Notes Section

Control of yeasts in sucrose syrup by control of syrup pH.

A major problem associated with liquid sugar use has been that of contamination by yeasts. The large volume of publications in various journals on the subject of microbiology in liquid sugar attests the concern of industry concerning spoilage due to yeasts in liquid sugar and products in which liquid sugar is used.

The main difficulties have been associated with sucrose syrup and with sucrose syrup-corn syrup blends. Difficulties with yeast growth in blends have been far greater than in sucrose syrup. The problems are relatively minor in corn syrup itself and in the more dense invert syrups.

The effect of the pH value of sucrose syrup on yeast metabolism was investigated.

Changes in yeast counts, syrup pH, and taste and odor of the syrup during storage can be used as indexes of metabolism. Sucrose syrup at 7.25 pH was inoculated with 7000 spoilage yeasts per 10 grams dry substance equivalent (dse), adjusted to various pH values with HCl or NaOH and stored for 25 days. The syrup adjusted to 4.00 pH had a fermented taste and odor at the end of the period, the pH decreased to 3.40 and yeasts were too numerous to count (TNTC) using 1 g dse on a Millipore membrane. The original syrup at 7.25 pH also became fermented, the pH decreased to 6.25 and yeasts were TUTC. Syrup adjusted to 8.15 showed no decrease in pH throughout the period, no fermentation could be detected and the yeast count had decreased to 40 per 10 g dse. Further testing using lower levels of inoculation showed that the rate of metabolism decreased with increasing pH values up to about pH 8. At pH 8 and above it was found that yeast metabolism stopped and yeasts present in the syrup died during storage. These findings suggested a simple expedient for control of yeasts in sucrose syrup through control of the pH of syrup production.

Since high quality granulated sugar dissolved in properly treated water has a very low buffering capacity, an increase in pH value of liquid sugar can readily be obtained by increasing the hydroxyl alkalinity of the water used for solution of the sugar. An increase of about 5 ppm in the hydroxyl alkalinity of the sucrose syrup has been found to increase the pH of the syrup from about 7 pH to about 8 pH. Thus the equivalent of about 10 ppm NaOH added to sucrose syrup changes the product from

one in which yeasts can grow to one in which they die. The slight increase in hydroxyl alkalinity was found to have little or no discernible effect on such quality factors as syrup color and resistance to color formation, taste, odor, etc.

The activity of yeasts in sucrose syrup-corn syrup blends can also be reduced by increasing the pH value of the blend but what may be an objectionable increase in color occurs.

Laboratory results have been confirmed on a commercial scale and a major improvement in the microbiological quality of sucrose syrup, without changes in physical or usage qualities, has been obtained by control of sucrose syrup produced at a pH value of 8. Additional processing costs are insignificant.

Patent coverage has been applied for.

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Harvesting and delivering beets 24 hours a day. Harvesting and delivering of sugar beets in the Red River Valley of Minnesota and North Dakota must normally be completed between September 20 and October 25. Earlier harvest is not practical because of beet growth and later harvest is affected materially by cold weather, snow, and freezing conditions which adversely influence the recovery and storage quality of beets.

During the harvest season of 1960 and 1961, delivery of beets at Moorhead, Crookston and East Grand Forks, Minnesota, was extended from 14 to 24 hours a day in order to complete harvest by October 25. An increase in the acreage contracted, increased yields, use of multiple-row and multiple-unit harvesters by the growers, and weather limitations established the need for such a change. Modification and improvement of pilers did not increase receiving speed sufficiently to overcome an increasing speed of delivery by growers. Similarly, an extension of receiving hours beyond a 14-hour day did not serve to reduce long truck lines ahead of pilers and idle hours of field crews waiting for trucks to return.

As a result, a second piler crew was hired, permitting two shifts of 12 hours each, starting at noon and midnight. To equalize any advantage, the shifts were changed upon 50% completion

of harvest. Grower deliveries to local stations were divided into two groups representing approximately equal acreage for each shift. Harvest was not controlled, but delivery within a shift was identified with truck windshield stickers.

Growers have enthusiastically accepted the program with many reporting a 40% reduction in harvest costs. The number of days needed for harvest has been reduced by more than one third. An average truck hauls 10 loads per shift compared with 6 loads under the 14-hour day.

Most of the rotobeating and topping are done by the growers during daylight hours; lifting and loading are generally done after dark. Lighting for night operation has been no problem. A few use special generator units but most growers use regular truck and tractor generators.

Beets delivered under this system have been well topped, clean, fresh, crisp and cool. The face of storage piles is always fresh which creates no storage problems from dehydrated, frozen or warm beets. The only trouble spots in piles were in 1960 when a 24-hour stop in delivery was allowed when the shifts alternated. This was eliminated in 1961 with an 8-hour stop.

Piler maintenance improved with the advent of scheduled 15-minute stops for greasing. Repairs that were formerly put off until night are now made immediately. Increased lighting has improved working conditions and no increase in accident rate has occurred.

The rate of night delivery is approximately the same as in daylight. The average daily delivery at four end-dump local receiving stations has increased from 1,450 truck loads under the 14-hour system to 2,340 under the 24-hour system. This is more than a 60% increase in the receiving rate. With the increased delivery rate and reduction in overtime, an approximate 20% decrease in receiving costs has been noted.

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