NIRS Analysis of Liquid and Dry Ewe Milk

NIEVES Núñez-Sánchez[1], Garrido-Varo[1]*, JUAN M. Serradilla-Manrique[1] and JOSÉ L. Ares-Cea[2]

1.- Faculty of Agriculture and Forestry Engineering. ETSIAM. University of Córdoba. Spain
Apdo. 3048. 14080 Córdoba. Spain. pa2nusan@uco.es
2.- C.I.F.A. Hinojosa del Duque (Córdoba). Junta de Andalucía. Spain

The routine analysis of milk chemical components is of major importance both for the management of animals in dairy farms and for quality control in dairy industries. NIRS technology is an analytical technique which greatly simplifies this routine. One of the most critical aspects in NIRS analysis of milk is sample preparation and analysis modes which should be fast and straightforward. An important difficulty when obtaining NIR spectra of milk is the high water content (80 to 90%) of this product, since water absorbs most of the infrared radiation, and, therefore, limits the accuracy of calibrating for other constituents. To avoid this problem, the DESIR system was set up. Other ways of radiation-sample interaction adapted for liquids or semi-liquids exist, which are practically instantaneous and with limited or null necessity of sample preparation: Transmission and Folded Transmission or Transflectance. The objective of the present work is to compare the precision and accuracy of milk calibration equations in two analysis modes: Reflectance (dry milk) and Folded Transmission (liquid milk). A FOSS-NIRSystems 6500 I spectrophotometer (400-2500 nm) provided with a spinning module was used. Two NIR spectroscopic methods for milk analysis were compared: a) folded transmission: liquid milk samples in a 0.1 pathlength sample cell (ref. IH-0345) and b) reflectance: dried milk samples in glass fibre filters placed in a standard ring cell. A set of 101 milk samples was used to develop the calibration equations, for the two NIR analysis modes, to predict casein, protein, fat and dry matter contents, and 48 milk samples to predict Somatic Cell Count (SCC). The calibrations obtained for protein, fat and dry matter have an excellent quantitative prediction power, since they present r^2 values higher than 0.9. The r^2 values are slightly lower for casein and SCC (0.88 and 0.89 respectively), but they still are sufficiently high. The accuracy of casein, protein and SCC equations is not affected by the analysis modes, since their ETVC values are very similar in reflectance and folded transmission (0.19% *vs* 0.21%; 0.16% *vs* 0.19% and 55.57% *vs* 53.11% respectively). Lower SECV values were obtained for the prediction of fat and dry matter with the folded transmission equations (0.14% and 0.25% respectively) compared to the results with the reflectance ones (0.43% and 0.34% respectively). In terms of accuracy and speed of analytical response, NIRS analysis of liquid milk is recommended (folded transmission), since the drying procedure takes 24 hours. However, both analysis modes offer satisfactory results.