Gabe Overholt
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Tail Structures of Some Alkyl Polyglycoside Surfactants and Their Foaming Properties

Surfactants are amphiphilic molecules meaning they are composed of a hydrophilic head group and a hydrophobic tail group. Surfactants impact the intermolecular forces and lower the surface tension by adsorbing to gas-liquid interfaces—the layer between a gas and a liquid. Reduced values of surface tension, in the presence of surfactants, allows for the generation of stable gas bubbles dispersed in a liquid medium to create a foam. Tuning the foam stability via surfactant design is of significance due to the widespread application of foams in various industries such as cleaning, consumer care products, food, and oil recovery. Most common surfactants are synthesized from non-renewable resources like petroleum. Because of these adverse environmental impacts, there has been a push to use green surfactants produced from renewable resources.

Alkyl polyglycoside (APG) is a class of non-ionic surfactants derived from simple carbohydrates such as wheat and barley and fatty alcohols which come from oil crops like palm oil. Therefore, APGs can be produced sustainably. Even though APGs have a remarkable potential as green surfactants due to their resistance to salts, pH, and temperature, there is a lack of understanding on how APG tail structure affects its properties as a surfactant. The APGs, hexyl glycoside (APG06) and isooctyl glycoside (APG08) were chosen because they both have a 6-carbon long backbone; however, APG08 has a side chain on the beta carbon. Preliminary results from Wilhelmy plate surface tension testing have revealed that the CMC difference between APG06 and APG08 is inconsistent with usual CMC differences between linear and branched surfactants. Typical branched surfactants tend to have a higher CMC than linear surfactants, but APG06 was observed to have a higher CMC than its branched counterpart, APG08. Differences in interfacial properties affect other foam and surfactant characteristics. For instance, the tail chain length affects a surfactant solution's ability to wet or spread on a surfaces. In enhanced oil recovery (EOR), a form of tertiary oil production, surfactants increase the wettability of water on the stone. The water can go deeper into cracks in the stone and release more oil. APGs' resistance to salts and high temperatures makes them a green candidate for EOR. Understanding the change in physical properties of APGs' interfaces with changes in tail structure allows industries to choose surfactants to better suit needs.

INFORMATION

Department—Chemical Engineering

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Co-Authors—Dr. Sepideh Razavi

- Institution—The University of Oklahoma
- Department—Chemical Engineering
- Norman OK

Address—117 Edith Ln, Tuttle, OK, 73089

Campus Address—443 ½ Elm Ave, Norman, OK, 73069

Student's Phone Number— (405)-999-3301

Advisor—Dr. Sepideh Razavi

- Department—Chemical Engineering

Gabe Overholt
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- srazavi@ou.edu
- (405)-325-5458