Production of Cheese Powder without Emulsifying Salt: Effect of Processing Parameters on Rheology and Stability of Cheese Feed

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ABSTRACT

In cheese powder production, cheese is melted with water and emulsifying salts to create an emulsion (cheese feed) that remains stable until spray drying. As an alternative to the use of emulsifying salts, the influence of various processing parameters on cheese feed stability and rheology is investigated.

INTRODUCTION

Cheese powders are used in the food industry as natural functional and flavour ingredients in applications such as biscuits, savoury snacks, bakery products, sauces, dressings, ready meals and processed cheese, typically added at levels of 2-12%. In cheese powder production, cheese is comminuted and melted with addition of water and emulsifying salts. This cheese slurry, cheese feed, is then heat-treated and finally most of the water is removed by spray drying.

Emulsifying salts, primarily sodium phosphate, are added to create an emulsion that remains stable until spray drying and also to ensure a final powder with good keeping quality. The production of cheese feed for cheese powder resembles the first steps in the production of processed cheese, even though the dry matter content is significantly lower, typically around 35-40 %.

On the market there is a growing demand from consumers and authorities for food produced without additives, including emulsifying salt, and currently especially sodium.

Besides addition of emulsifying salts, parameters such as the characteristics of the cheeses used, addition of other dairy ingredients and processing parameters may affect the stability of the cheese feed. In the processed cheese industry, a term commonly used to describe the emulsification of cheese and water into a continuous system is the 'creaming reaction'. Lee et al.[1] showed that the creaming reaction is related to protein-protein interactions and that the properties of the final product can be related to the level of protein dispersion and re-association during processing. Protein dispersion and interactions may be affected by cooking time and mixing speed[1,2].

An increase in mechanical treatment during processing will furthermore lead to a decrease in fat globule size, which will provide a larger surface area for interactions between fat and protein. In processed cheese this result in a firmer (end) product[3], and in cheese powder production it might lead to a more stable cheese feed.

The aim of the present study was to assess the potential of adjusting the mechanical treatment of the cheese feed as alternative to addition of emulsifying salt in

preparation of cheese feed for cheese powder production.

MATERIALS AND METHODS

Cheese feeds were prepared in pilot plant scale in a Stephan Cooker (Stephan UMC5 electronic, Stephan u. Söhne GmbH) by mixing cheddar cheese (300 g), soft white cheese (200 g) and water (230 g).

Processing parameters varied were mixing speed (1500 or 2000 rpm for 60 s), mixing time before heating (60 or 300 s) and heating time (45 or 90 s). Cheeses were cut into pieces of approx. 4×4×4 cm and transferred to the Stephan cooker along with the water. Before heating mechanical treatment was performed by mixing Heating was performed by adding direct steam while continuously mixing. As control samples, feeds prepared using the same composition and processing parameters, but with the addition of 11.1 g disodium hydrogen phosphate (15 g/kg feed), were used. The emulsifying salt was dissolved in the water before addition to the Stephan cooker.

All cheese feeds were analysed for dry matter content, particle size (Mastersizer, Malvern Instruments Ltd.), stability by centrifugation, and apparent shear viscosity at 60 °C during 45 minutes with shear rate 15 s-1 (AR-G2, TA Instruments).

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