

heated for some time on the steam bath, and then poured into cold water, a clear blue liquid is obtained.

This liquid is neutralized with CaCO_3 , and the CaSO_4 filtered off. The lime salt is then decomposed with Na_2CO_3 , and the soda salt obtained, is evaporated to dryness. It is very soluble in water, and dyes silk and wool a fine violet-blue color.

It may, therefore, be seen from this that bromanile behaves in nearly the same way as its related compound, chloranile, on secondary monamines, and the difference of color was probably due to the impurity of my methylaniline, as the latter is very hard to obtain free from dimethylaniline.

However, the result on tertiary amines is very satisfactory, as it proves that nearly the same tints of colors are produced in both cases.

The dyes herein described are only few in comparison with what might be obtained; for, it will naturally be understood, that by substituting the methyltoluidines, xyloidines and naphthylamines, for methylaniline, and, on the other hand, substituting the dimethyltoluidines, xyloidines and naphthylamines, for dimethylaniline, etc., or using the benzylated amines, a large number of violet, blue and green dyes are here possible.

The nature of these bodies I have not yet had time to determine, but hope to do so ere long.

NEW YORK, Feb. 25th, 1880.

XIII.—ON THE DETECTION OF STARCH SUGAR MECHANICALLY MIXED WITH REFINED CANE SUGAR.

BY P. CASAMAJOR.

About a year ago we were often entertained by the daily press with accounts of the adulterations practiced by sugar refiners, and, among these adulterations, the one most generally used, as we were then told, was the mixing of refined sugar with starch glucose. I must confess that I never believed in such a practice; for, although I had tried to procure specimens of such sugars, I was not able to find any, and one or two specimens which were given to me, as of sugar so adulterated, turned out to be pure, so far as the presence of starch sugar was concerned. The idea that these sugars were so adulterated, very likely originated in the imperfection of the processes used to detect the presence of starch sugar.

This week, however, I have had the good fortune to come in possession of a sample of refined sugar largely adulterated with starch glucose. This sample was sent to Messrs. Havemeyer & Elder from St. Louis, and a slip of paper in the box gave the information that the barrel from which this sugar was taken was marked "Powdered Sugar, Manhattan Sugar Refinery, New York;" a refinery, of the existence of which I have not been able to find any proof.

The incredulity which I previously maintained as to the existence of adulteration with starch sugar, was based on the following considerations :

It is well known that if you have a sugar solution, you can only obtain from it, by the ordinary processes of refining, a quantity of crystallized sugar representing very nearly the difference between the cane sugar present and the soluble impurities. If you have, for instance, a sugar solution whose coefficient of purity is 90 per cent., the soluble impurities will represent 10 per cent. of the total of the substances in solution, and you can obtain, at the utmost, only $90 - 10 = 80$ parts of sugar from 100 parts of substances dissolved. Processes have been published whereby a greater yield may be obtained, but such processes require the use of alcohol or of large quantities of salts of magnesia, and they have never been used on any extended scale. As starch sugar in solution does not act otherwise than any other impurity in solution, the addition of it in a dissolved state to a sugar solution, can not have any other effect than to diminish the yield of sugar and increase that of molasses.

The only manner in which starch glucose can be mixed with refined cane sugar, so as to give a profit, instead of a loss, to the person effecting this mixture, is to mix the two substances in a solid state. Now, the starch sugar must either be added in large quantities—and then it seemed to me that it could be easily detected by the eye or by the taste—or it must be added in very small quantities, and then the difference between the price of sugar and that of starch glucose would not leave a profit proportional to the trouble. My experience with sugar refiners does not lead me to believe that the refiner exists who would adulterate his products by adding to them only one to two per cent. of starch glucose. Such a thing would not pay.

The object of this communication is to give a few easy processes for the detection of starch glucose in commercial sugar.

By the use of the optical saccharometer, the presence of starch sugar may be easily detected, when in quantities as large as in the sample in question. It is a dextro-rotate substance, and no other

dextro-gyrate substance can be used to adulterate sugar with efficiency in such large quantities.

The direct test, by the optical saccharometer, gives 97 per cent. After inversion, the reading of the saccharometer is 9.8 per cent. to the left, at 21° C. If we add these numbers, we find, by Clerget's table, that they correspond to 80 per cent. of cane sugar. As the sugar is dry, the balance, 20 per cent., nearly represents the quantity of starch sugar, as, from the appearance of the sugar, there must be very little inverted sugar present.

I need not now consider the subject of inversion, as a means of ascertaining the actual quantity of cane sugar present in a sample of commercial sugar, as I have already had occasion, in a paper read before this Society, at our regular meeting of February of last year, to discuss this subject at great length.* I may, however, say that if this sugar had been, what we call in the sugar business, a *straight sugar*, 97 per cent. of sugar, after inversion, would have given at 21° C. —32.5°, instead of —9.8°. I call your attention to this to show of what precious help the process of Clerget is in cases of this kind. It is a sad truth that very many persons, whose occupation is the analysis of sugars, are either entirely ignorant of the process of Clerget, or do not know enough about it to use it when they need it.

This sugar, tested by the alkaline copper solution, gives 17 per cent. of reducing substances, calculated as glucose, which shows that the starch sugar mixed with refined sugar contained $\frac{17}{85} = 85$ per cent. of these reducing substances.

The process which I had the honor of describing before this Society, at our June meeting,† gives unsatisfactory results with sugar adulterated with starch glucose. This is due to the imperfect solubility of starch glucose in methylic alcohol. After grinding the sugar under examination with the standard solution for three minutes, the process gave 85 per cent. of pure sugar—a discrepancy from the result by the saccharometer (80 per cent.), which never takes place with straight sugars.

Besides these processes, which can only be applied by persons provided with scientific appliances, the presence of starch glucose,

* See JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, I, 26; also Chemical News, 39, 212-234; Sugar Cane, II, 296; Moniteur Scientifique, Juin, 1879, 647; Stammer's Zeitschrift, Juli, 1879, 683.

† See JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, I, 205; also Chemical News, II, 74, 97, 107, 131; Sugar Cane, II, 531, 588, 693; Stammer's Zeitschrift, October, 1879, 957.

when used in such large quantities, may be readily detected by very simple processes, which may be applied by anybody who wishes to use such means as are always at hand.

One process for the detection of starch glucose consists in adding to the suspected sugar somewhat less than its own weight of cold water, and stirring for a few seconds. If starch sugar is present, it will be seen floating in the solution as white specks, which resemble crushed wheat. This appearance is due to the comparative insolubility of starch glucose in cold water, which allows it to remain undissolved quite a long time, and also to the fact that as the cane sugar present is crystalline, and its refrangibility is not very different from that of a sugar solution, the portion of it which remains undissolved is not so distinctly seen as the specks of starch sugar. These specks are best seen by using a beaker glass, and putting only enough sugar and enough water that we may be able to see light through the flat bottom of the glass. If a flat bottomed glass is not at hand, the observation may be made on a pane of glass.

This process for the detection of mixtures of starch glucose with cane sugar is so simple and satisfactory, that I might well be excused from giving another, but the one I am about to give is useful for the detection of other foreign substances in the products of refineries. This latter process is based on the fact, that the taste of sugar has a tendency to dull our perceptions of the taste of other substances mixed with sugar. So as to neutralize this effect of sugar, we may, before tasting a suspected sample, put a pinch of pure sugar in the mouth. If after this sugar is dissolved, but while we still perceive its sweet taste, we put on the tongue a pinch of sugar containing starch glucose, we distinctly perceive the bitterish taste of the glucose. The presence of chloride of tin in molasses or sugars, even when used in very small quantities, can be easily detected by its unpleasant bitter taste, if, before tasting the suspected products, we fill the mouth with the pure sweet taste of refined cane sugar.