

FURTHER INVESTIGATIONS ON THE PROBLEM
OF CLARIFYING RAW SUGAR CANE JUICES WITH ESPECIAL
REFERENCE TO REFRACTORY JUICES.

I. INTRODUCTION.

The attention of the Department of Sugar Technology has recently been occupied by a consideration of the clarification of refractory juices. The object of the investigation was to attempt to discover the cause or causes of difficult defecation and to evolve a factory clarification process of overcoming them.

The first part of the investigation, carried out by Duncan & Yearwood (1) was designed to show whether the difficult clarification of POJ 2878 (refractory juice) was due to certain of its organic constituents. Comparative analyses were carried out on the juices of POJ 2878 and BH 10(12), the following determinations being made: Pectins, Pentosans, Total Nitrogen, Non-protein and Protein Nitrogen, Fats and Waxes (Ether extract) and Total Colloids (as measured by the Dye Test).

The results of these analyses failed to indicate any outstanding differences which could be held responsible for the refractory nature of the juice of POJ 2878. The more important conclusions arrived at were: The Fat and Wax content of POJ 2878 was slightly higher than that of BH 10(12), but the Protein Nitrogen content was definitely lower. Further, the total amount of colloids present in the juice was of the same order for both varieties, and if the cause of the trouble was attributable to the colloids, it must be in their nature rather than in the total quantity present.

With regard to the second part of the problem numerous clarification processes were tried and one was eventually developed which gave satisfactory results. It is

essentially a modification of the lime-heat method of defecation, its main features being the addition of the lime in two separate fractions and the subjection of the juice to two heatings instead of the customary one. The authors attribute the success of this process to the fact that the colloids in the juice are subjected to two dehydrations, and make the suggestion that the colloids in POJ 2878 juice appeared to be very highly hydrated.

With a view to substantiating this suggestion the investigation was continued this year. A recent paper by Fieger & Choppin (2) on the measurement of the degree of hydration of the hydrophylic colloids of cane juices suggested a means of establishing this fact. The success achieved by these authors with the method employed was not duplicated by the writer and this part of the investigation had to be abandoned. Details of the method employed, the work done, and a discussion of the bound-free water hypothesis will occupy the first part of the thesis. (PART I).

In a private communication to this department, Dr. P. Honig, Head of the Technological Section of the Java Experimental Station, emphasizes the importance played by the inorganic constituents in cane juice clarification. He considers raw juice clarification chiefly as a precipitation of the inorganic constituents with a "mutual coagulation of sesqui-oxides and silicic acid and of sesqui-oxides with phosphate, together with the formation of calcium phosphate". Thus he speaks of a normal juice as one having $SiO_2 : R_2O_3$ ratio lying between 2 and 4 and $P_2O_5 : R_2O_3$ ratio between 0.3 and 0.7.

It was therefore decided to make a comparative study of certain of the inorganic constituents in the raw juices of different varieties and to follow their fate during clarification; in addition, it was hoped to establish the extent to which they were responsible in defining a good or bad clarifying juice.

Due to the long period occupied in the investigation of analytical methods (particularly those for estimating

Al_2O_3), the actual work done on cane juices was limited by the time available. However, the results of some forty juice ash analyses, and the conclusions drawn are presented in the second part of this thesis. (PART II). In addition, an account of the investigation of the methods of analysis and details of the methods finally adopted are given; also a new procedure for the determination of silicic acid in cane juices direct is recorded. The ash components of cane juice and their importance in the manufacture of raw sugar is also discussed.