

THE PROCESS OF MIXED MASSECUTES FOLLOWED BY CRYSTALLISATION IN MOTION AND CURING.

(Paper by R. G. DUCRAY.)

The process of boiling in molasses is one of the greatest importance in the recovery of the boiling house, and especially so in factories turning out white sugar by the ordinary sulphur and lime clarification, as is practiced on a large scale in South Africa. This article deals mainly with white sugar manufacture where the purity of 1st and 2nd massecutes cannot be maintained at a low figure by addition of molasses to syrup strikes, as can be done in the manufacture of cargo sugar.

In Natal we very often have to handle syrup having an apparent purity of 90, this giving correspondingly high 1st massecutes. Such high purities can also be brought about by the boiling of melted treacle sugar. The handling of such unusually high purities along with an unevenly balanced boiling house, is a great handicap to our factory superintendents, when their work is compared with those of Cuba and Hawaii, where mostly cargo sugar is made.

Assuming that in the manufacture of white sugar, final molasses having an apparent purity of 38-40, can be considered effectively exhausted, the only way to keep to such a low figure is by the careful separation of molasses from wash this being efficiently carried out by the double curing of white sugars, thereby ensuring technical control of Pan boiling.

Densities, that is the degree of supersaturation of the massecutes have also to be taken into account in Pan work. The degree of tightening of a 1st massecuite in the pan is limited by the purity of same. High purities and high concentration mean reduced circulation in pans, hence, danger of caramelization and difficult discharge to crystallizers. First massecutes are usually boiled to 90-92 Brix, when a drop of 18-20 purity between massecuite and molasses can be expected, giving, on an average, run offs of 68 purity; 2nd massecutes from these being boiled from syrup; 1st wash, and 1st molasses of 68 purity, can be worked out to 72-76 purity. These massecutes containing 50-60 per cent molasses are naturally more viscous than syrup massecutes, and can be tightened to 93.94 brix without any fear of local overheating brought about by bad circulation as mentioned in the case of 1st massecutes, and when left in crystallizers from 24-30 hours usually yield a molasses of 50-55 purity.

Upon the treatment of this molasses greatly depends the resulting sucrose recovery of the boiling

house. Most modern factories especially those under American-trained superintendents, practice Dr. Spencer's three massecuite method of pan boiling. In this method, which, of course, is slightly modified to suit the manufacture of white sugar, the 1st and 2nd massecutes can be boiled on the lines given above. The third massecutes, yielding 3rd sugars and final molasses, are boiled from "syrup" seed, the amount of seed being derived from a cut strike and the correct proportions as calculated to bring about required purities being used for one 2nd and one 3rd massecuite. Two factors of great importance come into play here, and can only be determined by practical experience, viz:—the amount of grain in the seed used and the size of same. These factors form the basis of the exhaustion of final molasses in subsequent crystallization in motion. Care must be exercised in the boiling that no false grain is formed, this being ensured by slow boiling at comparatively high temperatures. The purity of these massecutes is about 62, and density equals 96 brix when a drop of 22-24 can be expected yielding final molasses of 38-40 purity. Results of this kind can only be obtained under ideal working conditions and no such items as low steam pressure, or shortage of water, etc., during the boiling, well known disturbing factors in South Africa, should come into play.

A modification of this method of boiling is sometimes practiced. The 3rd massecutes are boiled to 64-68 Purity and double cured. This yields an off-white sugar, and molasses of 44-48 Purity, which is boiled to string proof and allowed to crystallize out in the hot room. The wash from these massecutes is boiled as 2nd or 3rd massecutes. This system of boiling has nothing in its favour, requiring larger steam consumption, and more pan, crystallizer, centrifugals and molasses storage capacity.

The sugar obtained from the three massecutes system when the 3rd massecutes are boiled on grain, is, as a rule, not marketable, being a hard sugar and the grain being larger than hot room sugar. The best way of disposing of same is to remelt it in either juice or water, clarify, and take same up in pans along with syrup for 1st massecuite strikes, when it is subsequently changed to white sugar. In the case of 96 test factories, this sugar can be made into a magma with either syrup or 1st molasses, and taken up as seed for 1st massecuite.

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Process of Mixed Masseccutes.

Reference has been made above to the use of crystallizers and a few words on the principle of crystallization in motion and advantages of same would not be out of place. A strike of grained masseccute upon being dropped from a pan consists of sugar crystals and molasses, the molasses holding a percentage of crystals in solution. Masseccutes of a certain degree of supersaturation for the temperature at which they are dropped allow more sugar to crystallize out on cooling down. If cooling takes place at rest, new crystals will form, the original crystals present in the masseccute having dropped to the bottom of the storage tank and the molasses remaining on top. This new crop of crystals is usually so fine that it cannot be recovered when the masseccute is purged, and passes through the linings of centrifugals along with the molasses. If such a masseccute be cooled in motion, the original crystals at striking point are constantly brought into contact with the supersaturated molasses, the sugar in same therefore builds up on the grain already present. Upon curing, such a masseccute will have parted with most of its sugar in solution; the molasses, therefore, being of lower purity than one in which a high percentage of small crystals would be present, as is the case when cooled at rest.

The advantages of crystallization in motion from a technical point are therefore striking; from the handling of the first products. First molasses are slightly reduced in purity, thereby making the degree of purity of 2nd masseccutes more easily maintained at the required purity of 75. This of course yields a lower 2nd run off than would otherwise be the case and at the end of 3 boilings, final molasses is obtained more readily and cheaply. The common

method of boiling, etc., followed in Natal's white sugar factories is as follows:—

1st Masseccutes.—Boiled from syrup, 1st wash and melted treacle sugar left in crystallizers 12-20 hours, double cured and yielding white sugars.

2nd Masseccutes.—Boiled from syrup, 1st wash, 2nd wash and 1st molasses, left in crystallizers from 20-30 hours, double cured and also yielding white sugar.

3rd. Masseccutes.—Boiled from 2nd molasses of 50-55 Purity to string, left in crystallizers from 5-8 days, yielding treacle sugar and final molasses of 42-45 apparent purity. The stirring gear of crystallizers is set in motion after the appearance of grain, from masseccute.

This method of boiling 3rd masseccutes is very inefficient and should be condemned when the boiling house capacity of the factory allows boiling of same on grain, as previously explained. For proper exhaustion of molasses, the masseccute should be left in the crystallizers for some 12 days, and where possible the temperature not allowed to drop below 125 degrees F., below which point crystallization of sucrose from molasses is comparatively slow.

Before closing it is interesting to remember that a source of great trouble in crystallization in motion is the stiffening of the masseccutes upon cooling; and in order to increase the fluidity of the masseccutes, it is the common practice to add molasses or water to same. The amount of such dilution should be carefully controlled, any excess dilution might dissolve some of the crystallized sugar, thereby destroying the aim of careful pan boiling and also affecting results from centrifugals.

There being no discussion the Chairman thanked Mr. Ducray for his paper.

DETERIORATION OF CUT UBA CANE

(Paper by G. C. DYMOND, Empangeni.)

The subject of my paper is a particularly complex one, on account of, firstly, the difficulty of explaining and reducing the results of vital functions and the numerous factors which influence them to an exact science; secondly, the magnitude of the limits of error due to sampling even cane from the same field, and thirdly, the basis of the interpretation of the results obtained.

Before proceeding with the actual deterioration and the losses involved in cane between the knife and the mills, it is necessary to have at least some general ideas about plant physiology and more par-

ticularly those vital functions of a cane relative to sucrose before as well as after cutting.

A growing cane has for its object in life the storing up of food reserves against the time when the seedling or embryo plant will require nourishment during its initial growth, that is before it has developed its own chlorophyll system. This potential food is useless to it in the form presented, and the plant cells secrete certain wonderfully active bodies called enzymes, which break down the complex food reserves into simpler bodies which can be utilised by the germinating plant.