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Tail-unsaturation Enables Fine-tuning on the Rheological Properties of Sugar-based Surfactants

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Sugar-based surfactants are recognized as green surfactants and widely used in various applications ranged from viscosity modifier to pharmaceutical applications. However, only a scarce number of examples were reported to exhibit non-Newtonian rheological behaviour, and equally underexplored is the strategy to fine-tune the rheological profile. Our recent study shed light on this area by showing how the headgroup anomeric configuration, axial (alpha) or equatorial (beta) of hexadecylmaltoside (C16G2) influences micelle formation and structure. Small-angle neutron and X-ray scattering revealed that alpha-C16G2 forms short cylindrical micelles (contour length ca. 1000 Å), whilst beta-C16G2 assembles into very long worm-like micelles (contour length ca. 10000 Å), which prompts a closer monomer-monomer packing of the head groups as induced by hydrophobic and hydrogen bond interactions.

Herein, we report on how tail-unsaturation influences the self-assembly and macroscopic response of the system, i.e. the rheology. Importantly, we showed how the configuration (cis vs trans), the position and the types (alkene vs alkyne) of the unsaturation can be utilized to fine-tune the rheological behaviour of sugar-based surfactants. Understanding the relationship between the physical properties and the chemical structure of these sugar-based surfactants would provide us the knowledge to design novel surfactants for different applications.

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