# Does Beet Sugar Follow the Trend in the Demand for the Higher-Quality Sugars?

CHAS. M. FRENCH[1]

To analyze the demands properly, the general sugar market must be treated in two parts: First, direct consumption, as the domestic market, and, secondly, food fabrication, as the manufacturing market. Although most properties of quality are common to both groups of purchasers, the criterion of quality in the domestic market is confined entirely to generalities, while the basis of quantity in the manufacturing market has become extremely specific and technical.

As a primary requisite for both markets, and a very elementary one, to be sure, sugar's resistance to caking or setting up under ordinary circumstances can hardly be stressed sufficiently. The quality of free flowing is necessarily inherent in the sale of a granulated product.

### Householder Wants Fine Sugar

To the household buyer in the direct consumption market, general appearance is the foremost criterion of quality. Although general appearance is not visible at point of sale, brand associations of good sugar are quite strongly fixed. Crystal size determines whether a sugar is coarse, medium or fine, and this property above all fixes a sugar's popularity with a household buyer. As a matter of fact, crystal size is the only criterion by which a householder judges sugar, good, bad, or indifferent. Therefore, in this respect a standard must be followed according to the custom of the buying public, and this varies somewhat geographically. Technically the term "reflectance" has been selected as a measure of general appearance; and the evaluation of this quality involves many factors, of which crystal size, color, and genuine crystal brilliancy are the most significant.

From an analysis of 45 random-picked samples over a territory from Chicago west to the Pacific Coast it was apparent that of all granulated sugars, regardless of source, the beet processors were catering somewhat to the household buyer who believes a fine-grain sugar is better than a coarser one.

### Food Manufacturing Needs Vary

For the manufacturing market, as in food fabrication, each field must be considered separately. In the order of magnitude of consumption, the bakers come first.

Fortunately, they have accepted sugar as sugar and are the most liberal of any trade on specifications. Occasionally, granulation

[1]Chemical Engineer, Manufacturer's Sales Service, Utah-Idaho Sugar Company.

standards are specified and rightly are so justified. Standard grain size is necessary for satisfactory keeping quality under unfavorable conditions, and also for routine processes, uniform granulation must be insured to conform with allotted mixing and dissolving times. On the other hand, icing work requires a sugar of good color, rather lack in color—if whiteness is called a color—to insure absolute white work. A powdered sugar must also be of sufficient fineness to eliminate any gritty quality in the finished plastic mass as an icing, or irregularities in behavior due to irregular absorption in the liquid phase. The baking trade is justified in demanding 6X for that reason, which is between 92 and 95 percent through a 100-mesh screen. Could cases of bakers' resistance to beet sugar be attributed to an oversight of this kind?

In the confectionary trade, they again accept sugar as sugar and pay little attention to specific qualities. Nevertheless, they do require an especially high-quality sugar for certain purposes and then again "anything sweet will do!" In confectionery, one of the foremost factors in performance is a sugar's behavior when the solution reaches the boiling point. Considerable foaming has been encountered at this point with poor sugars due to traces of non-sugars present.

According to Browne and Zerban in their newest edition of "Sugar Analysis," (page 1,106), foaming is caused by the absorption of surface-active substances, especially emulsoid colloids, on the air or gas bubbles in the form of a film. The most stable foams are obtained from such colloids as soaps, saponins, or proteins, which are able to form tough, semi-solid films. The quantity of foam and its stability afford a simple, approximate measure of the emulsoid colloids present. However, the results do not necessarily parallel those of surface-tension measurements, because foaming is effected by additional factors. The foaming character of our sugars at this point has been largely improved in recent years since we have been alert to this shortcoming. Aside from behavior on boiling, sugar must be of such quality to make white goods both at low and high temperatures. The quality of low-temperature white goods depends on the inherent color within the sugar, while the color at high temperatures depends on the sugar's resistance to decomposition and formation of accompanying colored substances.

On barley-candy tests, measuring resistance to break down at high temperatures and form colored substances there is some little difference but not enough to differentiate between sugars for high-temperature work. Particularly since today's new processes of vacuum cookers, the tendency to carmelize is minimized if not entirely eliminated. On the other hand, sugars which color more readily at high temperatures resist inversion to some degree. The following

correlation between color and inversion is given by Browne and Zerban (page 1,110) :

As the ash content increases it exerts a buffering effect; there is less inversion, but the alkalinity of the ash causes greater coloration. Neutral or acid salts generally increase the amount of invert sugar formed but give light-colored candies. Alkaline salts or salts of volatile acids produce less inversion but greater destruction of invert sugar with consequent high-color formation. Ammonium salts and amino acids cause strong inversion and also the formation of dark-colored, nitrogenous substances. Iron salts are in a class by themselves, producing strong inversion owing to hydrolysis, and also very dark-colored poly-hydroxy compounds of iron.

A confectioner makes the most critical demands for a sanding sugar, one of exact grain size and crystalline brilliancy. Uniformity is paramount with a minimum of fines.

The refiners set a high standard here with their premium sugars of Confectioner's Crystal A, AA, and Sanding; however, in order to meet the specifications of the latter, many of the processors are producing and marketing a "Manufacturer's Coarse Granulated."

In supplying the canning trade, we enter the most highly specialized market of all. The canners have been working for considerable time to perfect the quality of their pack through the guidance of their national association. Since keeping quality with them is the paramount issue, all factors bearing on this issue were closely scrutinized. Investigations finally showed that failures known as puffers, swells, and flat sours, were due to micro-organisms from not only the raw material but also the sugar used in the pack. Often lack of sufficient heat treatment for sterilization could be the cause, but where organisms were found to be heat resistant up to the cooking temperature, the solution of their problem lay in eliminating that sort of contamination at the outset. Therefore, when sugar used in process was found to carry heat-resistant organisms producing gas in certain packs causing ''swells'' and other organisms generating acid causing a "flat-sour" spoilage, the canners united through their national association and demanded sugar specified free of these organisms—generally classified as thermophiles. The standards of thermophillic tolerance on hard swells and flat-sour organisms are easily met today by the majority of granulated sugar-suppliers but a few years were required in the process of elimination and control.

The canners found an excessive sulfite content objectionable for use in acid packs, and in order to meet their specifications, certain changes in plant operations were made with the result that sugars are generally now held below the tolerant limit for sulfites, as designated by the canners.

With the carbonated-beverage industry coming to the front in order of a sugar consumer, scientific men in their organization pointed out the desirability of using only biologically pure materials; hence, the demand for sugars to meet their requirements; freedom from yeast and molds especially is necessary for a product compounded without pasteurization or heat treatment of any kind. Of course, the sterility of a bottling environment is primarily essential, but if the sugar measures up to tentative bacterial standards, our contracts have been fulfilled.

The biological qualities of sugars are continually improving which tend to raise standards. Even so, a small percentage of granulated sugars would rate commercially sterile. Isn't there more work to be done here *1*

Some sugars exhibit a peculiar action attributed to the emulsoid colloids present. In candy making it shows in foaming, and in bottling it appears as air retention when the sugar is made up to 32° Be sirups. Minute bubbles of entrained air seem to rise very slowly and when they do, they accumulate on the surface as a foam. Speed is usually the order of the day in bottling plants so that no additional time can be taken for clarification, and the sirup is termed milky by the bottler and then shot to the siruper. The siruper measures a quantity of sirup into the bottle, and the carbonated water begins to dribble in. Now the effervescing effect of the carbonated water, together with foamy characteristics of flavor compounds causes enough foam, but when the air-bubbles from the sirup let go with dilution, the situation is further aggravated.

## Summary

From my brief experiences in trade contacts during the past 3 years, the recognition of beet sugars as interchangeable with cane sugars has been noticeably more widespread as we have advanced in our alertness to the trades' demands.

Former shortcomings have been largely eliminated through improved processing methods and newer machinery, such as faster centrifugals. However, generally an untiring effort on the part of the operators has made it possible to meet high standards of bacterial purity.

The old capacity-rating figure: "How many tons of beets did we cut?" has given way to a consciousness of: "How many bags of sugar did we make?" And finally, developing with it, a pride in producing it, not just because its white, but because specific gains were made toward the ever higher standards.