

- Project Short Report -

AiF-FV 15218 N

„Structurisation of food emulsions“

Co-ordination: Forschungskreis der Ernährungsindustrie e.V. (FEI), Bonn

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Industrial association: Diätverband - Bundesverband der Hersteller von Lebensmitteln für
besondere Ernährungszwecke e.V., Bonn

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Aim of research:

Structure formation of food emulsions is very important for design of disperse and continuous phase with respect to product development and quality management. So far, production of low-fat products usually comes along with significant variation in quality. Mayonnaise, salad dressings, sauces or cream soups and spreads are oil-in-water emulsions with middle to high viscosity. Subject to fat content, rheological and sensory properties depend either on disperse fat phase or continuous water phase.

Reducing the fat content while obtaining specific rheological and sensorial properties is quite difficult. The substantially bigger water content has to be structured so that sensory attributes as well as product safety and shelf life of fatty products are reached. Many low-fat products had no success on the market or have been already rendered in development, because the known and required quality properties could not be reached. Often high stabilizer concentrations lead to an undesired firm, visco-elastic texture, which are far from the quality of fatty standard products. Inhomogeneous distribution of fat droplets, phase separation and formation of fat clusters affect sensorial and rheological properties in an undesired manner.

Physical and sensorial properties are considered to be enhanced by durable homogeneous distribution of the disperse lipophilic phase in the continuous phase by use of energetic interactions between phases as well as biggest specific surface area as possible and a small particle size distribution.

Results of research:

Starting point of analysis was definition of target variables with respect to rheological properties for design of low-fat products on basis of properties of standard products, especially salad dressing and spread.

The aim of project could be reached by systematic realisation of the project steps. One of the main results is that emulsifier system and dispersing technique always have to be considered in close relation to each other. Generally, double-stage high pressure homogenisation proves to be best method to generate a disperse phase with a large specific surface area and in a narrow particle distribution. This was the same case with high molecule surface active substances. Whey protein and emulsifying starch are excellent for interface stabilisation in neutral as well as acidic pH-value. Furthermore, egg yolk suits very good for pH-neutral emulsions and yeast for acid systems. Exceptional stable interfaces are generated by multi-layer-technique. However, this does not increase droplet size remarkably and is therefore no suitable measure for increasing the volume of disperse phase.

The most successful method to stabilise emulsions in acid pH-value is to use opposite charged high molecule surface active substances and stabilizers. It was possible to identify the most suitable stabiliser variations for each high molecule surface active substance. Furthermore it was feasible to determine proper variations for heat stable emulsions as well as emulsions presenting with high ion content. After all, findings of the trials were put into application in the form of a salad dressing and spread. All results of the project can be applied immediately by several manufactures of food industry because only technically available substances and dispersing systems were used.

Economical importance:

Results of project with respect to composition of fat reduced emulsions can be used by the industry in particular also by SME immediately.

For the development only common substances are used, which are not essential cost intensive than the products which are used so far.

Also the change of process which is necessary in principle will be not problematic. The applied high pressure homogeniser are still used often for emulsion preparation. The adaptation of industrial process is confined to realization of mixing of high viscous fluids. But this is indispensable since the design of interfaces and their interaction with stabilizing substances can be realized not flexible enough in a one-step process.

Results of project can be used for the development of new products as well as for quality management of existing production processes. The scientific background could be demonstrated but it was also postulated that a special fine adjustment is necessary for each application.

But also the producers of emulsifiers and stabilizers have versatile possibilities to use the project results. On the one hand new and/or improved compounds can be developed on this basis of the basic knowledge on interactions of emulsifiers and stabilizers and on the other hand, also new techniques of production of low fat emulsions can be developed by these companies.

In total, the results of the project make it possible for industry to produce more stable and qualitatively improved in fat reduced emulsions.

Altogether, the chance for German industry is given to enhance marked shares since products can be only successfully if healthy products meet the expectations of consumers with respect to sensory properties.

Publications (selection)

1. Wackerbarth, H., Schön, P., Bindrich, U. (2009) Preparation and Characterization of Multilayer Coated Microdroplets: Droplet Deformation Simultaneously Probed by Atomic Force Spectroscopy and Optical Detection, Langmuir 25 (5) 2636-2640.

Lectures/Workshops/Posters (selection):

1. Bindrich, U. (2009) Gestaltung der Textur fettreduzierter Emulsionen, Köln: Anuga FoodTec Foren 2009, DLG/GDL-Forum Feinkost Convenience am 12.03.2009, Lectures.
1. Bindrich, U. (2009) Verkapseln in fluiden Systemen durch Gestaltung der Phasen in Emulsionssystemen, Köln: Anuga FoodTec Foren 2009, GDL-Forum Mikroverkapseln und Coaten am 10.03.2009, Lectures.

Further information:

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