

On-site sensors for quality control of Breast Milk

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Breast milk is the first source of human nutrition. It contains a lot of bioactive components and nutrients for infants' growth. It is extremely important for immune systems, affecting a child's health for life. It is well established that the ideal nutrition is a mother's own milk, however, sometimes it is not possible. These reasons justify that milk banks as a specialized service integrated into the neonatology units of hospitals. When feeding neonates with breast milk from hospital banks, one key problem is the milk's nutrients, which should be adequate for neonates' nutritional needs. Milk quality is now monitored in laboratories with fully verified chemical reference procedures or milk analyzers with pre-calibrated medium or near-infrared (IR) devices, but an alternative for on-site and real-time monitoring milk quality control is the best option for adequate nutrition of neonates. [1].

Near-infrared spectroscopy (NIRS) is a real-time, non-contaminating, and versatile technique that provides information on food nutritive value. It allows the analysis of intact samples and it is a waste-free technique.

In this research work, we have worked in the development of quantitative calibration models to determine nutritive value in breast milk (energy, fat, carbohydrate and protein). A total of 68 samples were involved in this study. After trying different chemometric strategies with Unscrambler X software, we obtained the best coefficients of determination for calibration (R^2) for fat developing models with intact spectra ($R^2= 0.910$) and for energy, carbohydrates and total solids after standard normal variate and first derivative ($R^2_{\text{Energy}}= 0.927$; $R^2_{\text{carbohydrates}}= 0.894$; $R^2_{\text{Total Solids}}= 0.929$).

REFERENCES

- [1] Fusch, G.; Kwan, C.; Kotri, G.; Fusch, C. "Bed Side" human milk analysis in the neonatal intensive care unit: A systematic review. Clin. Perinatol. 2017, 44, 209–267.

155–177.