

Quantification of Nonionic Surfactants Solubilized in Aqueous Phase after Transesterification with Boron Fluoride-Methanol

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INRA UR1268 Biopolymères Interactions Assemblages

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Polyoxyethylene nonionic surfactants such as Tween 20 are often used in large excess to stabilize oil-in-water emulsions. The unadsorbed emulsifiers in the aqueous phase of the emulsions affect the physical and chemical characteristics of emulsions, notably their oxidative stability. Therefore, it is of importance to quantify the remaining amount of emulsifiers in the aqueous phase.

Some methods of determination of nonionic surfactant concentrations have been previously described. These methods involve the formation of a blue complex between the nonionic surfactant and ammonium cobalt thiocyanate (Brown & Hayes, 1955; Crabb & Persinger, 1964). However, several steps including drying of the samples and the extraction of the coloured complex in an organic solvent are required.

We developed a innovative protocol to determine the concentration of unadsorbed Tween 20 in emulsions. It is based on the transesterification of the fatty acids of the surfactant, directly in the aqueous phase of emulsions. Tween 20-stabilised emulsions were previously centrifuged to separate the aqueous phase from the oil droplets. The transesterification was performed according to the procedure described by Morrison & Smith (1964). Boron fluoride-methanol was added directly to the aqueous phase containing unadsorbed Tween 20. The mixture was heated at 100°C for 45 minutes to form fatty acid methyl esters. These derivatives were then extracted by an organic solvent and analyzed by gas chromatography coupled to a flame-ionization detector. The transesterification performed in the presence of an internal standard enabled to quantify the amount of each fatty acid.

The convenience and originality of this method allows the quantification of a wide range of emulsifiers containing at least one fatty acid chain, in a reduced number of analytical stages.