

UPASIRI SAMARAWEERA*, CARLSON, JEFFREY L., KEN KUBAT, Minn-Dak Farmers Cooperative, 7525 Red River Road, Wahpeton, ND 58075-9698. **Efficiency Improvements at Minn-Dak Farmers Cooperative Process Lab**

ABSTRACT

Process laboratory efficiency was improved by upgrading laboratory equipment, modifying analytical procedures and automating data entry into the laboratory information system. Many process streams are tested for multiple parameters on a variety of instruments. Prior to the changes, many of the tests required different sample preps. By changing the analytical procedures, one or two sample preparations were sufficient for all tests on a given sample. The use of automated sample dilutions was incorporated, reducing sample preparation time further. The use of automatic samplers, computer controlled analytical equipment and automatic data entry to the laboratory information system was the final step in the automation process.

As a result of many of the efficiency improvements, Minn-Dak has reduced the laboratory technicians from four to two without a reduction in the information provided.

The pan floor data entry was automated to gather the pan data (i.e. pan volume, boil time etc.) and then transfer that data the factory control software. The lab would fill in rest of the pan information (purity etc.) by running the samples and Sugar Boilers would have access to complete pan data. They were then able sort the data by the pan (A1, A2 etc) or by the time (4-12 etc), and observe pan performance over time and make changes if necessary.

Analysis for samples on the syrup bench includes POL (polarimeter), RDS (refractometer), pH (pH meter) and color (spectrophotometer), using four different instruments. The samples are diluted using an automated diluter to a preset ratio (e.g. 1 part sample 18 parts water) giving the diluted samples a final Brix of five. The sample cups are loaded on a sample changer and START button is clicked on the computer. The sample cups moves to a position under the aspirating line, as it does so its bar code is read. The instructions pertaining to that barcode are downloaded to the PLC. The sample cup is lifted to the aspirating line and the pump is started to run the sample through the instruments. The sample first runs through a copper coil immersed in a water bath set to 20° C and then runs through the pH probe, Polarimeter, refractometer and the spectrophotometer. The pump is stopped by the PLC after a preset time and data from each instrument reading is gathered and transferred to a review screen. The rest of the samples in the sample changer will run the same way and at the end all the instrument readings and the calculated original brix, purity, pH and color will appear for each sample on a review screen.

The program automatically flags and values deviating from programmed-in value ranges (e.g. standard liquor purity between 90-95). The technician can choose to accept or reject any of the values, even those automatically flagged. Date accepted is transferred to the lab database and appears on the computer display, available to supervisors and factory personnel.

Other Changes

The following instruments are used in Minn-Dak process laboratory.

Atomic Absorption Spectrophotometer

Autotitrator

YSI enzymatic Analyzer

Ion Chromatograph

Total Carbon Analyzer

The Atomic Absorption Spectrophotometer is used to determine calcium and magnesium in thickener overflow and filtered 2nd carbonation juice, the autotitrator is used to determine thickener overflow alkalinity and SO₂ in thin juice and the YSI is used to determine glucose and lactic acid in raw juice, tower center, BTS, samples.

In above three instruments samples runs are automated using autosamplers and data from the instruments are automatically transferred to the lab data base by a vendor program.