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Publication date:
2014

Document version
Early version, also known as pre-print

15th Food Colloids Conference

April 13-16, 2014, Karlsruhe, Germany

Program Book

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EMULSIFYING SALT AND CHEDDAR CHEESE AGE: FUNCTIONALITY IN CHEESE POWDER PRODUCTION

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Keywords: Emulsifying salt, emulsion stability, cheese powder
Main Topic: Controlling functionality in complex food systems

Cheese powder is produced from cheeses, which are mixed with water and emulsifying salts (ES, primarily sodium phosphates) and melted to form a hot slurry, referred to as cheese feed. The cheese feed is heat treated and finally spray dried. Currently there is an increased focus on reducing additives in food as well as a health based desire to reduce the general intake of sodium, and possibly also phosphates. There is thus a need for production of cheese powder without application of emulsifying salts. However, in order to do so, more knowledge about the functionality of emulsifying salts in stabilisation of cheese feed is needed. The aim of the present study was to investigate the interplay between maturation degree of cheddar cheese and stability and rheological properties of cheese feeds produced with and without ES.

Model cheese feeds were prepared in a Stephan cooker from cheddar cheese of five different ages (ranging from 5 to 17 months) combined with soft white cheese and water. All cheese feeds were prepared with and without addition of disodium hydrogen phosphate as ES. The feeds were analysed for emulsion stability by centrifugation and rheological properties by measurement of a flow curve directly after production followed by measurement of viscosity under a period of steady shear, equivalent to the holding time that occurs in industry. Another flow curve was measured at the end of the steady shear regime.

Results showed that cheese feeds containing ES were stable and had no phase separation, whereas for cheese feeds prepared without emulsifying salt, separation into three phases occurred in all samples. The cheese feed prepared from the youngest cheddar cheese exhibited a smaller amount of phase separation and hence a slightly higher stability. The rheological analyses showed remarkable differences between cheese feeds with and without ES. For cheese feeds containing ES, a general shear-thinning behaviour was observed and during the holding time viscosity increased, indicating that structure was built up, as also suggested by Lee et al. (2003) in processed cheese production. Surprisingly, the more mature and hence protein degraded cheeses caused the highest feed viscosity. For cheese feeds without ES, an almost Newtonian flow behaviour was observed directly after production, whereas after the holding time shear-thickening behaviour was seen. Furthermore, the viscosity of these feeds was much lower than for feeds with ES, and the feed prepared from the youngest cheese showed the highest initial viscosity, but a decrease during steady shear. Decreasing viscosity over time was also observed when using cheddar cheeses of medium maturity, whereas the more mature cheeses lead to a small increase in viscosity. The obtained results illustrate the fundamental differences in the functionality of cheese feeds prepared with and without ES. Further investigations of microstructure of cheese feeds are carried out by confocal laser scanning microscopy along with analyses of the degree of proteolysis in the cheddar cheeses.

Reference

Lee, S.K.; Buwalda, R.J.; Euston, S.R.; Foegeding. E.A; and McKenna, A.B.: Changes in the rheology and microstructure of processed cheese during cooking, LWT 36, 339-345, **2003.**