

Analysing milk with the Pearl™

Analysing milk to meet quality control standards is easy with the Pearl™ IR transmission accessory.

IN 2010 THE USA PRODUCED around 10% of the world's milk and dairy accounts for 13% of the food industry turnover in Europe. Monitoring the health of livestock and quality of cow milk is valuable to the large scale dairy industry worldwide.

FTIR spectroscopy is a non-destructive way to determine purity and characterise the contents of dairy samples. Traditional liquid cells are an effective way of detecting the lactose, protein and fat concentrations in milk, but can be time intensive.

The Pearl™ liquid transmission accessory can record high-quality IR spectra of milk with reproducible pathlengths as small as 25 μm . Moreover, sample loading and cleaning is easy, fast and requires little user-training, which can save a lot of time and money.

Within the Pearl™ is a liquid sample cell called the Oyster Cell. Samples can be dropped onto the cell and loaded into the Pearl™ for fast analysis. The lightweight, portable, and robust design makes the Pearl™ highly suitable for applications in the field.

Method and Results

Store-bought milk samples of varying fat and lactose concentrations were tested. Each sample was dropped onto a CaF_2 window and a liquid capillary film of the sample was formed by closing the upper window over the top.

The Pearl™ was placed into a commercially available spectrometer to record the spectra shown.

The water content of milk is >85% and significantly influences its spectrum, which is why a water background subtraction has been applied to the data.

The flavour and aroma of fats like milk lipids affect the palatability of food but the amount of fat in milk is important for suckling calves.

Figure 1 shows the spectra of fat free, low fat, semi-skimmed and whole milk, which correspond to 0, 1, 2 and 3.5 % fat, respectively. The sharp absorption bands at 2920, 2850 and 1750 cm^{-1} indicate dairy fats, and increase in intensity with greater fat concentration.

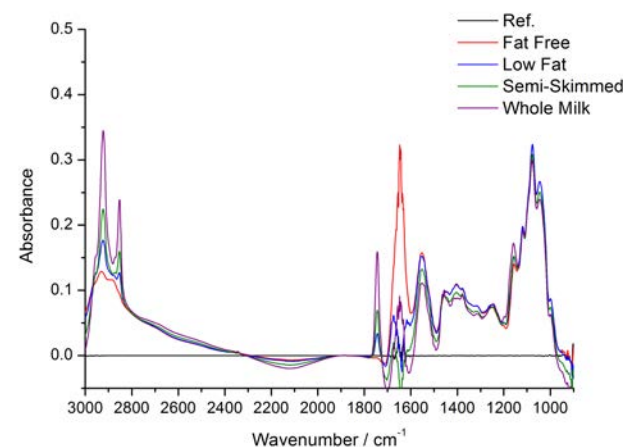


Figure 1: spectra of various milk types

Lactose is the principal carbohydrate, accounting for roughly 5%, in milk. Therefore, quickly identifying the percentage of lactose in hundreds of milk samples can be cost-effective.





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“ Simple and fast when
using the Pearl™ ”

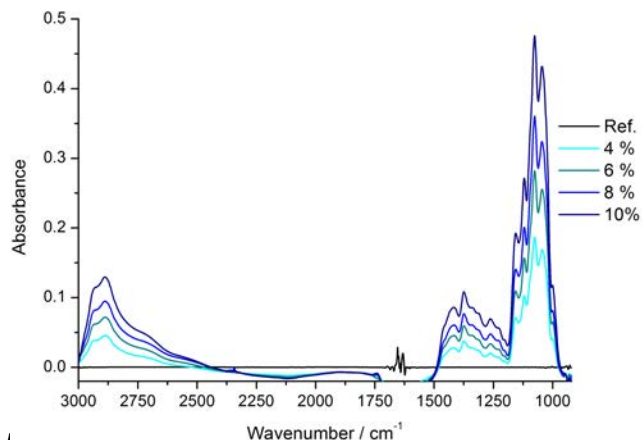


Figure 2: spectra of four solutions containing different lactose concentrations in water

By comparing the intensity of the milk's lactose absorption band at 1045 cm⁻¹ with the known % of lactose, an easy-to-use calibration curve can be made, as shown in Figure 3.

The calibration curve can be used to accurately determine what % lactose is in solution for an unknown sample.

Conclusions

Spectral analysis of milk to determine fat and lactose content is simple and fast when using the Pearl™ liquid transmission accessory.

Whether checking retail milk quality or ensuring the health of newborn calves, FTIR analysis is an

invaluable technique for monitoring a herd's milk production, as well as fertility and even CH₄ emissions.

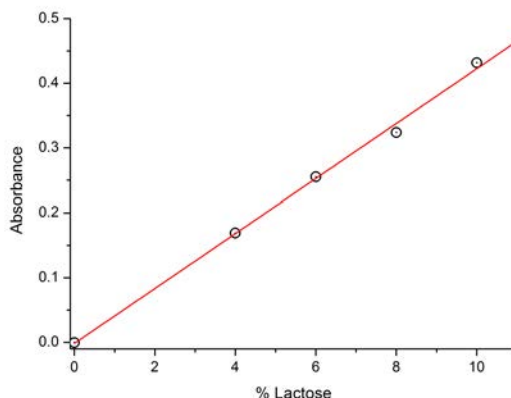


Figure 3: calibration of lactose vs. absorbance

The ease, speed and accuracy of this technique contributes to a cost-effective dairy management system and encourages healthy cows and high quality dairy products for consumers.

For complementary IR analysis techniques on solid dairy products like cheese and yoghurt, why not look at our ATR accessory?

Acknowledgement

John Coates, President of Coates Consultancy, performed independent spectroscopic analysis of the above milk samples.

References

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