

The National Food Institute uses knowledge of nano-microstructures of ingredients to develop healthy foods.

 Xanthan gum-chitosan nanofibres. National Food Institute

Nano-designed ingredients with improved properties

The National Food Institute uses carbohydrates, proteins, and lipids to develop natural so-called nano-micro-structured ingredients, which the food industry can use to produce functional, healthier, tastier, and safer foods.

All foods - both natural and processed - contain nanostructures. For example, milk contains casein, a kind of milk protein with a diameter of between 100 and 200 nm, and meat consists of protein filaments that are far less than 100 nm thin.

By using carbohydrates, proteins, and lipid nano- and micro-structures, the researchers at the National Food Institute can develop new natural ingredients with a better functionality. Due to the size and improved properties of the designed ingredients, the food industry can make products with the same pleasant taste, but with a lower sugar, fat, and salt content. This is due to the fact that the industry does not have to use the same quantities of the new ingredients.

Enhanced delivery of bioactive substances

In addition, nano- and microstructured ingredients have a larger surface area per unit compared to similar ingredients with a larger structure. This makes these ingredients more biologically active, thus making it easier for the body to absorb them. The researchers at the Institute utilize this property to develop optimized delivery systems of bioactive substances - such as antioxidants, vitamins, and polyphenols - to the body so that the substances end up where they are most needed.

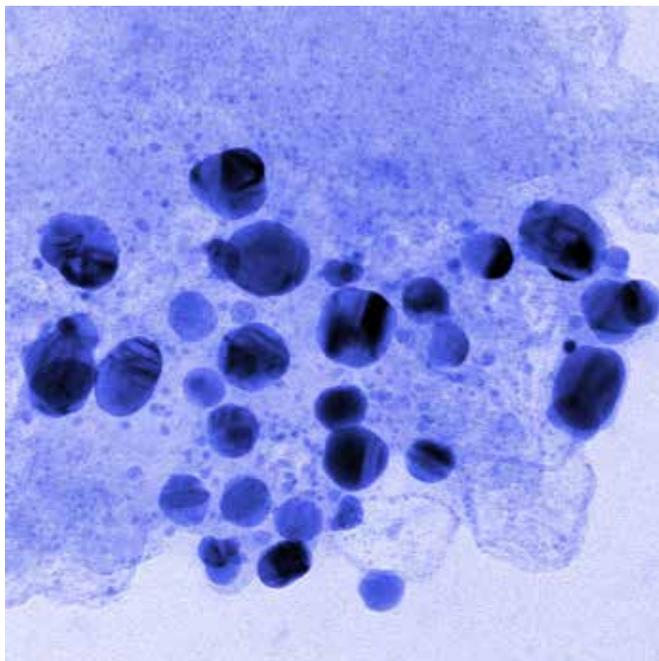
Healthy probiotic bacteria with a protective layer

The researchers at the Institute work with the ingredient company Chr. Hansen to encapsulate probiotic bacteria, which for example can create balance in the bacterial composition of the gut after someone has received a harsh dose of antibiotics or following a period of illness. In order for the bacteria to work as intended, a significant number of them must be alive when they reach the gut.

In this project, the researchers use their expertise to coat the bacteria with a protecting membrane of nano-microstructures of sugar molecules. The membrane improves the stability of the bacteria so that they become less sensitive to changes in temperature and they stay intact if they are e.g. mixed into moisture and low pH rich foods such as juice and yoghurt.

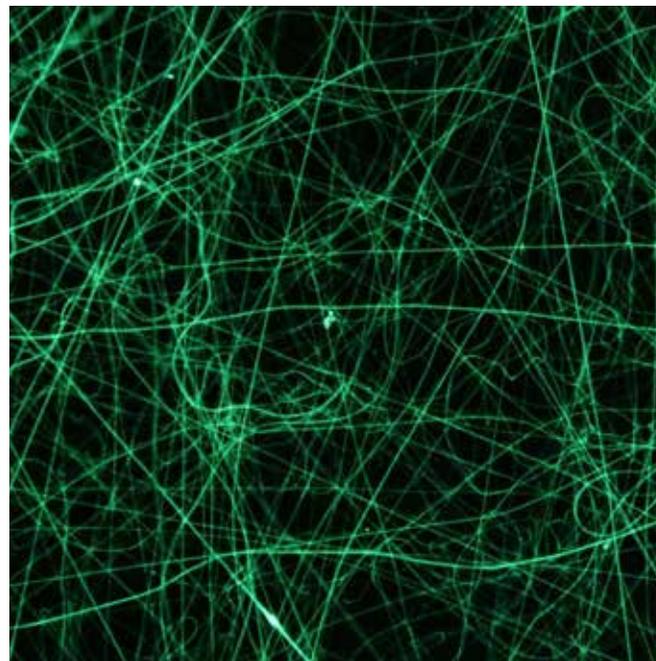
The knowledge from the project will make it possible to produce a wider range of food and beverages that contain probiotic cultures and have a longer shelf life than today.

"The project provides us with a greater knowledge of how the body absorbs different nano- and microstructures. Thus, the Institute can develop techniques that can control where and



The National Food Institute conducts research into foods' nanostructures to find ways of developing healthier, tastier, and safer food ingredients and foods.

☐ Silver nanoparticles. National Food Institute



The National Food Institute conducts research to study the body's uptake of different bioactive substances and ingredients in nano- or microsize.

☐ Nanofibres. National Food Institute

when encapsulated bioactive substances are released in the body to achieve the desired effect," Professor Ioannis S. Chronakis from the National Food Institute says.

Cracking the code for the production of vegan sausages

In addition, the researchers use their knowledge of nano- and microstructures to develop edible 'film' made from plant-based ingredients, which can be used by manufacturers of vegetarian and vegan foods.

Their innovation may be used e.g. to provide vegan sausages with the right 'snap' - something that used to cause manufacturers headaches. Moreover, it will be cheaper to produce the improved film with the methods from the National Food Institute. This will be a great help to small manufacturers in particular.

The researchers can design the film so that it contains substances that are also able to protect against disease-causing microorganisms. Moreover, the researchers' innovations can easily be adapted so that a number of different industries can use them.

“**The ambition is** that the research at the National Food Institute can help to meet the demand for ingredients with added value which have specific health-beneficial effects and are manufactured sustainably with less resources. Moreover, the goal is to improve people’s health and quality of life by continuously developing profitable nano- and microtechnologies which the food industry can apply to create functional, healthier, tastier, and safer foods. The Institute will also work on adapting these methods so they become useful for manufacturers of pharmaceuticals, textiles, cosmetics, packaging, and feed.”

Ioannis S. Chronakis
Professor