Monitoring raw milk reception at the dairy plant using BUCHI NIR-Online® Process Analyzer

The BUCHI NIR-Online® process analyzer monitors and documents the entire load of raw milk at the receiving dock of the dairy plant. True fat, protein or solids-non-fat values of the complete delivery enable milk processors to pay the right price to the milk producers as well as to segregate the raw, unprocessed milk based on its quality to different storage tanks. Doing the sampling just before the milk enters the dairy plant enables dairy plant operators to decide upon acceptance or rejection of the raw material.

1. Introduction

Milk is commonly delivered to the dairy plants by road tankers. Since further processing of milk depends mostly on its quality, the decision of accepting the milk has to be done quickly after arrival and based on accurate and reliable analytical information. Delays can cause milk deterioration and consequently higher labour and operating costs if not interruption in plant operation.

Apart from the major milk quality indices such as bulk milk cell count, bacterial count, temperature and sediment, total milk solids is what defines the price milk processors pay to the producers. It is in the dairy processor`s interest to determine the true average value of total solids, solids-non-fat, protein or fat [1,2] content of the entire tanker truck load rather than judging the milk composition based on a small sample volume manually taken by the plant operator.

Assuming a milk price of 5 USD/kg of milk solids and processing capacity of 1.000.000 l of fresh milk per day, determination of a true average of total milk solids being 0.03 % lower than the spot sample analysis, results in dairy processor`s savings of 69.000 USD per year. This calculation takes 1.0335 kg/l as average milk density and total milk solids content of 12.2 %. Annual savings ensure a payback period of less than a year.

The implementation of BUCHI NIR-Online® process analyzer before the fresh milk enters the dairy plant or just after the cooling step and before the storage tank (Figure 1) provides true average values of the chemical quality indices of the entire load. Within seconds, several parameters (Table 1) are continuously, simultaneously and accurately measured enabling plant operators to take the right decisions in realtime.

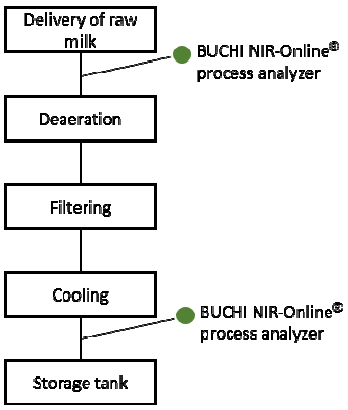

Figure 1. Raw milk delivery to the dairy plant

2. Measurement setup

BUCHI NIR-Online® process analyzer: X-One (NIR)

Wavelength range: 900-1700 nm

Measurment principle: Transflection

Interface to process: X-Cell (1), Milk pipe (2) Varinline adapter for GEA Tuchenhagen piping system (3) All interfaces come with 2 mm pathlength adapter

3. Results

The BUCHI NIR-Online® process analyzer was found to be suitable for accurate measurements of the relevant parameters in raw, unprocessed milk.

Table 1. Calibration performance.

Parameter	Range [%]	SEC
Fat [%]	3.2-4.9	0.03
Protein [%]	2.8-3.8	0.04
Solids-non-fat [%]	8.4-9.2	0.03
Total solids [%]	11.7-13.7	0.05
Acidity [% lactic acid]	0.130-0.190	0.004
Freezing point [°C]	-0.508 to -0.536	0.003

SEC: Standard error of calibration (absolute)

4. Conclusion

Results clearly show that NIR-Online® process analyzer equipped with an X-Cell, milk pipe or varinline adapter is able to simultaneously measure process relevant parameters of raw milk. This enables dairy processors to decide in realtime upon acceptance or rejection of the incoming raw material and to pay the right price to the milk producers based on true average value of total milk solids. Realtime information prevents delays in processing and thus positively impacts quality and operation costs. Seamless documentation of the complete process through an automatic reporting system provides production managers insight into the relevant statistics at all times.

5. References

[1] Manuals of Food Quality Control, chapter 8: Food Analysis: quality, adulteration and tests of identity, Food and Agriculture Organization of the United Nations.

[2] ISO/TC 34/SC 5 Standards for Milk and Milk Products, International Organisation for Standardization.