Standard Liquor Storage

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Received for publication February 27, 1968

High density beet sugar liquors can be stored for indefinite periods of time under any weather conditions providing the conditions of storage are such that (1) yeasts and molds cannot flourish and (2) crystallization cannot proceed.

Yeasts and molds found in beet sugar juices will not develop and flourish in solutions that are above 8 pH and above 67 R.D.S. Dilute solutions of beet sugar juices, on the other hand, offer ideal media over a wide range of temperatures for the development and growth of many strains of yeasts and molds. It is paramount, therefore, in the storage of either standard liquor or evaporator thick juice that moisture from condensation on the walls of the storage tank or from other sources be completely eliminated at all times. This can be accomplished by establishing a vapor barrier at the surface of the liquor by covering it with a layer of suitable oil to a depth of approximately one-eighth of an inch. The oil acts to prevent moisture from escaping from the surface of the liquor into the vapor space of the tank. At the same time it coats the steel and prevents rust. The relative humidity can then be controlled at a point such that the tank walls never reach the dew point. This is done by circulating a sufficient amount of outside air through the vapor space of the storage tank to make sure that the relative humidity of the air inside the storage tank is equal to the relative humidity of the air outside the storage tank. Under such conditions condensation will not occur. Utah-Idaho Sugar Company's plant, at Moses Lake, Washington, has stored standard liquor during beet campaign and processed it during a summer juice campaign for the past five years without having any trouble with yeasts and molds.

For crystallization to occur in storage it is necessary for the liquor to be super-saturated and for a sufficient number of nuclei to be present to start the process. Crystallization can be controlled by adjusting the R.D.S. of the liquor going into storage so that it is only saturated or slightly supersaturated at the temperature stored. To prevent both yeast and molds and

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crystallization in 94 purity liquor the R.D.S. should be kept between 67.5 and 68.5. The amount of nuclei present in the juice can easily be controlled by proper filtration of the juice and by filtering all dust particles out of air that is circulated through the vapor space of the storage tank.

Pumping Juice Out To Storage

Whenever the amount of standard liquor flowing to the pan floor storage tanks exceeds the amount of standard liquor required for the white pan station operation, the excess is pumped to the outside standard liquor storage tank No. 7. This is done as follows: (Refer to Figure No. 1).

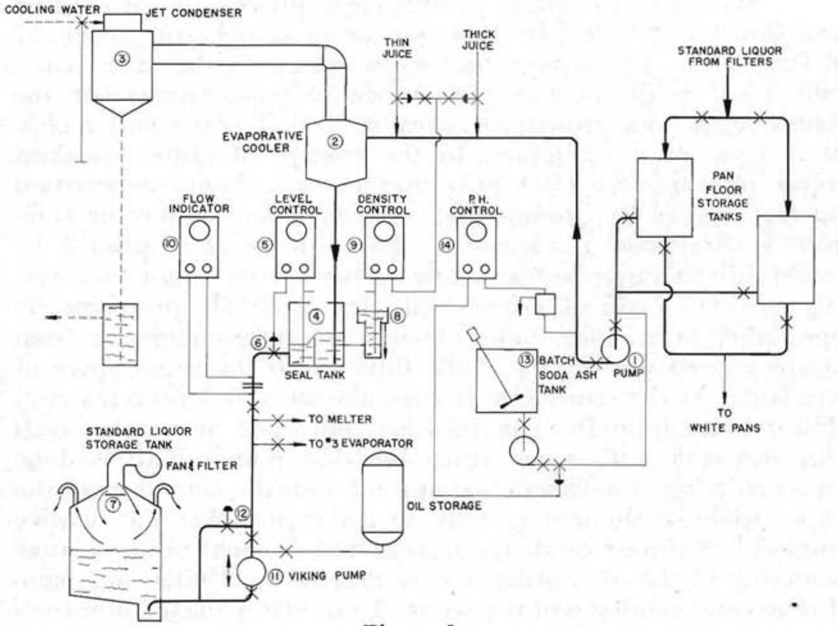

Figure 1.

Pump No. 1 is started which pumps liquor to evaporative cooler No. 2. Jet condenser No. 3, being in operation, maintains an absolute pressure of approximately 4" mercury on the evaporative cooler at all times. As liquor enters the cooler, evaporation takes place causing the temperature of the juice to lower to the temperature of evaporation corresponding to 4" mercury absolute or 125°F. Juice leaving the evaporative condenser flows to a seal tank No. 4 where the seal on the evaporative cooler is maintained. A level controller No. 5 measures the level in this seal tank and controls valve No. 6 to allow liquor to flow to the outside storage tank No. 7 without the entrainment of air. A sample of juice leaving the leg line in the seal tank is diverted to a bubble tube sampler No. 8. Density control instrument No. 9 measures the density of this liquor and in turn regulates thin juice or thick juice flow to the evaporative cooler to control the density of the liquor or the R.D.S. of the liquor within 67.5 to 68.5 R.D.S. Flow meter No. 10 records the amount of liquor flow going to the outside storage tank. At storage tank No. 7 liquor bypasses pump No. 11 through remote controlled valve No. 12 and enters the storage sump underneath the oil which previously was placed in the tank. pH is controlled by drawing a sample of juice just after pump No. 1, measuring the pH and controlling a flow of dissolved soda ash from batch soda ash tank No. 13 by use of pH controller No. 14. The soda ash enters just upstream of pump No. 1 to assure quick response and thorough mixing.

Whenever the amount of standard liquor flowing to the pan floor becomes less than is required for the continuous operation of the white pan station, pump No. 11 is started and remote controlled valve No. 12 is closed to regulate the amount of liquor to be returned to the high melter for processing. From the high melter the liquor returns to the pan floor storage tank via the standard liquor filters.

Recovery of Standard Liquor from Storage During Juice Campaign

During juice campaign part of the factory evaporator station must be used to: (1) furnish water for the boiler and for process, (2) furnish steam to operate the vacuum pans and other process equipment and (3) reheat the liquor coming back from the standard liquor storage tank. Refer to Figure No. 2. Here well water is boiled in evaporator bodies No. 1 and No. 2 and the condensate, as needed, is returned to the boiler. Condensate remaining from evaporators, pans, heat exchanger, etc., is used for general hot water or process water and for centrifugal wash water. Vapor from evaporator body No. 1 is used for boiling white pans and preheating the water entering No. 1 body. Vapor from No. 2 body is used for boiling high raw and low raw pans and for reheating standard liquor in body No. 3. Body No. 3 acts as a condenser for the evaporator station while heating the juice. Number 4 and 5 evaporators are not used. To remove solids from the water feeding bodies No. 1 and No. 2 Nalco 75 balls are used and both bodies are provided with blow down lines.

Pump No. 11 is started to return liquor back to evaporator body No. 3. Remote valve No. 12 then is throttled to control the level in No. 3 evaporator. The temperature of the juice leaving No. 3 evaporator is controlled by steam control valve

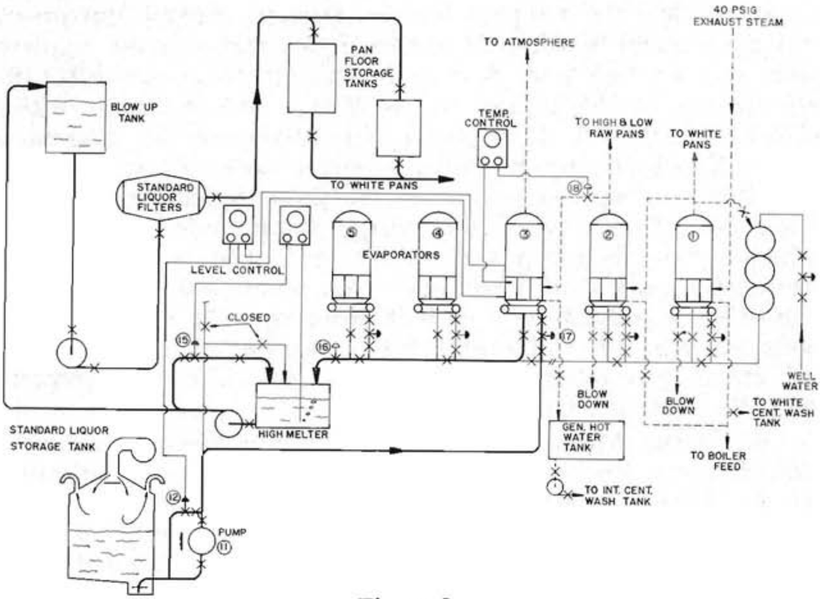

Figure 2.

No. 18. Valve No. 15 controls the level in the high melter. Here the high raw and low raw sugar is added and remelted. Then the liquor is pumped to the pan floor storage tanks by way of the blow up tank and standard liquor filters. The white pan operator controls remote valve No. 16 to regulate the amount of flow to the high melter and hence the flow to his pan floor standard liquor tanks. Pan operation and sugar end operation from here on are the same as for the beet campaign.

Sugar end management during juice campaign is the same as that of the beet campaign. Standard liquor purities are higher, due to the addition of the high and low raw sugars made during the juice campaign. This makes for increased white pan yields and better purity drops. High raw and low raw purities remain the same as for beet campaign. Molasses purities are as good or slightly better than for beet campaign.

Advantages of Liquor Storage

1. The sugar end and the beet end are less dependent upon each other. If the sugar end is shut down, the beet end can continue to operate, and the juice can be sent out to storage. If the beet end is shut down, juice can be pumped back from the storage tank, and the sugar end can continue to operate. This means that mechanical and operating delays are not so costly, and production levels are maintained at a higher rate.

2. Molasses purity can be maintained at a point consistent with good extraction without affecting the cutting capacity of the plant. The low raw purity can be lowered until the brown centrifugals are just keeping up. If the sugar end starts to get behind, standard liquor is put out to storage.

3. Juice storage provides additional sugar storage that is cheaper and safer than equivalent bulk granulated storage. This is true because: (1) the initial investment is less and (2) the beet end capacity can be increased without increasing the sugar end capacity.

4. Sugar made during juice campaign can be made to the specifications required by the market such as bottlers, grain size, and packaging. Sugar can often be packaged and loaded directly without being stored. This means the bags reach the market in better condition and costs of handling and breakage are reduced.

5. A schedule for packages for a complete sales year does not have to be decided upon before the end of the beet campaign. Large inventories of certain packages are not required at the end of campaign, and carry over of these packages from year to year is minimized.

6. Plant clean up at the end of campaign can be shortened since many of the remaining sugar end syrups can be adjusted for pH and R.D.S. and pumped into storage for processing during the juice campaign.

7. Juice storage can eliminate the cost of in and out charges for sugar stored in transit warehouses.

8. With sufficient juice storage capacity warehouse operations can be placed on a current basis and automated, thus requiring less labor and less warehouse space. Sugar is simply packaged as it is needed.