



Acid- and Acid/Heat-Coagulated Cheese - Cheeses Made without Chymosin : A Review

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Abstract

Acid- and acid/heat-coagulated cheese are cheeses made from direct acid- or acid/heat coagulation, consumed fresh without aging and have a soft texture. Despite of its short shelf-life, acid- and acid/heat-coagulated cheese are widely produced in all over the world due to their relatively easy manufacturing step and their popularity among consumers. Nowadays, acid- and acid/heat-coagulated cheese are used a lot as an ingredient of various foods as well. Therefore, understanding the characteristics of acid- and acid/heat-coagulated cheese is necessary to have more challenged application in food industries.

Keywords: coagulations, cheeses, direct acidifications, acid/heat coagulation, unaged

INTRODUCTION

Acid-coagulated cheeses refer to cheeses made with no or minimal amount of rennet (Chandan, 1991). Rennet is added as a choice of cheese makers as little as 0.5 mL/1,000 L (i.e., approximately 2 ppm). During acid-coagulation, milk is coagulated by either direct acidification with various acids or by the additions of starter culture. Typical types of acid- and acid/heat-coagulated cheese can be Cottage cheese, Quarg, Fromage frais (skim), Queso Blanco, Ricotta, Paneer, Mascarpone, cream cheese, and Neufchatel (Lucey, 2011).

Major manufacturing steps for acid-coagulated cheese are described in Fig. 1. These cheeses are not yoghurt as draining of whey is done during cheese making (for Cottage cheese, draining of whey is done after cutting).

Unlike many other cheeses (in most cheeses, coagulation of milk is mainly occurred due to chymosin activity), coagulation is induced through direct acidification in acid coagulated cheese (Farkye 2004a, 2004b). In this review, two major types of acid-coagulated cheese, Cottage cheese and cream cheese are to be

Table 1. Typical Manufacturing Parameters for the Production of Cottage Cheese

Processing Stage	Short Set	Medium Set	Long Set
Level of starter addition (%)	2 – 5	1 – 3	0.5 – 1
Time before cutting (h)	5	8	13 – 16
Incubation temperature (°C)	30 – 33	27	21 – 24

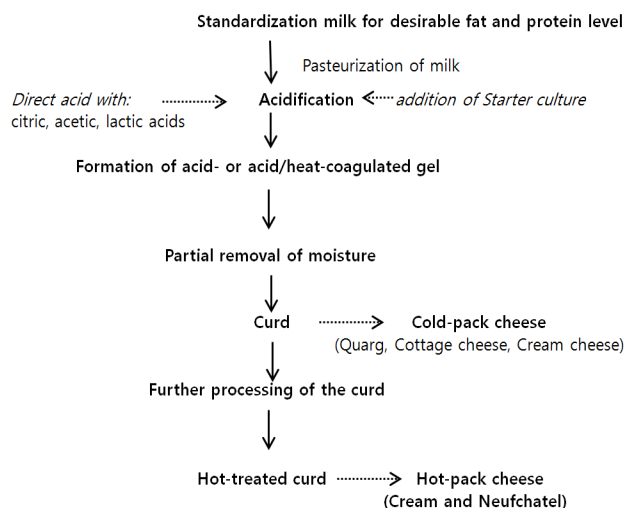


Fig. 1. Simplified processing steps for the manufacture of acid- and acid/heat-coagulated cheeses.

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mainly discussed. Also various types of acid/heat-coagulated cheese are to be covered.

Cottage Cheese

Cottage cheese, is also called Pot cheese (as Cottage cheese was originally sold in a pot), is very popular in United States and Europe. Nearly 5% of whole cheese sale are composed of Cottage cheese in U. S. Cottage cheese has a very mild acidic flavor (sometimes recognized as bland flavor) as curd is washed before draining to remove acidity produced during manufacture (Drake, 2007). There is no pressing step during Cottage cheese making so approximately 80% of moisture content is retained as most of whey is still remained in the curds (Fig. 2). Cottage cheese seems to be lumpy and creamy but meaty and smooth texture is a desirable body (Guinee *et al.*, 1993). Cottage cheese is believed to have an origination from cottages, i.e., left-over milk after butter-making was used to make Cottage cheese in farm's cottages.

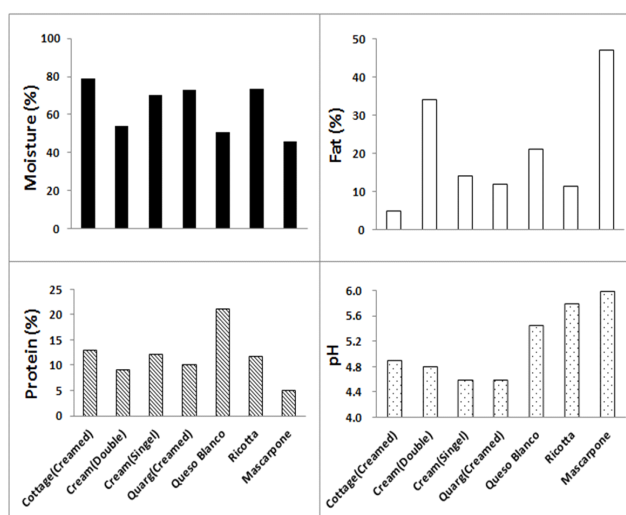


Fig. 2. General composition of acid- and acid/heat-coagulated cheeses (approximation from various sources).

Cottage cheese is usually made from skimmed milk after pasteurization (Hindrichs, 2004). Creamed Cottage cheese (~15% of pasteurized cream is added after curd-washing) has slightly higher fat content (~3%, Fig. 2) compared to normal (or low fat) Cottage cheese (Hubbard *et al.*, 2015).

There are three processing methods in Cottage cheese making based on the set-time before cutting, named as short, medium and long set (Table 2); the longer the set time is, the higher the incubation temperature is, and the more starter culture is added. This is probably due to the purpose of reaching similar level of acid development as pH of most Cottage cheese is in the range of 4.8–5.0 (Fig. 2), regardless of the manufacturing conditions (i.e., different set-time). *Lactococcus lactis* subsp. *lactis* and *Lc. lactis* subsp. *cremos* are most commonly used starter cultures (i.e., non-gas producing mesophiles). (Lucey, 2002; Lucey and Singh, 2002; Jelen and Renz-Schauen, 1992).

After draining, 'dressing' is applied to the curd. The term 'dressing' in acid-coagulated cheese manufacturing means that adding stabilizers such as guar gums, xanthan gums and/or carrageenans. Cottage cheese normally has shelf-life less than 1 mo (Johnson and Lucey, 2006).

Cottage cheese is also made with direct acidification with hydrochloric, lactic and other acids, but the using the acids is less frequent compared to the use of starter culture (Lucey *et al.*, 2003).

Cream Cheese

Cream cheese is deeply loved by consumers and produced in all over the world. Due to its popularity, cream cheese has various nominations; Rahmfrischkäse (German), Neufchatel and Baker's cheese (U.S.), Suisse, Bondard, and Gournay (France). Cream cheese is especially popular in United States as more than 300,000 tones are produced every year. To be named as cream cheese, the fat content should be no less than 33% and moisture content should be no more than 55% (Schulz-Collins and Senge, 2004).

Table 2. Comparison of Major Manufacturing Variables in Acid-Coagulated Cheese

	Ways of Removal of Moisture	Curd-Washing	Dressing	Cold-Pack	Hot-Pack	Body (Texture)
Cottage	Cutting/syneresis	Yes	Yes	○		Smooth/meaty
Quarg	Stirring/centrifugation	No	Yes	○		Smooth/soft
Cream	Stirring/centrifugation	No	Yes	○	○	Spreadable
Neufchatel	Stirring/centrifugation	No	Yes		○	Less smooth & grainer than cream cheese

It is also easy to find in the label like ‘double’ or ‘single’ as cream cheese is classified based on the amount of fat. Single cream cheese is made from milk with 3–3.5% fat and double cream cheese is made from milk with 8–14% fat.

There are two manufacturing methods in cream cheese making, cold-pack type and hot-pack type. In cold-pack type cream cheese, stabilizers and salts are added to cold curd (10–12°C) while in hot-pack type cream cheese, curd is heated up to 65–70°C after mixing with stabilizers and salt.

Cream cheese has a mild, salty and acidic flavor and the texture is smooth and spreadable. Cream cheese has a lot of food applications as an ingredient; cheese cakes, frostings, dips, toppings, sweet & savory dishes and desserts.

Acid/Heat-Coagulated Cheese

Ricotta, Queso Blanco and Mascarpone cheeses are typical type of acid/heat-coagulated cheese and either acid or heat is adopted for coagulation. Acid/heat-coagulated cheeses are usually made without starter inoculation. These cheeses are acidified with acidulants such as lactic acid, when milk is still hot (80°C) after pasteurization at 80–85°C. Starter can be added only for the purpose of flavor development in Queso Blanco cheeses (Torres and Chandan, 1981a, 1981b).

Unlike acid-coagulated cheese, Acid/heat-coagulated cheese, such as Ricotta and Queso Blanco, has a pressing step during cheese making and this is why moisture content is lower compared to that of acid-coagulated cheese (Fig. 2).

CONCLUSIONS

Acid- and acid/heat-coagulated cheese are widely consumed in all over the world due to their unique mild flavor and soft texture. Acid- and acid/heat-coagulated cheese are consumed without ripening. Acid- and acid/heat-coagulated cheese have a diverse use in foods, i.e., consumed as it is or consumed as an ingredient of various foods. For acid-coagulated cheeses, acidification of milk with starter is more common during cheese making while direct acidification of milk with various acids, such as citric acids, is mostly used in acid/heat-coagulated cheeses. Acid- and acid/heat-coagulated cheese seems to have lots of potentials in South Korea’s cheese market as acid- and acid/heat-coagulated cheese does not have any flavors from aging since they are eaten as fresh. However, low Ca content

in acid- and acid/heat-coagulated cheese (less than 100 mg/100 g of cheese) could be a possible adverseness for the popularity in Korea’s cheese market.

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- Received 15 December, 2015
Revised 22 December, 2015
Accepted 25 December, 2015