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Comparison of the microstructure of Mozzarella cheese using synchrotron-based transmission and ATR-FTIR microspectroscopic techniques.

Fourier transform infrared (FTIR) spectroscopy is a well-established technique for the analysis of dairy products due to its ability to rapidly provide molecular information related to chemical composition. Despite the widespread use of FTIR spectroscopy, FTIR microspectroscopy has only had limited applications in dairy products to date. Current methods of analysis of the microstructure of dairy products involve fluorescent stains and time-consuming sample preparation. In contrast, FTIR microspectroscopy is label-free, non-destructive and requires minimal sample preparation.

In this study, synchrotron-based FTIR (S-FTIR) microspectroscopy was used to acquire spatially-resolved chemical images of the microstructure of Mozzarella cheese in both transmission and surface-specific attenuated total reflection (ATR) modes. Fixed cheese sections were used for transmission measurements, whilst a small piece of fresh cheese was measured directly at 4 C in ATR mode without any further preparation. This was achieved using an in-house developed macro-ATR device coupled with a cooling stage at the IR Microspectroscopy (IRM) beamline (Australian Synchrotron). S-FTIR spectra obtained from the two modes were subsequently compared to identify differences in molecular structure and distribution patterns of major components, particularly proteins and lipids, between fixed and fresh cheese. These results have been used to determine the optimal methods of analysis for cheese.

High-resolution S-FTIR chemical maps of *pasta filata* Mozzarella cheese were obtained, clearly showing the characteristic parallel alignment of proteins. Areas high in protein or lipid were separated using hierarchical cluster analysis (HCA). Principal component analysis (PCA) was subsequently applied, using spectra with the same protein/lipid ratio previously identified by HCA, to distinguish differences in molecular structures of cheese with different treatments. This study demonstrates the potential of the S-FTIR microspectroscopy technique, together with chemometric approaches, to analyse cheese microstructure. Insights into molecular structures of proteins and lipids present in Mozzarella cheese not available through other microscopic methods were gained. This information provides a better understanding of the impact of processing on cheese structure and will assist efforts to support Australian dairy manufacturers to improve shelf life, texture or the functionality of dairy products.

Keywords or phrases (comma separated)

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Yes

Are you an ECR? (<5 yrs since PhD/Masters)

No

What is your gender?

Female

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