

Modelling texture in low-fat yoghurt – relevance of shear and elongational flows

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Studies correlating food texture (i.e. sensory) with rheological properties tend to focus implicitly on shear as the prevalent flow type in the mouth. Recently it has been suggested in the sensory science literature that elongational flows might play a more important part, since the food is compressed between the tongue and the palate during mastication. This resembles a lubricated squeezing flow.

As part of a large project on structure-sensory relationships in low-fat dairy products we have evaluated various rheological methods, including imperfect squeezing flow viscometry, which, ideally, delivers estimates of the biaxial elongational viscosity. The empirical Posthumous funnel method, in which the type of flow is both shear and elongation, was also included.

Using multivariate techniques, we have studied the relationships between sensory characteristics and rheological and microstructural properties in a set of 25 low-fat yoghurts spanning a wide sensory space.

Fat contents were 0.3 and 1.5%, and four different dairy-based protein concentrates were employed as fat replacers at four different levels. One full-fat yoghurt (3.5 % fat) served as a reference.

Sensory profiling was performed by a panel of twelve trained assessors. A total of 29 descriptors (visual, olfactory, flavour, textural) were used, including the meta-descriptor Creaminess.

Rheological measurements included steady shear viscometry, oscillation, squeezing flow viscometry and Posthumous funnel measurements. Microstructure was studied using confocal laser scanning microscopy (CLSM). Image features were extracted from CLSM images using the Angle Measure Technique (AMT).