10. Data Analytics What Can New Analyses Techniques Bring for Better Farm Results 2

Title presentation

Chip-size, low cost near infra-red Sensors for milk analysis with lab grade performance

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Abstract

In 2019, dairy market was valued at more than $ 600 Billion, and it is projected to exceed 1 Trillion $ by 2024, making it one of the largest food sectors worldwide. Milk is also considered one of the most foods consumed worldwide. Therefore, milk composition and quality are two crucial factors to be measured. Milk components are measured by various technologies; most common is ultrasonic in addition to spectroscopic techniques like MIR technology. The issue with these two techniques are mainly accuracy in case of ultrasonic and very high price in case of MIR spectroscopy. In this work, the robustness and efficiency of the chip-size, low cost near-infra red sensors NeoSpectra® to accurately determine the milk components are demonstrated. Compared to other competing technologies in the market as well as some benchtop instruments, NeoSpectra is showing a much better performance and exceeding ICAR on farm standards and even close to lab standards.

The prediction models are built using cow milk taken from various regions/herds. 115 raw, fresh cow milk samples were collected from 3 different breeds and 5 different herds. Chemical analysis for fat, protein and lactose is performed using official methods of analysis of AOAC international 19th edition. Milk measurements using NeoSpectra sensors are collected using milk samples in off the shelf glass beakers and milk is covering at least 1 cm above the bottom of the beaker.

As a summary of the results, fat is measured using NeoSpectra sensors and prediction models with a coefficient of determination (R2 = 0.98) and (RMSE=0.157) and testing results (R2=0.99, RMSE=0.167, SD (standard deviation) =0.147). Protein is measured with (R2 = 0.89) and (RMSE=0.078) and testing results (R2=0.979, RMSE=0.127,SD=0.131). Lactose is measured with (R2= 0.9) and (RMSE=0.068) and testing results (R2=0.84, RMSE=0.091, SD= 0.097). These results show that NeoSpectra sensors & prediction models surpassed ICAR's standard for on farm analyzer which requires SD (standard deviation) = 0.25 for fat, protein and are very close to ICAR's standard for lab analyzer which requires SD = 0.1(1, 2).

In conclusion, the NeoSpectra® NIR sensors showed the ability to enable low cost milk analyzers that not only complies with ICAR standard for on-farm milk analyzers, but also exceeds it to a performance level that is very close to ICAR lab analyzer requirements.

1- ICAR. 2017a. Guidelines for Testing, Approval and Checking of Milk Recording Devices.

2- ICAR. 2017b. Guidelines for On-Line Milk Analysis.