Session 7: Latest tools using MIR-spectra in the ICAR world.

S07.O-03

NEAR INFRA-RED SPECTRUM OF RAW MILK, RAW OR HOMOGENISED?

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In near infra-red (NIR) spectroscopy, variations in the particle size of milk (fat globules and casein micelles) can scatter the incoming radiation and increase the path length to an unknown extent. One proposed solution is the homogenisation of raw milk to standardise the particle size before acquiring the NIR spectrum. However, it's been previously recognised that homogenisation also leads to chemical and structural changes in raw milk, such as changes in pH, fatty acids, and fat globule membrane. Moreover, the NIR spectrum of raw milk is dominated by two strong absorption bands of water, and their properties also depend on the suspended and dissolved elements. Therefore, this study investigated the effect of homogenisation on the NIR spectrum of raw milk. Two NIR datasets of raw milk were acquired in transmission mode (800-2500 nm) before and after homogenisation. Samples used for the training were collected from individual cows (October and November), and for the test dataset, samples were obtained from the bulk tank (April to November) to include seasonal and lactation stage variations. To study the impact of homogenisation on the complete spectral range, PLS regression models were developed for fat and protein, and obtained regression vectors were compared. In the raw spectrum, it was observed that the homogenisation narrowed the combination band of water absorption and increased the scattering effect (baseline) in the short-wave NIR (SWNIR) region. Observed differences in PLS regression vectors illustrated changes in the water molecular structure and fatty acids profile of the homogenised milk. Moreover, it was also observed that models developed using homogenised milk were less robust (RMSEP of 0.23 and R^2 of 0.52 for protein) compared to the raw milk models developed to investigate seasonal and lactation stage changes (RMSEP of 0.09 and R^2 of 0.93 for protein). Therefore, the impact of homogenisation on the chemical composition of raw milk should be considered before developing chemometrics models.