Superhydrophilic interfaces and short and medium chain solvo-surfactants

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Pure α-monoglycerides (MGs)[1,2] and glycerol carbonate esters (GCEs)[3] are two families of lipochemical molecules composed of a polar building block, glycerol for MGs, glycerol carbonate for GCEs, and a fatty acid lipophilic part.

From a chemical point of view, MGs include 2 free oxygen in the hydroxyl functions and one ester function between the fatty acid and the glycerol parts, GCEs contain 2 blocked oxygen in the cyclic carbonate backbone and 3 esters functions, 2 endocyclic in the five-membered cyclic carbonate function , 1 exocyclic between the fatty acid and glycerol carbonate parts. At the physico-chemical level, MGs[4] and GCEs[3] are bifunctional molecules with amphiphilic structures: a common hydrophobic chain to the both families and a polar head, glycerol for MGs and glycerol carbonate for GCEs. Physicochemical properties depend on chain lengths, odd or even carbon numbers on the chain, and glyceryl or cyclocarbonic polar heads.

The solvo-surfactant character of MGs and [5]overall GCEs were discussed through the measurements of critical micellar concentration (CMC) or critical aggregation concentration (CAC). These surface active glycerol/glycerol carbonate esters were classified following their hydrophilic/hydrophobic character correlated to their chain length ($LogP_{octanol/water}$=f(atom carbon number)). Differential scanning calorimetry and optical polarized light microscopy allow us to highlight the self-assembling properties of the glycerol carbonate esters alone and in presence of water. We demonstrated by thermal analysis the polymorphic behaviour of GCEs, and the correlation between their melting points versus the chain lengths

Coupling the self-aggregation and crystallization properties, superhydrophilic surfaces were obtained[5] by formulating MGs and GCEs. An efficient durable water-repellent coating of various metallic and polymeric surfaces was allowed. Such surfaces coated by self-assembled fatty acid esters in a stable coagel state present a novel solution for the water-repellent coating of surfaces.

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