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Use of X-ray tomography in aerated dairy food and cheese research

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ABSTRACT

Whipped foods like chocolate mousse and whipped cream are becoming more and more popular. In addition to a good taste, consumers want a fine yet firm and stable foam. Stability of the froth is dependent on the foam structure including air bubble size distribution. Variations in bubble size leads to changes of physical properties which in turn have an influence on quality aspects like mouth feeling, flavour, appearance and shelf life (Ihara et al. 2010, Kovácová et al. 2010, Müller-Fischer et al. 2007, Müller-Fischer and Windhab 2005).
In this study the effect of altering the whipping type and/or whipping speed was quantified by visualising air bubble size distribution using X-ray tomography. This gave the opportunity to study 3D structures without having to manipulate the sample too much. In turn the influence of different bubble size distributions on texture, stability and sensorial attributes was determined.
In chocolate mousse different whipping speeds were found to have an effect on the size of the air bubbles, whereby a faster speed resulted in more smaller air bubbles. No influence on texture, stability or sensorial aspects was determined. The effect of whipping type was also studied, with on one hand an industrial type of aerating and on the other hand a common household type of whipping. While both types were used at approximately the same speed, differences in air bubble size distributions were found with the industrial aerator resulting in larger air bubbles. Between these mousses further differences were detected in texture and colour. The mousse whipped with an industrial aerator was statistically softer, had a higher cohesiveness and was scored as darker by the tasting panel.
Similar tests with different whippings speeds were conducted on whipped cream, but sensorial attributes were not yet examined. As with chocolate mousse, smaller air bubbles were formed with a higher whipping speed. A statistical difference in texture was found, with a faster whipping speed resulting in a softer cream with a higher cohesiveness. No differences in stability were detected.
In the second part of the study, the use of X-ray tomography during cheese ripening was examined. In various cheese varieties, the eyes are an important quality parameter. Size, number, shape and distribution play a significant role in the economic value of the cheese (Musse et al. 2014, Polychroniadou 2001). While the traditional method, consisting of tapping the wheels and listening to the sound, is not quantifiable, dependent on personal skills and therefor subjective, a second method, cutting the cheese and analysing a section, is destructive and limited in analysed volume (Kraggerud et al. 2009, Lee et al. 2012, Schuetz et al. 2013).
In this study X-ray tomography was used to investigate the kinetics of ripening cheese. The eyes were visualised and quantified as also the roundness of those eyes. As tomography is a non-destructive and objective method, the same wheels of cheese were examined during the ripening period, giving the opportunity to follow the evolution of one eye during this period.

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