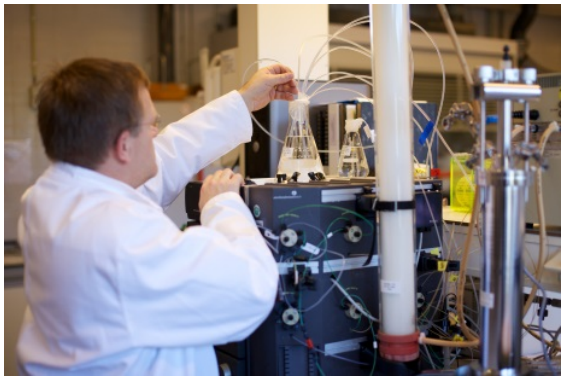
Protein technology

The research area of protein technology is very broad and covers work on protein, peptides and enzymes in relation to functionality, processing and health. Enzymes are proteins with a catalytic function and they are frequently used to modify properties of food ingredients or food products. Enzymes can however also be used as a protein ingredient like for instance Rubisco from plant leaves which is in fact an enzyme but it can also be used as a functional protein ingredient in food with excellent nutritional properties.



The research area Protein technology has four activities, namely:

- *Purification of (new) plant proteins from plants, seeds and side streams.*
  The purpose of this activity is to evaluate the possible future use of new protein sources in human diets aiming at substituting animal proteins. Typical topics such as isolation procedures aim at removal of unwanted components while preserving functional properties. The protein technology group has large experience and is well equipped to partially purify proteins up to hundreds of grams scale using simple precipitation techniques. In addition protein purification at gram scale can be performed using various types of column chromatography (ion exchange, size exclusion, hydrophobic interaction and chromatofocussing. The proteins are purified for research on protein functionality especially for new types of plant proteins but also for research on the allergenicity of proteins. TNO has ample experience with purification of proteins from peanut, lupin, pea, soy, rapeseed, canola, sunflower, beet leaves, algae etc. At the moment Rubisco type proteins from various types of plant sources (including algae) have the main focus.
  High-scale and high-level protein purification
  Large study on the extraction of food ingredients from algae
- *Modification of protein for desired functionality*
  To improve or alter the functionality of proteins, modification can be applied to obtain proteins with desired functionality or specific properties. Several enzymatic processes like (partial) hydrolysis or crosslinking are already used by the food industry. In addition physical modifications of proteins using heat or pressure can sometimes be very helpful in altering protein functionality. The research at TNO is focused on finding the relationship between protein structural properties (and changes therein) and the functional behavior of these proteins. Knowledge on enzymes and their specific actions is up to date and is combined with structural protein analysis and the determination of the functional properties.
  TNO - Ultra High Pressure generates innovative product textures

- *Structure analysis and evaluation of allergens of both existing and new proteins*.
  To gain insight in the allergy of proteins, and especially new protein sources, understanding is needed of how proteins in food systems are digested and how this is related to allergenic reactions. Currently, TNO aims at finding relationships between protein properties, digestion and allergy. On the one hand proteins are characterized for their structural parameters, such as secondary, tertiary and quaternary structure, and their physical parameters (denaturation temperature, gelation performance, foam capacity). On the other side, proteins are subjected to an in vitro digestion systems to find out whether or not they are digested well. The protein technology groups works in close collaboration with the TNO research group Food Safety and the University of Utrecht.
- *Structuring of proteins at the micro and mesoscale.*
  To translate knowledge on protein functionality to application, TNO investigates structuring of proteins at different length scales. Techniques such as electrospinning, ultra high pressure, extrusion and printing are used to create protein structures with new functionality and textures. Topics as meat alternatives and applicability of alternative protein sources are key, and hence the understanding of functionality on molecular level and the translation to larger scale is necessary. Properties such as aggregation and gelation behavior of protein, or interfacial behavior in foams/emulsions are covered. In addition, pilot plant facilities offer the production of (small-scale) model food products but also real-time products such as meat, meat replacers, bakery and confectionary products