

“Pickering Emulsifiers” based on small granular starches – Manufacturing and physico-chemical characterization

Berthold Wiege^{1*}, Ali Marefati², Marilyn Rayner², Norbert U. Haase¹, Heinz Themeier¹ and Maria Matos^{2,3}

1 - Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Safety and Quality of Cereals, Schützenberg 12, 32756 Detmold, Germany

2 - Department of Food Technology, Engineering, and Nutrition, Lund University, P.O. BOX, SE 221 00 Lund, Sweden

3 - Department of Chemical and Environmental Engineering, University of Oviedo, Julián Clavería 8, 33006 Oviedo, Spain

Small granular starches from quinoa, amaranth, and rice were surface hydrophobized (esterified) with cis/trans 2-Octen-1-ylsuccinic anhydride (OSA) to different degrees of modifications (i.e. 0.6, 1.2, 1.8, 2.4, 3.0% of OSA) in aqueous alkaline slurry at pH = 8.2-8.4 at 32°C. The dry matter content of the suspensions was 17.7% and the reactions were carried out within 120-200 min.

The degree of substitution (DS) was determined by alkaline hydrolysis of the ester and titration back with sulfuric acid - as a reference method. Furthermore a quantitative FTIR-method was developed for determination of the amount of OSA which was chemically bound, by integration of the C=O bond of the ester (1728 cm⁻¹) and with a higher accuracy by evaluation of the –COO⁽⁻⁾-bond at 1569 cm⁻¹.

Physico-chemical properties of these “Pickering emulsifiers” were characterized by light scattering, scanning electron microscopy, and their pore size distribution (BET). Emulsifying properties were determined in relation to the degree of modification and different starch/oil ratios (i.e. 50, 100, 200, 400, 800 mg starch/ml oil) by laser light scattering experiments.

It was feasible to formulate emulsions stabilized by small granular starches. Particularly, surface hydrophobized starches from quinoa and amaranth have a great potential for applications in the food, cosmetic and pharmaceutical industry. Unfortunately these starches are not commercially available. Currently, the high raw material price of quinoa and amaranth prevents applications of such emulsifiers in the food industry. In the case of cosmetic and pharmaceutical industry the situation seems to be different.

***Corresponding author:** Dr. Berthold Wiege, Tel.: 49 (0)5231 741-320 E-mail: berthold.wiege@mri.bund.de