Amino acid-based surfactants

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The 20 standard amino acids offer a large variety of chemical structures that allow fine tuning of the physical chemical properties of the corresponding surfactants. The amino acid can be linked through different types of cleavable bonds such as an amide bond for N-acyl amino acid-based surfactants.

The amino acid-based surfactants contain an amide bond, which may contribute to the self-assembly of the surfactants both at surfaces and in the bulk. In order to assess the importance of this type of intermolecular association, the behavior of sodium lauroyl glycinate and sodium lauroyl sarcosinate were compared. The former surfactant is capable of forming intermolecular hydrogen bonds while the latter carries a N-methyl group and is therefore unable to form such bonds.

Aspartic and glutamic acids, two natural amino acids, have two carboxylic groups separated by a spacer of two and three carbons, respectively. The synthetic homologue aminomalonic acid has one carbon as a spacer. The properties of that series of dicarboxylic amphiphiles and the effect of the spacer length both on the bulk behavior and on the adsorption at interfaces have been investigated. Parameters such as the effect of pH, the specific interactions with different type of counterions and the chelating properties were studied.

![Chemical structures](image)

Sodium N-lauroyl aminomalinate  Sodium N-lauroyl aspartate  Sodium N-lauroyl glutamate

Sodium N-lauroyl sarcosinate  Sodium N-lauroyl glycinate

We have also investigated physical chemical properties and the mode of hydrolysis of surfactants based on the amino acid betaine as polar headgroup. Whereas alkaline hydrolysis is much more rapid than for normal esters, acid hydrolysis hardly occurs at all, even under very acidic conditions. The rate of alkaline hydrolysis is further accelerated by micellization (micellar catalysis). This is very different from the hydrolysis characteristics of uncharged surfactant esters, such as PEG fatty acid esters (fatty acid ethoxylates), for which the rate is slowed down by micellization. Betaine esters of long chain fatty alcohols are potent bactericides and their short half-life in solution makes them interesting as "temporary biocides".