GREEN SUGAR-BASED SURFACTANTS AND MONOMERS FROM MARINE RESOURCES

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The development of green surfactants based on natural renewable resources is a concept that is gaining recognition in detergents and cosmetics.[1] This new class of biodegradable and biocompatible products is a response to the increasing consumer demand for products that are both "greener", milder and more efficient. In order to achieve these objectives, it is necessary to use renewable low-cost biomass that is available in large quantities and to design through green processes molecular structures that show improved performance, favorable ecotoxicological properties and reduced environmental impact. Within this context, marine algae represent a rich source of complex polysaccharides and oligosaccharides with innovative structures and functional properties that may find applications as starting materials for the development of green surfactants and cosmetic actives. The Ecole Nationale Supérieure de Chimie de Rennes (ENSCR) and the Centre d'Etude et de Valorisation des Algues (CEVA) in Brittany (France) have developed original surfactants based on alginates (cell-wall polyuronic acids from brown seaweeds) or ulvans[2] (sulfated rhamnouronans from the cell wall of green seaweeds) and fatty hydrocarbon chains derived from vegetable resources.[3,4] Controlled chemical and/or enzymatic depolymerizations of the algal polysaccharides give saturated and/or unsaturated functional oligosaccharides incorporating rare sugars such as uronic acids (mannuronic, guluronic, iduronic, glucuronic acids) and sulphated rhamnose. The functionalization of these oligosaccharides through transesterification / transglycosylation processes in fatty alcohols is solvent-free and yields anomerically pure derivatives. Aqueous basic and acid treatments lead to anionic or neutral single-tailed surfactants (efficient interfacial and foaming properties). Additional structural variations (bola lipids[5], double-tailed surfactants[2]) are proposed as expansions of the classical single-tailed molecules for the preparation of emulsifying agents and stable drug delivery systems. Macromolecular surfactants with associative behaviour were also developed, out of vegetable oil and ulvan polymer extracted green seaweeds.[6] These surfactants are biodegradable in seawater and have been tested as dispersants for oil-spills.

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3 Roussel, M., Benvegnu, T., Lognoné, V., Le Deit, H., Soutrel, I., Laurent, I., Plusquellec, D., *Eur. J. Org. Chem.* **2005**, 3085-3094
4 CEVA - Unpublished results
5 Roussel, M., Lognoné, V., Plusquellec, D., Benvegnu, T., *Chem. Commun.* **2006**, 3622-3624
6 WO 2007/045795: Product resulting from the grafting of fatty chains to ulvans and use of said product as a surfactant.