

Enzyme Modified Cheese (EMC)

About Cheese

One of the major dairy products is cheese. Cheese is a fresh food made by lactic acid bacteria and enzymes acting on milk. It is consumed throughout the world, particularly in America and Europe. As an efficient source of calcium, cheese is gaining in popularity, and global consumption of it is increasing. There are two types of cheese: natural cheese, which is ripened during manufacturing; and processed cheese, in which natural cheese is processed and pasteurized. There are many varieties of natural cheese, depending on the region where it is produced and the method of production, and each has a characteristic flavor (aroma and taste). Although processed cheeses do not have as much flavor as natural cheeses, they have some advantages over natural cheeses, such as longer shelf-life and a consistent flavor that can be adjusted for local tastes.

Cheese as Flavoring

Although natural cheese is commonly eaten as it is, the use of cheese for cheese-flavored snacks and sauces has increased in recent years. Natural cheese requires a ripening process, which increases the cost and therefore makes it unsuitable for use in mass-produced, inexpensive foods. Instead of using natural cheese, chemically synthesized flavorings can be used to add cheese flavor to food. These days, natural foods are more favored by

consumers, so flavorful but low-cost natural cheese is in demand. Natural cheeses that have a shorter ripening process are relatively inexpensive; however, they have the disadvantage of bland flavor. In order to solve this problem, enzymes are used to enhance the flavor of natural cheese.

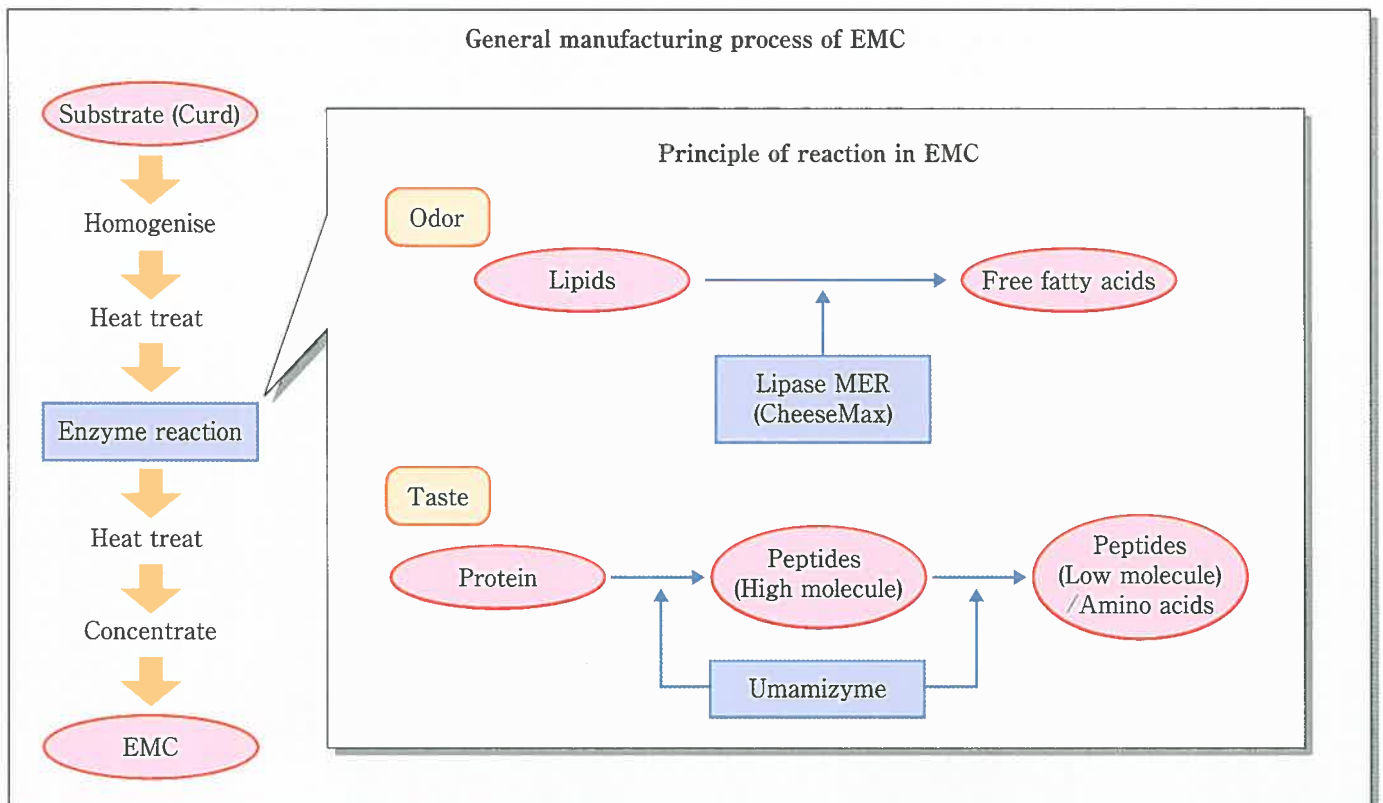
EMC

Cheese with flavor enhanced by enzyme treatment is called Enzyme Modified Cheese (EMC), and its use is increasing. It is not commonly eaten as it is but used as a flavoring to add cheese flavor to food. Pre-ripened curd or under-ripened natural cheese is used as an ingredient. After the flavor is enhanced by the enzymes' reactions, the cheese is processed into powder or paste and then added to processed foods.

What types of enzymes are suitable for the production of EMC? Basically, enzymes with reactions that are related to the ripening process of natural cheese are used.

Use of Lipase in EMC

Lipases are extensively used to enhance the flavor of EMC because the fatty acids formed in the decomposition of milk fat are important for flavor. Generally, short-chain fatty acids have a cheese-like aroma, middle-chain fatty acids have a butter-like aroma, and long-chain fatty acids have a



soap-like aroma; therefore, short-chain fatty acids are one of the key components in cheese flavor. Lipase (pregastric esterase), which is obtained from the forestomachs of calves, kids, lambs, or the like, has been used for a long time in natural cheese production. Pregastric esterase specifically liberates short-chain fatty acids and is widely used in EMC production. However, due to recent problems such as BSE and foot and mouth disease, pregastric esterase is not the best choice for EMC. Instead, lipase from microorganisms is growing in popularity. The advantages of using the microorganism-derived lipase include low cost, compliance with kosher regulations, and production of a wide variety of flavors, depending on the types of lipase used. A new product of our company, Lipase MER "Amano," (CheeseMax for the U.S. market) is a microorganism-derived lipase that increases the amount of short-chain fatty acids in EMC and produces an aroma which is very similar to that of pregastric esterase.

Use of Protease in EMC

Proteases are often used to intensify the taste. The properties required for EMC proteases include the ability to liberate many low-molecular peptides and amino acids, which create *umami* or savory flavor, and impart a less bitter taste. Bitterness comes from hydrophobic amino acids contained at the ends or within peptides. Using

peptidase in combination with protease can effectively reduce bitterness by decomposing amino acids. One of our products, Umamizyme, is a combined enzyme preparation of protease and peptidase; it increases the amount of amino acids without creating bitterness, making it an appropriate enzyme for EMC production. Furthermore, Umamizyme not only intensifies the taste but also has other effects, such as softening the ingredients of EMC and enabling manufacturing with highly concentrated material. This improves the efficiency and workability in the production process.

Future of EMC

These days, cheddar, blue, and other types of EMC with flavors similar to natural cheese are produced. The flavor of EMC, however, lacks a quality found in natural cheese. This is probably because the enzyme reactions involved in the ripening of natural cheese are so complex that some flavor components cannot be formed solely through the action of protease and lipase. Accordingly, a variety of approaches are followed in EMC production, such as combining many enzymes or using lactic-acid bacteria fermentation in combination with enzymes. Our company has data to produce EMC with flavor profiles similar to those of natural cheeses. We are also continuing to research and develop new enzymes for EMC in addition to protease and lipase.

