# Determination of Moisture Profiles of a Pressed Type of Cheese by NMR

A. Castell-Palou, M.R. González-Centeno, O. Rodríguez, S. Simal

Department of Chemistry. Universitat de les Illes Balears.
Ctra. Valldemossa km 7.5, 07122, Palma de Mallorca, Illes Balears, Spain.

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## ABSTRACT

The moisture profiles of cheese cylinders, ripened during 31 days at 16ºC, and laterally isolated in order to avoid the mass transfer along the radial axis, have been determined. For this purpose, a NMR method was settled up to measure moisture in cheese. The main advantage of the method was that it allowed a simple and quick determination of the moisture content in each cylinder's section, which only required a little amount of non-pretreated sample (less than 1g). The results obtained clearly showed the suitability of the proposed method in the determination of the cylinders' moisture profiles.

## INTRODUCTION

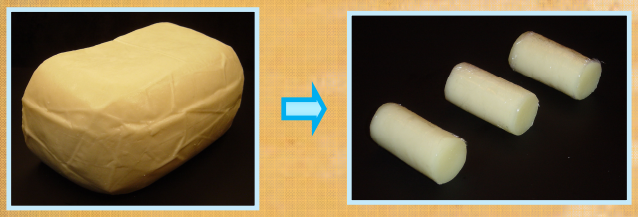
Cheese ripening is an important step in the manufacture of cheese and implies a substantial loss of water.

The **aims** of this work were to set up a simple and quick method to determine moisture in cheese, using a NMR technique; and to determine the moisture profiles of cheese cylinders by means the proposed method.

## MATERIALS AND METHODS

### Raw material and drying chamber

Cheese cylinders (0.04 m length and 0.02 m diameter) were cut from unripe pressed cheeses, laterally isolated and ripened during 31 days at 16ºC.



Moisture profiles at different drying times were measured with a time-domain NMR equipment (minispec mq 20, Bruker).


### Method to determine moisture profile in cheese

A calibration curve was performed with samples of ground cheese dried until obtaining a wide range of moisture contents. The moisture contents were determined according to the International Dairy Federation standard norm 4A (1982).

By using a combined relaxation time analysis and an spectroscopic software (OPUS Quant; Bruker) the method to determined moisture content was optimized and validated.

Moisture contents of samples not used in the calibration were compared with those obtained by the validated method. The goodness of the proposed method was evaluated through the percentage of explained variance (%var) and the mean relative error (MRE).

## RESULTS AND DISCUSSION

The figures obtained for the %var (99.5) and the MRE (3.0) proved the suitability of the NMR method for measuring moisture in cheese. Figure 1 shows a good agreement ($R^2$=0.996) between the estimated and the experimental moisture contents.

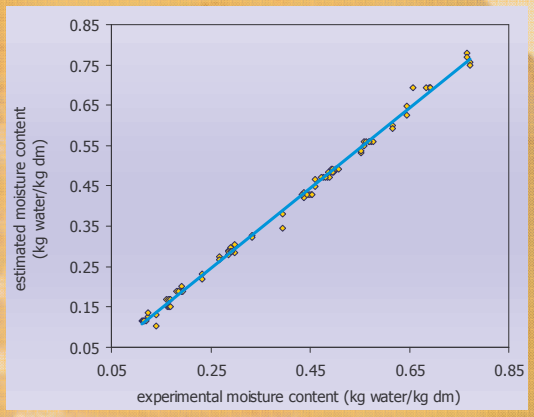



***Figure 1.*** *Representation of the estimated moisture contents versus the experimental ones.*

The proposed method was employed to determine the moisture profiles of the cheese cylinders at different drying times (figure 2).

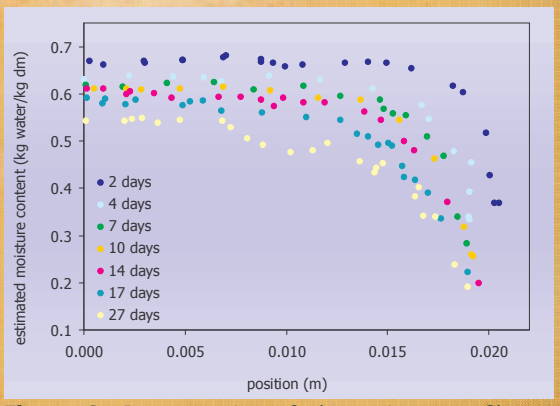



***Figure 2.*** *Representation of the moisture profiles at different ripening times.*

## CONCLUSIONS

By means of the proposed method, the moisture profiles of cheese samples could be easily measured. The shape and evolution of moisture profiles during the drying period were clearly observed. The knowledge of the evolution of these moisture profiles could help, in the future, to better understand the mass transfer mechanisms which take place during cheese ripening.

### References

H. Todt, G. Guthausen, W. Burk, D. Schmalbein and A. Kamlowski, Food Chem., 96, 436 – 440 (2006).

IDF (1982). Cheese and processed cheese. Determination of total solids content. IDF Standard 4A. Brussels, Belgium: International Dairy Federation.