

SYNTHESIS OF BIOBASED SURFACTANTS

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This work conducts a technical analysis of the current production and consumption of vegetable oils and some of the oily byproducts to determine the potential feedstock for the synthesis of non-food-competitive surfactants and surfactant-based systems. It defines the concentrated phosphatides (phosphatidic sludge) as no-low-value streams, appropriately suited for chemical valorisation. The study further creates biobased surfactants by amidation of phosphatidic sludge derived from refinery of vegetable oils with amines of different basicity, under the action of calcium oxide as catalyst. Besides waste remediation, the use of phosphatides enabled to create the mixed surfactant compositions, comprising fatty acid alkanolamides and calcium glycerolphosphatides with improved solubility in organic non-polar solvents. Briefly, the syntheses were conducted by reactions of known amounts of phosphatidic sludge (0.1 mol) and alkanolamines (0.3 mol) under the action of calcium oxide as catalyst (40 mol%, based on phosphatidic sludge). The reaction systems were introduced to the round-bottom flask equipped with reflux condenser and mechanical stirrer and were heated under constant agitation at 80–100 °C for 0.5 h and at 110–125 °C for 2.5 h. Reaction progress was monitored by potentiometric titration of amines, and by IR-analyses of the probes of the reaction media during the course of the processes. After syntheses, the unreacted amines were removed at elevated temperature (60–80 °C) under reduced pressure (5–10 mbar) in the nitrogen flow (Fig.).

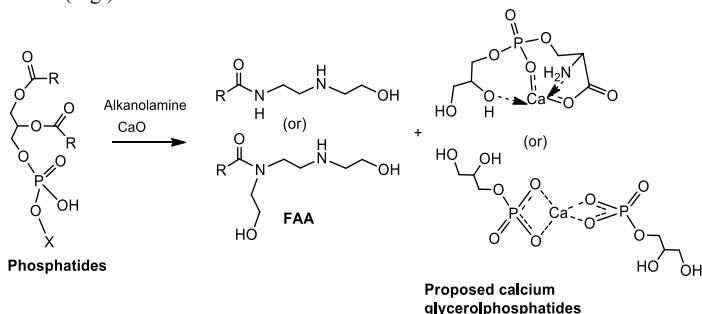


Fig. Proposed conversion of phospholipids into FAA. R = alkyl or alkenyl fatty acid residues.
X = H or serine residue

The IR analysis identified the formation of FAA. In IR spectra of the products, new characteristic bands at 3300 cm⁻¹ (N–H stretching vibrations), 1645 cm⁻¹ (C=O amide stretching vibrations), and at 1560 cm⁻¹ (N–H amide bending vibrations) appeared after reactions of phosphatidic sludge and alkanolamines. At the same time, the characteristic vibrations of ester bonds at 1745 cm⁻¹ (C=O ester stretching vibrations) disappeared after syntheses, additionally providing evidence in favour of the generation of FAA. There have been also noted changes at 3600–3000 cm⁻¹ (O–H stretching vibrations) and at 1055 cm⁻¹ (P–O stretching vibrations of POOH), likely associated with the interaction of phosphatides and calcium hydroxide. The NMR and colloid-chemical studies analysis identified the formation of FAA. Considering the combined data, it is proposed the reaction course, as pictorially represented in Fig.