J. Dairy Sci. 98:8391–8404
http://dx.doi.org/10.3168/jds.2015-9765
© American Dairy Science Association®, 2015.

Effects of whey or maltodextrin addition during production on physical quality of white cheese powder during storage

Zafer Erbay* and Nurcan Koca†[1]
*Department of Food Engineering, Faculty of Engineering and Natural Sciences, Adana Science and Technology University, 01180 Adana, Turkey
†Department of Food Engineering, Faculty of Engineering, Ege University, 35100 Izmir, Turkey

ABSTRACT

There is an increasing demand for cheese as a food ingredient, especially as a flavoring agent. One of the most important cheese flavoring agents is cheese powder. To obtain an intense cheese flavor, ripened cheese is used as a raw material in cheese powder but this increases production costs. Moreover, use of natural cheese decreases the physical quality of powder because of its high fat content. In this study, we evaluated opportunities to use whey or maltodextrin for improving the physical quality of powders in production of white cheese powder. We produced cheese powders with 3 different formulations—control (CON), whey-added (WACP), and maltodextrin-added (MACP)—and determined the effects of formulation on cheese powder quality. Physical quality parameters such as color, densities, reconstitution properties, free fat content, particle morphology, and sensory characteristics were investigated. The different cheese powders were stored for 12 mo at 20°C and we evaluated the effect of storage on powder quality. Addition of maltodextrin to cheese powder formulations significantly improved their physical quality. The densities and reconstitution properties of cheese powder were increased and free fat content was decreased by use of maltodextrin. The MACP particles were spherical with a uniform distribution and larger particle sizes, whereas CON and WACP particles were wrinkled, irregularly shaped with deep surface dents, and variable in size. Although caking was observed in scanning electron micrographs after 12 mo of storage, it was not detected by sensory panelists. The color of cheese powders changed very slowly during storage but browning was detected. The results of this study show that it is possible to use maltodextrin or whey in production of white cheese powder to reduce production costs and improve the physical quality of powders.

Key words: cheese powder, white cheese, whey, maltodextrin, storage

INTRODUCTION

Recently, there has been an increasing demand for cheese as a food ingredient, especially as a flavoring agent. For flavoring, the best material is ripened cheese and traditionally cheese has been added to food products in a spray-dried powder form to enhance flavor, appearance, and texture. In this context, the most important dehydrated cheese product is cheese powder. The best way to obtain a quality product with intense cheese flavor is to use ripened cheese as the raw material. However, the high cost of ripened cheese restricts its use in cheese powder manufacture. Moreover, the use of natural cheese has a detrimental effect on some physical properties, such as reconstitution of powders, because of its high fat content (West, 2007; Guinee, 2011).

The quality of cheese powders depends on many parameters. Physical features of powders are very important, especially in industrial applications. The composition of cheese powder provides useful information about not only the main physical and storage properties, but also the structure and morphological features of powder particles (Kim et al., 2002; Fitzpatrick et al., 2004; Thomas et al., 2004; Barbosa-Canovas et al., 2005; Vignolles et al., 2007; Paterson et al., 2007). Additionally, free fat content in powders directly influences the reconstitution and storage features of powders (Kelly et al., 2002; Kim et al., 2002, 2009; Vignolles et al., 2007, 2009; Park et al., 2014). Moreover, physical properties of powders such as color, which can indicate defects during processing and storage, and densities, which are used to determine storage, processing, packaging, and distribution conditions, are critical properties (Barbosa-Canovas et al., 2005; Schuck, 2011). Furthermore, most food additives that are prepared in powder form need to be hydrated before using. Therefore, interfacial properties, water interactions, and dissolution of dairy powders are important factors in food development

Received April 29, 2015.
Accepted August 14, 2015.
[1]Corresponding author: nurcan.koca@ege.edu.tr

and formulation (Thomas et al., 2004; Schuck, 2011; Richard et al., 2013). The process of reconstituting dairy powders with water depends on a combination of several properties, such as wettability, sinkability, dispersibility, and solubility (Freudig et al., 1999; Schuck, 2011). In addition to all these, sensory characteristics are an important property to ensure customer satisfaction (Koca et al., 2015).

In previous studies, we reported the energetic performance and improvement opportunities in cheese powder production and cost formation mechanisms in production (Erbay and Koca, 2012a,b; Erbay and Koca, 2014). We determined the effects of spray-drying process conditions and optimized the spray-drying process (Erbay et al., 2015; Koca et al., 2015). These studies showed that although powders with strong cheese flavors can be produced, their physical properties are not good enough to be used by industry. Further, the simplest way to decrease raw material costs is to use additives such as carriers or fillers to substitute for ripened natural cheeses (Erbay and Koca, 2012a,b, 2014; Erbay et al., 2015; Koca et al., 2015). The use of carriers or fillers may also improve the physical properties, especially the reconstitution properties of powders. In the food industry, one of the most commonly used materials as a carrier or filler is maltodextrin. Maltodextrins are hydrolysis products of starches and they are a mixture of saccharides with a broad molecular weight distribution between polysaccharides and oligosaccharides. Maltodextrins are known to improve particle size, bulk density, hygroscopicity, solubility, and caking properties (Chronakis, 1998; Danviriyakul et al., 2002; Papadakis et al., 2006; Goula and Adamopoulos, 2008; Gianfrancesco et al., 2010). Another material frequently used in powder formulations is whey. Whey is a very important byproduct of dairy industry with a high functional protein content. It is widely used in powder formulations to improve the physical quality of powders such as particle properties, reconstitution abilities, and flowability (Thomas et al., 2004; Kelly, 2006; Schuck et al., 2007; Hoppe et al., 2008; Charve and Reineccius, 2009; Dissanayake et al., 2012). Although whey is generally used in powder form, especially in industrial applications, use of fluid whey showed promising results for some meat products (Yetim et al., 2001, 2006; Das and Sharma, 2009; Terra et al., 2009). The use of fluid whey may be a good option especially if the production plants of cheese powder and cheese are close. In cheese powder production, fluid whey may be used to substitute for both cheese solids and water. Moreover, the cost of fluid whey is lower than that of whey powder.

Few studies have focused on cheese powder in the scientific literature; to our knowledge, the effects of product formulation on cheese powder quality have not been investigated. The primary motivation behind this study was to investigate opportunities for addition of whey or maltodextrin to the cheese powder formulation to increase the physical quality of powders while reducing raw material costs. Moreover, variations in product quality parameters during storage were studied.

MATERIALS AND METHODS

Materials

White cheese ripened for 7 mo was supplied by Sütaş Dairy Company (Bursa, Turkey). White cheese blocks were ground into small pieces, transferred to air- and water-tight durable polypropylene plastic containers, stored at 2°C, and processed within 48 h. Whey was obtained from Kashar cheese production in Pınar Dairy Company (İzmir, Turkey). It was pasteurized, cooled to refrigeration temperature, and used within 3 d to avoid the increase of acidity. Although whey is typically used in powder form, we used fluid whey to substitute both cheese DM and water. Maltodextrin (dextrose equivalent value of 20) was purchased from Qimhuangdao Starch Co. (Hebei, China). The composition of white cheese and whey used in the study is reported in Table 1. The moisture content (mean ± SD) of maltodextrin used in production of cheese powders was 5.45% ± 0.14.

Production Procedure

Before spray drying, cheese emulsions were produced with 25% DM. In this study, cheese emulsions were prepared with 3 different formulations: cheese emulsion (**CE**) to produce control cheese powder (**CON**), whey-added cheese emulsion (**WACE**) to produce whey-added cheese powder (**WACP**), and maltodextrin-added cheese emulsion (**MACE**) to produce maltodextrin-added cheese powder (**MACP**).

Cheese emulsion (the control sample) was composed of ground white cheese, water, and Joha emulsifying salts (Kipa Chemical Company, Istanbul, Turkey) at 3% (based on cheese weight). The ingredients were heated by adding hot water and sheared in a blender (model LB10S, Waring, Torrington, CT) at 6,000 rpm for 1 min. Subsequently, the slurry was heated in a water bath to 80°C and sheared again at 6,000 rpm for 10 min. The slurry was fed to the spray dryer at 45°C.

Whey was used in place of water in the production of WACE, whereas maltodextrin was added directly to replace 30% of cheese DM to produce MACE. To keep the DM content of WACE constant, white cheese use was reduced by approximately 13%.

Download English Version:

https://daneshyari.com/en/article/10973376

Download Persian Version:

https://daneshyari.com/article/10973376

Daneshyari.com