tasseled or not. The presumption is that they had. We have in the above what appears to be an example of a complete cycle of growth in the sugar cane, probably a cycle which would not be realized farther south. Evidently the cool nights of the winter had helped to complete the period of growth, while at the same time they prevented a beginning of the second growth, which would certainly have reversed the metabolic activities within the cane and secured an inversion of a part of the sucrose. It is probable that the meteorological conditions which produced so complete a growth do not often obtain and the above data are therefore of interest, both from a chemical and physiological point of view. The analyses were made in the Sugar Laboratory by Mr. Arthur Given.

COLORING-MATTER IN YELLOWISH GRAY SUGAR.

BY Y. NIKAIDO.

Received June 27, 1903.

THE crystallized sugar we obtained from the last few straight pans in the 1902 campaign, at the sugar factory operated by the Standard Beet Sugar Co., Leavitt, Neb., acquired a slight yellowish gray tint. The samples were saved and subjected to investigation. Since we could not make a series of investigations at this time of the year, the work is not complete, but some of the statements may be interesting to sugar-makers.

Herzfeld considers iron oxide as one of the causes of the gray coloration of crystallized sugar.[1] For this reason, the sample of sugar in question was tested qualitatively. Iron oxide, lime, soda and potash salts and a little organic coloring-matter were found in it. In order to ascertain how much iron oxide in the massecuite is sufficient to produce a yellowish tint in the sugar crystals, the quantity of the iron oxide in the massecuite sample was estimated and found to be 0.02 per cent. As it seemed doubtful that such a small amount of iron oxide in the massecuite would cause the coloration of sugar crystals, complete analyses of the massecuite and ash of the same were made and the results obtained were as follows:

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[1] *Ztschr. Rubenzuckerind.*, **46**, 1 (1896).

MASSECUITE.

Constituents.	Per cent. in water-free material.
Sucrose	84.76
Invert sugar	0.93
Raffinose	2.38
Ash	3.34
Organic matter	8.57
Iron oxide	0.02
	100.00

COËFFICIENTS CALCULATED.

	Per cent.
Total solid	89.83
Water	10.17
Polariscope reading	79.90
True purity	84.76
Saline coëfficient	25.38
Glucose coëfficient	1.10
Coëfficient of organic matter	9.89

ASH.

	Per cent.
Acid-insoluble matter (mostly silica)	0.80
Iron oxide (Fe_2O_3)	0.65
Calcium carbonate	13.86
Sodium chloride	7.06
Sodium carbonate	16.99
Potassium sulphate	28.94
Potassium carbonate	29.80
Magnesia	trace
Moisture and undetermined	1.90
	100.00

According to these analyses, excepting raffinose, there is no unusual constituent in this massecuite, judging from the analysis of another massecuite which yielded a good quality of white sugar. For the purpose of comparison, a statement of this analysis is here given:

Composition.	Per cent. in water-free material.
Sucrose	83.83
Invert sugar	3.34
Raffinose	none
Ash	4.88
Organic matter	7.95
Iron oxide, less than	0.01
	100.00

COËFFICIENTS CALCULATED.

	Per cent.
Total solid	90.50
Water	9.50
Polariscope reading	79.00
True purity	83.83
Saline coëfficient	17.17
Glucose coëfficient	3.98
Coëfficient of organic matter	9.48

Raffinose in considerable quantity is said to have the effect of changing the normal form of sugar crystals, producing needles, but it has nothing to do with the coloring of the sugar. It may, therefore, safely be said that the coloring of our sugar was principally due to the iron oxide, although the other impurities might have played some part. It would be worth noting that even such a small quantity of iron oxide as 0.02 per cent. is sufficient to cause coloration of sugar crystals.

In order to trace the source of the iron oxide, the limestone used for defecation was analyzed. It seemed possible that the rock might have contained an unusually large quantity of iron oxide. Since *oxide of iron is soluble in sugar solution even in the presence of alkali,* it was reasonable to suppose that iron might have been thus introduced in the carbonation process. The results of the limestone analysis are as follows:

	Per cent.
Moisture	trace
Insoluble matter	1.96
Organic matter	trace
Alumina (Al_2O_3)	0.33
Iron oxide (Fe_2O_3)	0.47
Calcium carbonate	96.53
Magnesium carbonate	0.38
Phosphoric acid	trace
Soda and potash	trace
Sulphuric acid	trace
	99.67

The above figures computed to a basis of burned lime give the following:

	Per cent.
Insoluble matter	3.41
Alumina (Al_2O_3)	0.57
Iron oxide (Fe_2O_3)	0.82
Calcium oxide	94.53
Magnesium carbonate	0.66
	99.99

It may be seen that this lime contains very little iron oxide. It is evident therefore that we must look elsewhere for the sources of the iron which caused the trouble in the pan.

Some iron doubtless came from the lime, and some unquestionably came from the water used in diffusion. The water from the Leavitt well was found to contain 0.0024 per cent., or 24 parts per 100,000 of oxide of iron.

Quite recently a sample of lime removed from the kiln by Superintendent H. Schmode was subjected to analysis and found to be radically different in composition from the first sample analyzed. The results of this analysis are here given:

	Per cent.
Acid-insoluble matter	26.10
Acid-soluble silica	0.26
Lime (CaO)	63.44
Magnesia (MgO)	0.11
Alumina (Al_2O_3)	3.97
Iron oxide (Fe_2O_3)	2.09
Carbon dioxide (CO_2)	3.05
Sulphuric acid (SO_3)	0.14
Undetermined	0.84
	100.00

There is certainly sufficient iron oxide shown in this sample to have caused all the disturbances noted. These two analyses would indicate a decided lack of uniformity of composition in the lime rock used at the factory.

To sum up the whole matter, it is my opinion that the coloring of the sugar in the massecuite was due to iron oxide. The source of this iron is still an open question, but the evidence at hand points rather clearly to the lime rock as the origin of it.

The author wishes to express his gratitude to Prof. H. H. Nicholson, as the investigation has been carried on in the chemical laboratory of the University of Nebraska by his permission.

SOME CHEMICAL CONSTANTS OF FOSSIL RESINS.[1]

BY R. A. WORSTALL.

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WHILE the literature relating to the resins in general is quite extensive, it is nevertheless true that published data, in regard to

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[1] Read before the International Congress of Applied Chemistry at Berlin, June, 1903.