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Cheesemaking

Cheesemaking (or *caseiculture*) is the craft of making cheese. The production of cheese, like many other food preservation processes, allows the nutritional and economic value of a food material, in this case milk, to be preserved in concentrated form. Cheesemaking allows the production of the cheese with diverse flavors and consistencies.[1]

During industrial production of Emmental cheese, the as-yet-undrained curd is broken by rotating mixers.

A cheesemaking workshop with goats at Maker Faire 2011. The sign declares, "Eat your Zipcode", in reference to the locavore movement

Contents

History

Cheesemaking is documented in Egyptian tomb drawings and in ancient Greek literature.[1]

Cheesemaking may have originated from nomadic herdsmen who stored milk in vessels made from sheep's and goats' stomachs. Because their stomach linings contains a mix of lactic acid, bacteria as milk contaminants and rennet, the milk would ferment and coagulate.[2] A product reminiscent of yogurt would have been produced, which through gentle agitation and the separation of curds from whey would have resulted in the production of cheese; the cheese being essentially a concentration of the major milk protein, casein, and milk fat. The whey proteins, other major milk proteins, and lactose are all removed in the cheese whey. Another theory is offered by David Asher, who wrote that the origins actually lie within the "sloppy milk bucket in later European culture, it having gone unwashed and containing all of the necessary bacteria to facilitate the ecology of cheese."[3]

Ancient cheesemaking

One of the ancient cheesemakers' earliest tools for cheesemaking, cheese molds or strainers, can be found throughout Europe, dating back to the Bronze Age.[4] Baskets were used to separate the cheese curds, but as technology advanced, these cheese molds would be made of wood or pottery. The cheesemakers placed the cheese curds inside of the mold, secured the mold with a lid, then added

pressure to separate the whey, which would drain out from the holes in the mold. The more whey that was drained, the less moisture retained in the cheese. Less moisture meant that the cheese would be more firm. In Ireland, some cheeses ranged from a dry and hard cheese (mullahawn) to a semi-liquid cheese (millsén).[5]

The designs and patterns were often used to decorate the cheeses and differentiate between them. Since many monastic establishments and abbeys owned their share of milk animals at the time, it was commonplace for the cheeses they produced to bear a cross in the middle.

Although the common perception of cheese today is made from cow's milk, goat's milk was actually the preferred base of ancient cheesemakers, due to the fact that goats are smaller animals than cows. This meant that goats required less food and were easier to transport and herd. Moreover, goats can breed any time of the year as opposed to sheep, who also produce milk, but mating season only came around during fall and winter.

Before the age of pasteurization, cheesemakers knew that certain cheeses can cause constipation or kidney stones, so they advised their customers to supplement these side effects by eating in moderation along with other foods and consuming walnuts, almonds, or horseradish.[6][7]

Process

The job of the cheesemaker is to control the spoiling of milk into cheese. The milk is traditionally from a cow, goat, sheep or buffalo, although worldwide cow's milk is most commonly used and, in theory, cheese could be made from the milk of any mammal. The cheesemaker's goal is a consistent product with specific characteristics and organoleptic requirements (appearance, aroma, taste, texture). The crafts and skills employed by the cheesemaker to make a Camembert will be similar to, but not quite the same as, those used to make Cheddar.

Some cheeses may be deliberately left to ferment from naturally airborne spores and bacteria; this approach generally leads to a less consistent product but one that is valuable in a niche market.

The production of Gruyère cheese at the cheesemaking factory of Gruyères, Canton of Fribourg, Switzerland

Culturing

To make cheese, the cheesemaker brings milk (possibly pasteurised) in the cheese vat to a temperature required to promote the growth of the bacteria that feed on lactose and thus ferment the lactose into lactic acid. These bacteria in the milk may be wild, as is the case with unpasteurised milk, added from a culture, frozen or freeze dried concentrate of starter bacteria. Bacteria which produce only lactic acid during fermentation are homofermentative; those that also produce lactic acid and other compounds such as carbon dioxide, alcohol, aldehydes and ketones are heterofermentative. Fermentation using homofermentative bacteria is important in the production of cheeses such as Cheddar, where a clean, acid flavour is required. For cheeses such as Emmental the use of heterofermentative bacteria is necessary to produce the compounds that give characteristic fruity flavours and, importantly, the gas that results in the formation of bubbles in the cheese ('eye holes').

Cheesemakers choose starter cultures to give a cheese its specific characteristics. Also, if the cheesemaker intends to make a mould-ripened cheese such as Stilton, Roquefort or Camembert, mould spores (fungal spores) may be added to the milk in the cheese vat or can be added later to the

cheese curd.

Coagulation

During the fermentation process, once the cheesemaker has gauged that sufficient lactic acid has been developed, rennet is added to cause the casein to precipitate. Rennet contains the enzyme chymosin which converts κ-casein to para-κ-caseinate (the main component of cheese curd, which is a salt of one fragment of the casein) and glycomacropeptide, which is lost in the cheese whey. As the curd is formed, milk fat is trapped in a casein matrix. After adding the rennet, the cheese milk is left to form curds over a period of time.

Draining

Fresh chevre hanging in cheesecloth to drain.

Once the cheese curd is judged to be ready, the cheese whey must be released. As with many foods the presence of water and the bacteria in it encourages decomposition. The cheesemaker must, therefore, remove most of the water (whey) from the cheese milk, and hence cheese curd, to make a partial dehydration of the curd. This ensures a product of good quality that will keep. There are several ways to separate the curd from the whey, and it is again controlled by the cheesemaker.

Scalding

Maturing cheese in a cheese cellar

In making Cheddar (or many other hard cheeses) the curd is cut into small cubes and the temperature is raised to approximately 39 °C (102 °F) to 'scald' the curd particles. Syneresis occurs and cheese whey is expressed from the particles. The Cheddar curds and whey are often transferred from the cheese vat to a cooling table which contains screens that allow the whey to drain, but which trap the curd. The curd is cut using long, blunt knives and 'blocked' (stacked, cut and turned) by the cheesemaker to promote the release of cheese whey in a process known as 'cheddaring'. During this process the acidity of the curd increases and when the cheesemaker is satisfied it has reached the required level, around 0.65%, the curd is milled into ribbon shaped pieces and salt is mixed into it to arrest acid development. The salted green cheese curd is put into cheese moulds lined with cheesecloths and pressed overnight to allow the curd particles to bind together. The pressed blocks of cheese are then removed from the cheese moulds and are either bound with muslin-like cloth, or waxed or vacuum packed in plastic bags to be stored for maturation. Vacuum packing removes oxygen and prevents mould (fungal) growth during maturation, which depending on the wanted final product may be a desirable characteristic or not.

Mould-ripening

In contrast to cheddaring, making cheeses like Camembert requires a more gentle treatment of the curd. It is carefully transferred to cheese hoops and the whey is allowed to drain from the curd by gravity, generally overnight. The cheese curds are then removed from the hoops to be brined by immersion in a saturated salt solution. The salt absorption stops bacteria growing, as with Cheddar.

If white mould spores have not been added to the cheese milk the cheesemaker applies them to the cheese either by spraying the cheese with a suspension of mould spores in water or by immersing the cheese in a bath containing spores of, e.g., *Penicillium candida*.

By taking the cheese through a series of maturation stages where temperature and relative humidity are carefully controlled, the cheesemaker allows the surface mould to grow and the mould-ripening of the cheese by fungi to occur. Mould-ripened cheeses ripen very quickly compared to hard cheeses (weeks against months or years). This is because the fungi used are biochemically very active when compared with starter bacteria. Some cheeses are surface-ripened by moulds, such as Camembert and Brie, some are ripened internally, such as Stilton, which is pierced by the cheesemaker with stainless steel wires, to admit air to promote mould spore germination and growth, as with *Penicillium roqueforti*. Surface ripening of some cheeses, such as Saint-Nectaire, may also be influenced by yeasts which contribute flavour and coat texture. Others are allowed by the cheesemaker to develop bacterial surface growths which give characteristic colours and appearances, e.g. by the growth of *Brevibacterium linens* which gives an orange coat to cheeses.

Quality control

Cheesemakers must be skilled in the grading of cheese to assess quality, defects and suitability for release from the maturing store for sale. The grading process is one of sampling by sight, smell, taste and texture. Part of the cheesemaker's skill lies in the ability to predict when a cheese will be ready for sale or consumption, as the characteristics of cheese change constantly during maturation.

A cheesemaker is thus a person who has developed the knowledge and skills required to convert milk into cheese, by controlling precisely the types and amounts of ingredients used, and the parameters of the cheesemaking process, to make specific types and qualities of cheese. Most cheesemakers by virtue of their knowledge and experience are adept at making particular types of cheese. Few, if any, could quickly turn their hand to making other kinds. Such is the specialisation of cheesemaking.

See also

- List of cheesemakers

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External links

- Illustrated recipes for making cheese at home (https://web.archive.org/web/20070925001225/http://biology.clc.uc.edu/Fankhauser/Cheese/CHEESE.HTML)
- Cheese Terminology and Classifications (https://web.archive.org/web/20140202104817/http://www.sandandsuccotash.com/cheese-terminology-classifications/)