

AN INVESTIGATION OF THE EFFECT OF THE COMPLETE
FILTRATION OF CANE JUICE AT THE CLARIFICATION STAGE
OF THE SUGAR PROCESS.

I. INTRODUCTION:

The dark turbid juice obtained by the milling of sugar cane is not in a proper condition to be made into sugar and therefore it must be treated so as to remove as much as possible, the germs, colloids and suspended particles of dirt. This removal process is called clarification and in the raw sugar factory this is accomplished by adding milk of lime to the juice until it is alkaline, and completing the precipitation by heating to 212°F.

The purpose of clarification then is to remove from the juice all constituents other than sucrose. However, it is not possible to completely eliminate the non sucrose constituents of cane juice and so clarified juice contains minute flocculent materials. In other words, the clarified juice which is concentrated to syrup and eventually boiled to sugar, is an impure solution.

Now, the crystallization of sucrose from impure concentrated syrup is slower, more difficult and less complete than from pure liquids (20). Again, Prinsen Geerlings (21) points out that "it is evident that for a given concentration, the supersaturation is greater in pure than in impure sugar, and therefore the former forms grain more readily than the latter, partly because a pure syrup contains more sucrose per 100 parts of dry substance and partly because this sucrose crystallizes out more easily from pure than from impure solutions."

Furthermore, the impurities in syrup, especially fine bagacillo, become embodied with the sugar crystals during their growth and impart to them a dark colour which cannot be removed by washing. Finally, these impurities are deposited on the tubes of the evaporator and vacuum pan causing scale to form which retards the boiling and consumes more steam.

A better quality sugar can best be obtained by producing a better quality syrup. A better quality syrup can only be obtained by producing a superior clarified juice.

It is therefore apparent that any further purification of clarified juice would increase materially the rate and amount of sucrose precipitation as well as prevent undue scaling up of the evaporation vessels. The problem therefore resolves itself to finding a way of improving the clarified juice in a raw sugar factory without increasing the cost of production.

The remarkable success of ion-exchange in the Beet sugar industry has encouraged research workers to investigate its application in the cane sugar industry, but any initial success in this endeavour should not discourage other approaches to the problem. With this in view it has been thought desirable to investigate the effect on the complete filtration of cane juice at the clarification stage of the sugar process. Some of the results obtained and the difficulties encountered are reported in this paper.

Someone might question the desirability of improving raw sugar when, in any case, it is going to be refined. In theory sugar refining is very simple, being the abstraction of sucrose and the elimination of non-sugars from the raw sugar. However, in practice there is a great deal of complication and great cost for equipment and materials used in the process, and as the margin between the cost of raw and refined sugar is narrow, it is essential that the refiner receives a product which contains as little non-sugars as possible, which is regular in grain size and low in colour and molasses content.

Filtration as practiced in the raw Sugar factory today is restricted to the mud from the clarifiers. Why not find out if clarified juice, which because of the efficiency of modern heavy-duty milling, contains even more organic non-sugars than formerly, cannot be economically filtered to produce a product which would increase the yield of sugar from a given amount of juice, increase the rate and ease of crystallization producing a more stable and uniform crystal of improved colour and purity, and reduce or eliminate the scaling problem?

REVIEW OF LITERATURE

To do this raw cane juice was clarified in the laboratory and filtered through several filter materials in a laboratory filter.

The filter itself is quite different from the types generally used, and therefore, was itself subject to study as to its further use in investigations of this nature or for development for use in the raw sugar factory.

The raw cane sugar factory are valuable as the clear filtrate is used to manufacture sugar whilst the cake or mud is used as a fertilizer in the field. A recent paper by Higgins (48) presents the importance of filter cake as a source of wax. He reckons that the yield from Cuba in the West Indies would be around 2700,000 per annum, the wax after extraction being still utilized as a source.

With respect to the filtering of juices in the raw sugar factory, there is nothing in the literature. The raw sugar factory has always been concerned with the filtering of mud settling. Indeed it would seem that most sugar technologists and research workers are in agreement with Spencer and Means (45) who feel that "if the clarification has been defective no amount of screening will greatly improve the juice nor will any further form of filtration give satisfactory results. Cloth filtration, unless filter aids are added is practically impossible as the fine flocculent material which has passed through the defecation process soon clogs the pores of the cloth. It is now recognized that the sooner the juice is brought to the syrup stage the better, and that clear juice is to be obtained by correct clarification rather than by an after treatment."

Such a statement from such recognized authorities must indeed deepen the ardour of even the most enthusiastic student, and receive support from the fact that so many studies have been undertaken to try and find a better clarification process.

While searching through the literature it became evident that unlike most other industrial processes, filtration and the methods of filtration have been developed mostly by experience and experiments rather than as a result of theory, and it is encouraged to note the great strides which have been made in formulating theory

Turbidity