INTRODUCTION
- Digitization of the dairy industry is essential to meet the requirements of Industry 4.0.
- The first step in dairy processing is the compositional analysis of incoming raw milk.
- Conventional laboratory techniques are time-consuming and expensive and often involve hazardous chemicals.
- Vibrational spectroscopic (such as mid-infrared) techniques provide a low-cost and robust alternative.
- NIR spectroscopy sensors can be installed on the process line for real-time compositional analysis.

NEAR INFRARED SPECTROSCOPY
- The principle of NIR spectroscopy is based on the absorption of specific wavelengths due to the vibration of molecules in materials.
- For example, the water molecules will absorb 1350-1450 nm and 1850-2000 nm wavelengths.

Figure 1 Measurement Approaches In Process Analytics

NEAR INFRARED SPECTROSCOPY
- The resultant response is called the NIR spectrum and can provide information about the chemical properties of a sample.

Figure 2 Principle of NIR spectroscopy

RAW MILK
- The spectra of milk components can be measured by NIR spectroscopy.

Figure 3: NIR Spectra of Water

Table 1 Prediction performance of calibration models

REAL-TIME MEASUREMENT
- Variations in flowrate did not influence the spectra of raw milk or the prediction performance of the model.
- Repeated measurements provide a consistent prediction of component concentration.
- Temperature variations can influence the prediction performance of calibration models.

CONCLUSIONS
- NIR sensor with optical fiber transflectance probe can quantify components of raw milk in line.
- The variation in flowrate did not influence the spectra of raw milk.
- The sample’s temperature can affect the robustness of calibration model’s prediction performance.

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