## *Research Note*

### *CHARACTERIZATION OF SLOPS OF HIGH TEST MOLASSES ALCOHOLIC FERMENTATION*[1]

The rum industry of Puerto Rico is dealing with some technical problems which endanger its stability and future development: an erratic supply of raw material, slops disposal and energy conservation. The Rum Pilot Plant of the Agricultural Experiment Station has proposed schemes to cope with these problems; one is the conversion of part of Puerto Rico's annual sugarcane harvest into high test molasses intended for rum production.

High test molasses is heavy partially inverted syrups having 75–80% total sugars as invert and 2–3% sulphated ashes. It is produced by the same common milling, clarification and evaporation steps as those in raw sugar production. Acid or enzymatic inversion of the sucrose in the juice or syrup is introduced before final concentration to about 85° Brix.

The higher price of inverted cane syrup at present, as compared to that of blackstrap molasses is a strong point against the use of inverted cane syrup for rum production. However, in viewing the entire process from planting of sugarcane to the treatment of distillery wastes, the use of high test molasses may show advantages which can be translated into net economic gains and thus compensate for the difference in price. A high priority has been given to this phase of the study. An area of particular interest because of its impact on the environment and on operational costs of a distillery is the waste produced from the fermentation of high test molasses. Its relative cleanliness means reduction of treatment costs prior to ocean disposal. This cleanliness also increases the possibility of reusing high test molasses waste in part to dilute fresh mash for fermentation with the corresponding conservation of energy. Fewer operation stoppages for column descaling should occur because of the low ash content of the waste. This fact may also increase the use of high test molasses slops as animal feed supplement.

This report presents preliminary experimental data on the characterization of the slops of high test molasses obtained in the Rum Pilot Plant as a secondary product from four fermentations performed on a 1,000 gal level.[2]

[1] Manuscript submitted to Editorial Board February 9, 1981.

[2] The total sugars content in the molasses mashes fluctuated from 17.3 to 20.2 g/100 ml. The initial pH from the above mentioned mashes varied from 4.6 to 4.9. The alcohol yield obtained from the fermented mashes fluctuated from 8.5 to 10% by volume.

TABLE 1.—*Analysis of slops from high test molasses*

| Analysis | Slops from High Test Molasses | | | | | Slops from Blackstrap molasses[1] |
|---|---|---|---|---|---|---|
| | MR-1 | MR-2 | MR-3 | MR-4 | Average | |
| pH | 4.3 | 3.8 | 3.4 | 3.6 | 3.8 | 4.7 |
| °Brix | 3.5 | 2.8 | 3.5 | 3.2 | 3.2 | 11.3 |
| Density (g/ml) | — | 1.0089 | 1.0207 | 1.0151 | 1.0149 | 1.0431 |
| Total sugar (g/100 ml) | 0.44 | 0.32 | 0.36 | 0.44 | 0.39 | 1.6 |
| Total solids (%) | 2.89 | 2.57 | 3.01 | 2.53 | 2.75 | 8.62 |
| Ash (%) | 0.62 | 0.53 | 0.47 | 0.53 | 0.54 | 2.42 |
| COD (p/m) | 32,496 | 23,200 | 32,267 | 27,034 | 28.749 | 92,224 |
| BOD (p/m) | 10,400 | — | — | — | — | 30,000 |
| Alcohol (%) | 0 | 0 | 0.16 | 0.52 | 0.17 | |
| Metals | | | | | | |
| Na (ppm) | 75 | 102 | 125 | 162 | 116 | 294 |
| K | 1930 | 1770 | 1970 | 1650 | 1830 | 5,600 |
| Mg | 160 | 200 | 223 | 183 | 192 | 1,500 |
| Ca | 273 | 227 | 250 | 343 | 273 | 2,000 |
| Fe | 18.9 | 33.8 | 26.6 | 33 | 28 | 16 |
| Cu | 86 | 42 | 45 | 25 | 49.5 | 12.5 |
| Zn | 3.70 | 5.70 | 2.80 | 3.70 | 4.00 | 4.10 |
| Total acidity (g/l) | — | 2.69 | 2.93 | 2.33 | 2.65 | 5.25 |
| Temperature (°C) | — | 96 | 95 | 95 | 95.3 | — |

[1] Average composition of Puerto Rico distillery slops.

Samples for the analysis were obtained by installing a sampling tube before the filter system of the beer column.

Temperature, pH, BOD, °Brix, and alcohol analyses were measured immediately. Residual aliquots were preserved for other analyses. The analyses followed the Manual of Analytical Methods of the Rum Pilot Plant[3] and the Standard Methods for the Examination of Water and Waste Water.[4]

Preliminary results are presented in table 1, which also includes a representative analysis of slops from blackstrap molasses for comparison purposes. The majority of the characteristics studied showed lower values than those of the slops from blackstrap molasses. A reduction of more than 50% in the BOD and COD values of high test molasses slops was obtained in comparison with those values in the slops of blackstrap molasses. This fact suggests that the use of high test molasses for the manufacture of rum yields a waste with a significantly lower contaminating power than that of the waste obtained from blackstrap molasses. The color intensity in the high test molasses slops is lower than that of blackstrap molasses slops. There is an increase in the Cu level and a considerable decrease in pH. Should Cu level be consistently high, a study would be in order to determine the origin of that contamination. The ratio of COD/BOD and Ca/Mg were 2.8 and 1.42, respectively. Those values resulted very close to those reported by Basu.[5] During distillation the levels of sugar in the fermented mashes were not affected.

*Mario Ramírez*
*Rum Pilot Plant*

[3] Official Analytical Methods of the Rum Pilot Plant, 1969. Agric. Exp. Stn., Mayagüez Campus, Univ. P.R.

[4] Standard Methods for the Examination of Water and Waste Water, 14th ed. American Public Health Association, New York, 1975.

[5] Basu, A.K., 1975. Characteristics of distillery waste water, J. WPCF Vol. 47 No. 8, p-2184-190.