

## W/O/W double emulsions – the functional components of dairy products

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Nowadays, there is a growing demand from consumers for functional food. W/O/W double emulsions are a big challenge on this field in dairy products. Because of their structure (Fig. 1), these systems have a big potential for encapsulation of water soluble sensitive nutrient compounds and overcome the problem of changes in sensory profile. Moreover, W/O/W double emulsions are the appropriate solution how to reduce fat content in products.

Considering the complex structure, these systems struggle with instability. The basic step how to achieve a high encapsulation efficiency is to handle the preparation of the stable internal W/O emulsion. The most important factor is the lipophilic emulsifier. Here, PGPR (polyglycerolpolyricinoleate) is the best choice. For the W/O/W preparation, milk proteins in the external water phase fulfil the hydrophilic emulsifier function.

Fig. 1. Dairy W/O/W double emulsion.

In this study, we have set a goal to develop a particular method for the W/O/W 20 % preparation and have focused on the stability in dairy systems during processing and storage.

The method was a stepwise technology. The internal water phase and oil phase with PGPR had been pre-mixed using rotor-stator agitator at 50°C. This coarse W/O 40 % emulsion was homogenized at 150 MPa by the high-pressure homogenizer and mixed using rotor-stator agitator with external water phase (skim milk) at 40°C.

All emulsions (W/O and W/O/W) were controlled after preparation and then after 1, 2 and 4 weeks of storage.

The droplet size of w/o internal emulsions was measured using dynamic light scattering, and the sedimentation stability was evaluated using the sedimentation centrifuge LUMiSizer® (L.U.M. GmbH, Germany).

Glucose (5 % w/w) had been added in the internal water phases and after enzymatic measurement of the glucose concentration in the external water phase of double emulsions, encapsulation efficiencies of double emulsions were assessed. Besides microscopic observing, the droplet size of double emulsions was measured using laser diffraction.

We have found that our stepwise technology is a suitable solution for W/O/W preparations. Encapsulation efficiencies depended on the particular composition of emulsions and were in the range of 80 – 95 %. Polysaccharides (when added) stabilized double emulsions during storage period and prevented sticking of W/O droplets when milk fat used.

Above that, milk proteins are natural emulsifiers, so this is a way how to manufacture a low fat dairy products without taste changes and eventually with a sensitive bioactive compound.