VEGETARIAN ALTERNATIVES TO MEAT

Background

Why use meat surrogates?
In recent years, growing awareness about health and environmental issues has led to a considerable increase in demand in Europe for vegetarian alternatives to meat. The production of animal protein is very resource-intensive and animals must be fed 3-8 kg of protein to produce 1 kg of animal protein. This is not a sustainable way of supplying a growing population with protein. The farming of animals makes a significant contribution to the emission of carbon dioxide and methane, and there are also ethical issues to consider here. In Asia, people have eaten tofu, tempeh, and saitan for centuries as a source of protein. Vegetarian, meat-surrogate products are also of growing interest to consumers in Europe.

Objective

Our objective is to develop high-quality, vegetarian alternatives to meat having better sensory properties than those products currently in the marketplace. Of key importance here are the taste, juiciness, and firmness of bite. Extrusion cooking involves the kneading and cooking of proteins with water and other ingredients to form a homogeneous mass. The fibrous structures develop in the cooling process. This novel process allows juicy products to be made, whose texture, chewiness, and taste match the features of meat. There are clear opportunities in the convenience food area to use this process to manufacture vegetarian products having high consumer acceptance. For example, schnitzel, roulade and steak products can be made from the plant protein fibers.
Research projects

Fraunhofer scientists are involved in national and European research projects aimed at developing tasty meat surrogate products having high consumer accept- ance. This work is being undertaken in collaboration with ingredient and food manufacturers and other R&D organizations. The European Commission and the Federal Ministry of Education and Research and the Federal Ministry of Economics and Technology are funding these projects. Project coordination is being undertaken by the Fraunhofer IVV.

Researchers at the Fraunhofer IVV are engaged in the manufacture and characterization of suitable protein-rich raw materials and are studying their behavior in manufacturing processes. They are developing vegan and non-vegan formulations and are studying the interactions of the various ingredients. Optimum process conditions are being identified for manufacturing meat surrogate products.

The process

The extrusion cooking process allows ingredients to be simultaneously mixed, kneaded and rapidly heated under pressure. Formulations with a high protein content are being used to make extrudates having a meat-like texture. Conventional extrusion processes use raw masses having a low moisture content. This produces granulates which, after rehydration, can be used as a substitute for minced meat in foods. However, when raw masses having a very high water content are cooked in the extrusion process and then cooled prior to exiting the nozzle in a laminar flow the result is fibrous protein structures. This process allows the scientists at the Fraunhofer IVV to make extrudates with an elastic, meat-like texture. These are then customized with flavorings and herb/spice mixtures and processed into finished foods.

Expertise

Scientists at the Fraunhofer IVV have many years of experience manufacturing protein ingredients and characterizing their technological properties. This allows suitable proteins to be selected for the meat surrogate products. We have a new, state-of-the-art food pilot plant available for developing products. A highly specialized sensory panel is available to appraise the products. These vegetarian products, like conventional meat products, are moist and so have special hygiene requirements with regards to packaging and storage. Experts in packaging and product safety at the Fraunhofer IVV can provide full support in this area.

1 Scanning electron micrograph: Cross-section of wet-textured plant protein.
2 Extrudate having meat-like texture.
3 Example prepared meal.