Plant protein as a fat substitute - technologists are interested in opportunities through microparticulation

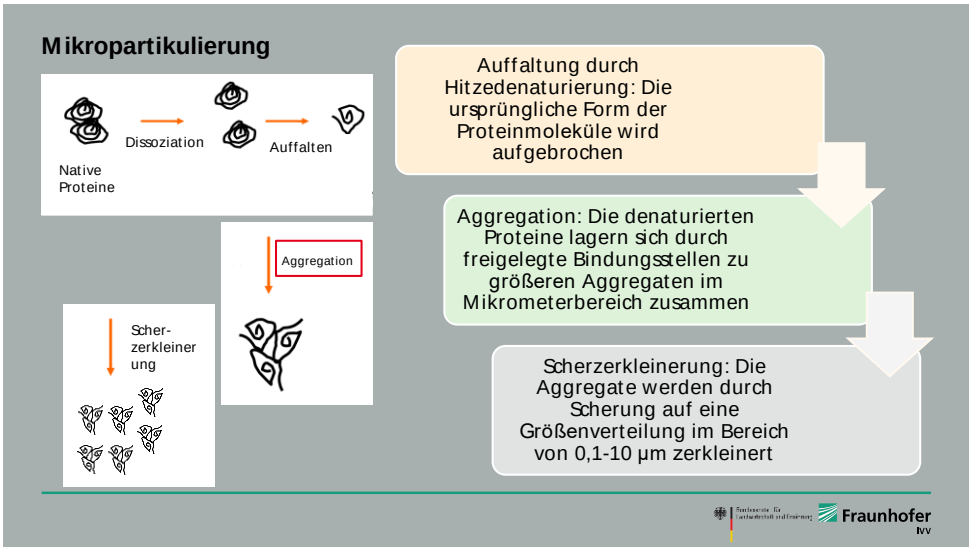
Whether it's meat, milk or cheese: Plant-based raw materials are in the process of revolutionizing nutrition - which makes them interesting for consumers and producers alike. But do they also have the ability to replace animal-based fat substitutes in popular products? Anna Martin from the Fraunhofer IVV (Research Institute for Process Engineering and Packaging) provided information about this topic at a webinar organized by the Gesellschaft Deutscher Lebensmitteltechnologen e.V. (GDL - German Food Technologies Society). The event focused on rediscovered and new plant-based raw materials and their potential for food production.

Less fat and still a treat - to make this possible, scientists at the Fraunhofer IVV reduce lupine and pea proteins to such an extent that they are the size of emulsified fat particles. (Photo: © Mareike Bähnisch)

Plant-based continues to grow

60 percent of consumers worldwide proactively seek products that improve their health. Against this background, plant-based raw materials continue to gain appeal. The market share for plant-based foods and beverages has recently seen double-digit growth and is also forecast to increase by up to 14 percent in this category between now and 2024. Success is determined by the multitude of properties that plant-based ingredients bring to the table.

The GDL is organizing a multi-part online lecture series on this topic and presenting the innovations from the development. The first webinar "Rediscovered and New Plant-Based Raw Materials" took place at the end of March. In addition to Tatar buckwheat and new fields of application for cocoa, the focus was also on the possibilities of vegetable proteins for fat reduction.



Principle of microparticulation at the Fraunhofer IVV.
(Figure: Fraunhofer IVV)

((Bildlegende))

Mikropartikulierung = Microparticulation
Native Proteine = native proteins
Dissoziation = Dissociation
Auffalten = Unfolding

Scherzerkleinerung = Shear shredding

Aggregation = Aggregation

Auffaltung durch Hitzedenaturierung: Die ursprüngliche Form der Proteinmoleküle wird aufgebrochen = Unfolding by heat denaturation: the original shape of the protein molecules is broken up

Aggregation: Die denaturierten Proteine lagern sich durch freigelegte Bindungsstellen zu größeren Aggregaten im Mikrometerbereich zusammen = Aggregation: The denatured proteins assemble into larger aggregates in the micrometre range due to exposed binding sites.

Scherrzerkleinerung: Die Aggregate werden durch Scherung auf eine Größenverteilung im Bereich von 0.1-10 µm zerkleinert = Shear shredding: The aggregates are shredded by shearing to a size distribution in the range of 0.1-10 µm

Focus on fat reduction

"Fat reduction is one of the pressing issues facing our society," explained Anna Martin of the Fraunhofer IVV at the beginning of her presentation. Because whether it's ready meals, snacks, or pastries and confectionery: "We can assume that the excessive energy density of

popular foods is one reason why the prevalence of obesity and diet-related diseases such as dyslipidemia and arteriosclerosis is increasing throughout Germany," she said.

One technological approach to reducing the fat content while maintaining the same enjoyment value is the incorporation of so-called fat substitutes, which are currently obtained exclusively on the basis of animal raw materials. Martin and her team now want to change that.

Creamy, smooth mouthfeel due to microparticulation

To obtain the plant-based fat substitutes, the researchers use microparticulation to thermomechanically break down particles of lupin and pea protein to such an extent that they are in the size range of emulsified fat particles (0.1 to 10 micrometers). Microparticulation can be achieved with various methods. "Technologies commonly used for this purpose are thermoplastic cooking extrusion, treatment of proteins in a scraped-surface heat exchanger, or a combination of heat exchanger and high-pressure homogenizer," Martin said.

Adapt process to plant raw materials

At the moment, the technologically established methods are still optimised for proteins of animal origin - such as whey proteins. The difficulty of microparticulation is mainly that a critical particle size of the proteins has to be achieved in order to "create an optimal mouthfeel for the consumer, which cannot be characterised as sandy or grainy," says Martin.

Plant proteins in particular consist of large globular storage proteins, which have much higher molecular weights than whey proteins. Because of this, the microparticulation process must be adapted to plant proteins and these may have to be modified in advance by methods such as enzymatic hydrolysis.

Broad range of applications for the goal

The goal of the joint project MIPRO is to produce the widest possible range of vegetable-based fat substitutes. Depending on the process, the microparticles obtained should have a cream-like to semi-solid consistency and can be used as a fat substitute in full-fat and reduced-fat foods. The project, which is funded by the Bundesanstalt für Landwirtschaft und Ernährung (German Federal Agency for Agriculture and Food), started last October and will run for three years.

Additional information and contact

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