of extraction be used in the preparation of the solution required for the determination.

For this purpose, the warm digestion process is found advantageous, a small amount of lead subacetate and precipitated calcium carbonate being previously added. Excess of lead subacetate should be avoided since this leads to the destruction of invert sugars, and on the other hand, if the juice has an acid reaction, inversion of sucrose will take place; the acidity, however, can be readily corrected by the employment of calcium carbonate.

The process recommended is as follows: Take 110 grams finely divided chips, add ten to fifteen cc. lead subacetate solution and one to two grams of precipitated calcium carbonate, digest in a half-liter flask on a water-bath from three-quarters to one hour. After cooling and making up to the mark, the moderately clear juice is decanted off and 100 cc. of it is measured out; a small amount of lead subacetate is next added to complete the clarification and the solution made up to 110 cc. and filtered. To 100 cc. of the filtrate a small amount of soda solution is added to precipitate the lead and the volume is then brought up to 200 cc. One hundred cc. of this liquid corresponds to ten grams of the beet pulp, and after its filtration, the reduction of Fehling's solution can be accomplished in the usual manner.

LEAD SUBACETATE FOR CLARIFICATION.

Courtonne (*Bull. Assoc. Chim., France*, 10, 457) refers to the chief methods proposed for the preparation of lead subacetate solutions and to the various formulas which have been assigned to this salt.

A series of tables is presented, giving densities of solutions of neutral and basic acetate, with the proportions of the solid salt, lead oxide and acetic acid contained therein, and showing also the relations between the two classes of solutions with reference to the amounts of acid and base present.

The author proposes the preparation of a basic acetate solution by adding to a solution of the neutral salt, an amount of ammonia sufficient to combine with such a proportion of the acetic acid of the lead acetate as will result in the formation of lead subacetate in solution along with ammonium acetate.

The proportions of the substances employed in the preparation of this solution are as follows:

Crystallized neutral lead acetate.....	350 grams.
Distilled water.....	825 "
Ammonia (22).....	55 "

The author states that this solution has been employed by him for a long period of time and has given uniformly good results in the clarification of sugar solutions.

In addition to the tables above referred to, the author inserts an additional one giving data of a corresponding character for solutions prepared by the process just described.

THE INFLUENCE OF LEAD SUBACETATE UPON THE POLARIZATION OF CANE JUICES.

Saillard (*Bull. Assoc. Chim., France, 10, 354*) reports results of a number of polariscopic tests of cane juices, where both normal and basic lead acetate were employed in the clarification.

Where the subacetate was employed the results were considerably higher owing to the formation of insoluble lead levulosate, thus decreasing the normal levo-rotary influence of the invert sugar present.

The author gives examples showing the effect of this difference upon the aggregate results for a whole milling season.

[Note by abstractor—Attention was called to this point a number of years since by Gill, Spencer, Edson, and others.]

THE INFLUENCE OF ALKALINE NITRATES UPON THE POLARIZATION OF SUGAR SOLUTIONS.

Gravier (*Bull. Assoc. Chim., France, 10, 351*) reports a number of experiments which he has conducted in order to ascertain

the influence of alkaline nitrates upon the polarization of sugar solutions. The tests were executed with both aqueous and alcoholic solutions, and both in the presence and absence of lead subacetate.

In aqueous solution the influence of potassium and sodium nitrates was almost inappreciable, but in alcoholic solutions, in the presence of lead subacetate, there was quite a considerable diminution in the polariscopic readings.

The author concludes that it is inadvisable to employ alcohol as a solvent in polariscopic work, especially where lead subacetate is used.

[TO BE CONTINUED.]

[CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF THE ROSE POLYTECHNIC INSTITUTE.]

THE VOLUMETRIC DETERMINATION OF PHOSPHORUS IN STEEL.¹

BY W. A. NOYES AND E. D. FROHMAN.

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VERY full directions for the volumetric determination of phosphorus in steel have been recently given by C. B. Dudley and F. N. Pease.² The method is rapid and easy of execution and gives concordant results in the hands of careful workers. There is, however, an uncertainty of about ten per cent. as regards the factor which should be used for converting the iron equivalent of the permanganate solution into the phosphorus equivalent. The most careful determination of the character of the products obtained by reducing molybdic anhydride with zinc and sulphuric acid seems to be that of v. der Pfordten,³ who finds that when solutions are reduced and titrated with but slight exposure to the air the molybdenum is reduced to a form corresponding to the oxide Mo_2O_3 . If this is true one molecule of molybdic anhydride requires, after reduction, the same amount of oxygen for oxidation as three atoms of iron. If we assume, further, that the yellow precipitate contains twelve molecules of molybdic anhydride for one atom of phosphorus, it follows that

¹ The work here described was presented to the Faculty of the Rose Polytechnic Institute for the degree of Bachelor of Science by E. D. Frohman.

² *J. Anal. Appl. Chem.*, 7, 108. This JOURNAL, 15, 519.

³ *Ann. Chem.*, (Liebig) 222, 155.