

# LATERAL THINKING REVEALS PLANT-BASED FOOD SOLUTIONS

Fuji Oil's pursuit of originality has established its global presence as an **INNOVATOR OF FUNCTIONAL INGREDIENTS** that enhance food products.

**Fuji Oil Holdings**, now celebrating its 70th anniversary, has embraced an entrepreneurial spirit since it was founded in 1950. The company has uncovered the molecular key to various ingredients and established unprecedented manufacturing processes through its focus on vegetable oils and fats, industrial chocolate, emulsified and fermented ingredients, and soy-based ingredients.

The company's technological prowess lies in its capacity to separate certain components from food ingredients and further break them down into molecules. "Our expertise enables us to see novel features and characteristics that lead to new applications of food ingredients and enrich people's diets," says Haruyasu Kida, chief technology officer of Fuji Oil Holdings.

## NOVEL METHOD TO PRODUCE COCOA BUTTER EQUIVALENTS

One of the company's flagship technologies is enzyme-based interesterification used to create cocoa butter equivalents (CBEs). Cocoa butter, made from cocoa beans, is a main ingredient of chocolate, but it is also the most expensive chocolate compound and its

supply can be insecure. In the 1970s, many chocolate manufacturers identified shea butter as an alternative, but it also posed difficulties with quality control and supply.

In the 1980s, Fuji Oil successfully developed CBEs from high oleic sunflower oil, which has a more stable supply than shea butter, by establishing novel interesterification technology that uses an enzyme called lipase as a catalyst.

A main constituent of cocoa butter is SOS fat, an enzymatic interesterification between stearic acids and oleic acids of 1-, 3-position triacylglycerol. Lipase has a high selectivity to the 1-, 3-position of a fatty acid, and the company successfully replaced the sunflower oil's oleic acids with stearic acids to turn the structure from OOO into SOS.

The concept of lipase-based interesterification was already established, but Fuji Oil developed effective methods to immobilize the enzyme and reduce the production of diacylglycerol, a byproduct that deteriorates the quality of CBEs, explains Kida. "A slight difference in technological thinking determines the way to success," he says. Fuji Oil currently holds the world's third largest share in the industrial chocolate market.

The company also applies its expertise in the enzymatic interesterification technology to design other triglycerides, enabling them to develop various value-added functional oils and fats. For example, in a production process similar to SOS fat, the company manufactures what is called BOB (1,3-dibehenoyl-2-oleoylglycerol) seed material, which enables better control of crystallization in chocolates.

## SOY PULP GOES FROM TRASH TO TREASURE

Other mainstay technologies include the production of water-soluble soybean polysaccharides (SSPS), says Akihiro Nakamura, executive officer of Research Institute for Creating the Future at Fuji Oil Holdings.

For more than 50 years, Fuji Oil has focused on soybean as a valuable plant resource and produced food materials by separating it into soy oil and protein. SSPS is extracted from soy pulp-refuse, 'okara' in Japanese, a byproduct from the isolation of protein when making tofu and soy milks. Okara is eaten in a few traditional dishes across Asia, but until the 1980s it was mostly discarded as industrial waste.

To turn okara into a valuable

resource, in 1988 Fuji Oil began to identify the entire structures of SSPS which consists of more than 500,000 molecules. "Understanding the structural functions of SSPS at a molecular level was a powerful tool to explain the merit of this ingredient to people outside Asia," Nakamura says.

In 1993, researchers at Fuji Oil established technology to isolate SSPS from soy pulp and eventually halved the amount of soy pulp waste, resulting in nutritional and environmental benefits. SSPS is soluble dietary fibre and may be used as a healthy additive to improve the properties and quality of food products. The researchers also discovered SSPS's pectin-like structure means it has low viscosity in water and can prevent protein particles from coagulating and precipitating under acidic conditions.

Under the trade name of Soyafibe-S, SSPS is now widely used as a stabilizer of popular yoghurt and other milk-based drinks sold around the world. It has a smooth mouthfeel and refreshing taste, positioning it as an alternative beverage stabilizer to conventional pectin.

The company continues to deepen the understanding of molecular mechanisms of SSPS to expand its potential



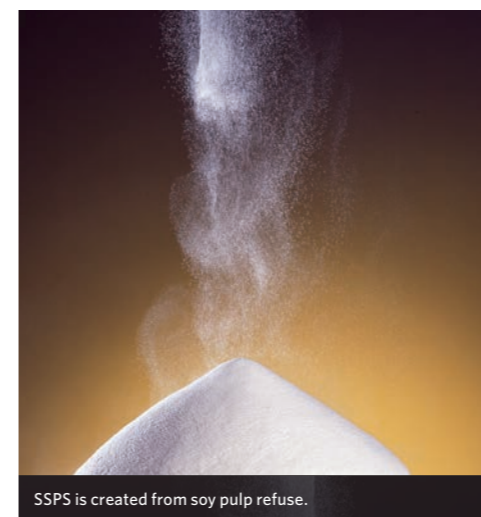
Fuji Oil has created a variety of plant-based food ingredients.



Akihiro Nakamura, executive officer of Research Institute for Creating the Future.



Haruyasu Kida, CTO of Fuji Oil Holdings.



SSPS is created from soy pulp refuse.



Added to yoghurt and milk-based drinks, SSPS creates a smooth mouth feel and refreshing taste.

applications. In 2012, researchers reported their finding on how molecular mass and negative charge of anionic SSPS affect protein stabilization.

## EXPANDING PLANT-BASED FOOD SOLUTIONS

Although soybean is a popular healthy food in Asia, soy allergies are of concern in Europe and the US. Searching

for an ingredient, that is non-allergenic, that has similar functional features to those of SSPS, Fuji Oil identified peas to be ideal, and is now building a factory in Germany to provide soluble pea polysaccharides as a functional ingredient for different types of food and beverage applications.

The company plans to strengthen international

research and development on growing concerns about sustainability. "Our long-established, plant-based food solutions will be key to sustainable development," Kida says. "Our vision for the global

society in 2050 means that we are focusing on technologies to realize tastier and healthier food while addressing solutions for the environment, agriculture and other food-related issues," Nakamura adds. ■

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