Eat Well, Live Well.





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Fermentation: Nature's Magic The Secret Behind Deliciousness—and MSG

Fermentation is Part of Our Lives

Everybody has heard of fermentation. But not many people know what it actually means, or how it works. You probably know that without fermentation, you wouldn't be able to enjoy the occasional beer after work, or a glass of wine with dinner. But what exactly is fermentation?

Fermentation has been used by humans for at least 10,000 years, primarily as a way to preserve foods and to improve their taste. It's a 100% natural process that is still used today to make a wide variety of foods including yogurt, kimchi, and soy sauce. And it also happens to be the secret behind producing MSG.

A Variety of Fermented Foods



What is Fermentation?

It's easy to confuse fermentation with food spoiling, because the underlying mechanism is basically the same. To understand the difference, let's take a look at milk.

Fermentation vs. Spoiling



As you know, if you let milk sit in the refrigerator past its expiration date—or even worse, if you forget to put it in the refrigerator in the first place—the milk turns sour. That's a common example of spoiling. But, of course, milk can be turned into healthy, tasty food products such as cheese and yogurt. These are common examples of fermentation. Scientifically speaking, the cause of both spoiling and fermentation is the same: microorganisms.



It wasn't until the 1850s that scientists really understood this. Before then, milk turning sour was thought to be a purely chemical reaction. In other words, scientists thought that two chemicals were interacting with each other to form a new product, which is what happens when iron rusts, or when a match is lit. Yogurt and cheese had been made for centuries, but nobody truly understood why milk could be turned into these food products.

It was Louis Pasteur, one of the greatest scientists of modern times, who demonstrated that living microorganisms—in milk, bacteria—caused the changes that occur in milk. (And, of course, this is why milk is now "pasteurized," a process whereby it is heated to eliminate bacteria and extend its shelf-life.)

Louis Pasteur



Pasteur's discovery changed the world, and the field of biochemistry was born. The discovery disproved the "spontaneous generation" theory, which held that life can spring from nothing. It also laid the foundation for a revolution in the science, development, and production of food and drink.

Today, fermentation is defined as a process by which microorganisms cause a beneficial change in an organic substrate. Yogurt and cheese are considered to be "fermented" not "spoiled," because microorganisms are employed deliberately to create a beneficial change in the milk. Bacteria aren't the only microorganisms used for fermentation. For example, yeast, which is not a bacteria, is used to ferment dough, giving us bread.

Scissors vs. Pac-Man

Broadly speaking, fermentation happens in one of two ways. Let's return to the milk example to take a closer look.

Two Types of Fermentation



The first type of fermentation can be thought of as "scissors fermentation." Enzymes produced by microorganisms cut apart proteins in the milk. You can think of this as "scissors fermentation," because the enzymes act like scissors that cut the proteins apart. If we use this type of fermentation for milk, the result is cheese. And, incidentally, if we use "scissors fermentation" for soy beans, we get soy sauce. "Scissors fermentation" makes food delicious because it increases the concentration of amino acids, including glutamate, which is "the umami substance."

The next type of fermentation can be thought of as "Pac-Man fermentation." A microorganism directly consumes sugar or carbohydrates in the milk, like Pac-Man. If we use this type of fermentation for milk, we end up with yogurt. "Pac-Man fermentation" used with grapes gives us wine. This is also the type of fermentation used to produce MSG.

Cows are Fermentation Machines

Have you ever wondered how cows turn grass into milk and muscle? The answer, of course, is fermentation. In a cow's stomach (which is more complicated than ours, having four separate compartments), grass is broken down into amino acids by microorganisms. Amino acids are the building blocks of proteins, and both milk and meat are protein-rich.

Cow's aren't the only fermentation machines walking around. Many herbivores, which are animals that eat only plants, perform the same process. And all animals, including humans, have gut bacteria that help to convert foods into useful substances using fermentation.

The Link Between Fermentation and MSG

In 1909, Dr. Kikunae Ikeda, the inventor of AJI-NO-MOTO[®], isolated glutamic acid from kombu, which is a type of seaweed. He recognized that the taste of this substance was neither sweet, sour, salty, nor bitter, so he gave it a new name: "umami." Dr. Ikeda's discovery led to the development of MSG, which would bring "umami" to peoples' tables as a food seasoning.

Dr. Kikunae Ikeda



But producing MSG on a large scale was challenging, which is a problem faced by many great discoveries. For years, MSG was produced through the "extraction method," which uses wheat protein extracted from gluten. But this process was inefficient, difficult to perform on a large scale, and hard to reproduce reliably in factories outside of Japan.

Fortunately, in the 1960s, the bacteria responsible for creating glutamic acid was discovered, and fermentation became the primary production method of MSG. Importantly, this made it possible to produce MSG in Southeast Asia, South America, Europe, and North America. Soon, the entire world had "umami" on the table.

How MSG is Made

The raw material used to make MSG is the most abundant source of sugar in the area where it is produced. For example, in Southeast Asia and South America, the source tends to be sugarcane or cassava, whereas in Europe and North America the source tends to be sugar beet or corn.

Fermentation and MSG Production



This "substrate" is rendered into glucose, which is fermented by bacteria that create glutamic acid. After a neutralization process, the product is MSG. Almost 100% of the 3.2 million tons of MSG that are produced each year is made using this simple fermentation process!

Fermentation Technology Helps People to Eat Well, Live Well

Ajinomoto has studied fermentation and associated technology for over 80 years. This type of research has yielded more than just amino acids and delicious foods. For example, further research on the fermentation method that creates glutamic acid, which is used to produce MSG, led to almost all amino acids being derived through fermentation. This technology is now used for cutting edge "biopharmaceutical" manufacturing. And the best part is that, being a completely natural process, fermentation is extremely kind to the environment. The byproducts (or, more accurately, "coproducts") of fermentation in our factories are returned to the soil as fertilizer, where they help to grow more raw materials like cassavas and corn.

The Ajinomoto Group will continue to develop fermentation technology, as well as our other knowledge and capabilities, to further advance sustainable business activities all around the world.

About Ajinomoto Co., Inc.

The Ajinomoto Group is a global company with specialties in the business of food and amino acids, guided by our leading-edge bioscience and fine chemical technologies.

Based on the corporate message "Eat Well, Live Well.", we have been scientifically pursuing the possibilities of amino acids in supporting the healthy lives of people all around the world. We aim for future growth and continuous contribution to greater wellness by creating value through sustainable and innovative solutions for communities and society.

The Ajinomoto Group has offices in 35 countries and regions, and sells products in more than 130 countries and regions. In fiscal 2018, sales were 1.1274 trillion yen (10.1 billion U.S. dollars). To learn more, visit <u>http://www.ajinomoto.com</u>.