NOVEL HIGH-PERFORMANCE INGREDIENTS BASED ON FUNCTIONALIZED POLYSACCHARIDES - THE ROLE OF ENZYMATIC CATALYSIS

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Polysaccharides are interesting starting materials in the design of high-performance cosmetic ingredients, not only because of their generally low toxicity and "green" profile, but also because of their wide and exciting propensity to form complex self-aggregated structures. These structures have direct relevance for formulation science, since they provide us with the means to tailor and optimize rheological characteristics, solubilization efficiency, emulsification and other critical attributes of a formulation. However, in order to fully exploit this potential of polysaccharide-based materials we need not only the ability to extract, purify and refine them on an industrial scale. We also need cost-efficient tools that allow us to optimize their performance and enable new functionalities. The present talk will focus on the role of industrial enzymatic catalysis in this context. Because of their natural origin, polysaccharides obviously lend themselves to enzymatic modification, and many carbohydrate-specific enzymes are available in bulk quantities, including well-known examples from the amylase and cellulase families. In the presentation, sugar-based surfactants will be used as the prime example of how enzymes can help us create tomorrow's polysaccharide-based ingredients. Today, sugar-based surfactants are used in manifold cosmetic and personal care products, in the form of "alkylpolyglucosides" (or "APGs" for short). However, this term is a misnomer in the sense that the hydrophilic head-groups in these surfactants are by no means polymeric. Rather, APGs consist of a mixture of species, in which the head-groups comprise merely one to three repeating hexose units. This constraint severely inhibits the full exploitation of alkylglycoside functionality, and many attempts to increase the head-group size have therefore been performed over the years. However, synthesis of alkylglycosides with longer head-groups by conventional means has proved prohibitively difficult, for reasons of physical incompatibility of the starting materials (glucose and fatty alcohols). Over the last couple of years, Enza Biotech AB has developed an enzymatic technology that allows us to circumvent the limitations of conventional APG synthesis. This technology allows for synthesis of alkylglycosides with longer head-groups, which are truly oligomeric, or even polymeric. As will be discussed in the talk, this opens up vast new possibilities for sugar-based surfactants, in areas that have so far been reserved for ethoxylated non-ionic surfactants. In the talk, the novel alkylglycosides will also be used to illustrate the more general observation that new materials based on sustainable starting materials not only allow us to mimic existing functionalities, but also to identify entirely new ones. For polysaccharides these opportunities generally have their origins in their complex self-aggregation behavior, which involves both the carbohydrate backbone and its substituents.