

Direct Mass Flowmeters Sweeten Bottom-Line of Orange Juice Production

RESULTS

- Improved process availability, saving time and money
- Improved reliability of the quality of the product
- Improved truck loading accuracy and productivity
- Sugar content determined directly while filling



APPLICATION

Citrus processing results in products for direct consumer consumption, by-products that are incorporated into a variety of food products, and industrial products used in non-food applications.

Typically, fresh orange juice is concentrated before shipping or storage for later use. Concentrating orange juice reduces transportation cost by minimizing the water content. Excess water shipped when orange juice is not concentrated to the desired level, leads to lost shipment revenue.

Due to slight variations in juice concentration, the market value of the final product is based on the sugar solids content rather than the total shipment weight. This sugar level is expressed in °Brix, which is the unit of measure of a sugar solution's concentration and represents the percent weight of sucrose in the solution.

Normally, fresh orange juice is concentrated to a level of 65°Brix. Because the supplier is contracted to deliver at a specified sugar level, concentration level must be controlled within the specification range and requiring accurate °Brix measurement.

Micro Motion meter eliminated costly errors associated with trial-and-error loading.

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CHALLENGE

Two common devices exist for determining the °Brix of a solution, refractometers and densitometers. Typically, critical angle refractometers are employed. These refractometers utilize a prism in contact with the fluid stream. A light beam is focused to fall on the prism-sample interface. The amount of reflected light represents the refractive index of the solution. As the solution concentration changes, the refractive index also changes. The measured refractive index is related to the sugar concentration.

Difficulties can arise when utilizing a critical angle refractometer to determine orange juice °Brix. Orange juice concentrate will coat the refractometer prism, resulting in an erroneous reading over time. This coating is unpredictable and must be cleaned from the prism on a regular basis to ensure measurement integrity. Eventually, prism replacement is required due to the physical damage associated with frequent cleaning.

A citrus processor using a refractometer was experiencing filling errors during out-loading of orange juice concentrate into tanker trucks. Utilizing a truck scale, the processor observed that 50% of the trucks were not being properly loaded. This required costly, time-consuming adjustment of the load.

SOLUTION

A Micro Motion® mass flowmeter was chosen to eliminate the costly errors associated with trial-and-error loading. The Micro Motion technology provided the added benefit of determining the sugar solids content of the tanker load by monitoring the orange juice concentration.

Micro Motion Coriolis meters use the same principal as densitometers to yield a highly accurate density measurement that is continuously monitored. The density of the fluid is directly related to the solution °Brix. Using a Micro Motion mass flowmeter density measurement to determine solution °Brix eliminates prism coating problems associated with in-line critical angle refractometers. It also serves as both a flowmeter for loading control and as a densitometer for concentration control, with a single device.

Temperature effects exist for both refractive index and densitometers methods during °Brix determination. Micro Motion technology incorporates a temperature compensated °Brix measurement based on the solution temperature and density. The measured °Brix value is automatically corrected for specific gravity at 20° C.

Previously, for this citrus processor, five out of ten trucks loaded each day did not meet load size specifications. With the addition of the Micro Motion mass flowmeter, the processor now loads 12 to 13 trucks a day with no load size errors. The flowmeter also allows the determination of the sugar content of the concentrate directly while filling, rather than sampling the truck after loading is completed. The Micro Motion flowmeter has enabled this processor to efficiently load tank trucks with higher quality orange juice concentrate, saving valuable time and money.

