MILK AND DAIRY PRODUCTS ANALYSIS : MIR OR NIR, ADVANTAGES AND DISADVANTAGES

(summary of the lecture held by G. Mazerolles (INRA, Poligny) at CECALAIT annual session)

In the last 30 years, infrared spectrometry has been used more frequently in dairy laboratories. Mid infrared instruments (MIR) were the first able to give accurate and precise quantitative results in milk analysis. Since then, the development of PCs and softwares made it possible to adapt near infrared (NIR) instruments or Fourier transform (FTIR) infrared instruments (MIR or NIR) to routine analysis.

Wavelengths from 2.5 to 50 μm belong to the MIR spectrum. In this region, analytes, but also solvants have strong absorption bands, affected by the environment of the chemical groups. Wavelengths from 0.7 to 2.5 μm belong to the NIR spectrum. They are more energetic, therefore penetration and diffusion of the wavelength are more important than in MIR spectrum. Spectral information is not as well described. On the other hand, the components of the optical systems in NIR are less expensive than in MIR.

A spectrophotometer is always composed by an infrared source, a dispersive or interferential system and a detector. They work either in transmission or in reflexion (see figures in La Lettre de CECALAIT).

Concerning calibrations, MIR instruments are ususally calibrated at well defined wavelengths. The same is possible in NIR, with concentrations related to absorbances by way of multilinear regression. Nevertheless, the most recent applications of NIR use rather a broader spectrum and need mathematical pretreatment of data and complex statistical techniques like principal component analysis or partial least squares. Actually, NIR analysis has mostly begin to develop since computers have been able to do these complex statistical calculations fast.

A survey of the litterature of the fifteen last years about dairy analysis shows, as expected, more MIR than NIR results. It confirms that MIR analysis remains the best technique for routine milk analysis. However, results obtained from the 80s show that NIR performs nearly as well as MIR and point out the interesting potential of NIR.

In milk, NIR signal does not seem to be affected by lipolysis, but the influence of a preservative agent is still unknown. Concerning cheese, the litterature survey showed interesting results and prospects for NIR. For instance, it seems that a single calibration could be used regardless of the maturation of the cheese.

Other interesting prospects concern milk analysis in farm, study of milk coagulation and on line process control, where NIR is coupled to optical fibers. This last application is already working in some production units.