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Interplay Between Electrostatic and Hydrophobic Interactions in Aqueous Dispersions of OSA-Modified Phytoglycogen Nanoparticles

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Phytoglycogen is a natural polysaccharide produced in sweet corn in the form of compact, 42 nm diameter glucose-based nanoparticles. Its highly branched, dendritic structure leads to interesting and useful properties that make the particles ideal as unique additives in personal care, nutrition and biomedical formulations. The properties of phytoglycogen can be altered through chemical modification. We consider the covalent attachment of charged, hydrophobic octenyl succinic anhydride (OSA) chains to the weakly charged, hydrophilic surface of phytoglycogen. When dispersed in water, the OSA-modified particles develop solid-like rheological behaviour with increasing concentration and exhibit a well-defined yield stress at a concentration much smaller than that for native phytoglycogen dispersions. The yield stress vanishes as either salt is added to the system or the pH of the dispersions is reduced below the pKa of the acidic group of OSA, with the material transitioning from a shear-sensitive gel to a flowing liquid to ultimately precipitating out of solution at the highest salt concentrations or lowest pH values. This result highlights the unique interplay between the electrostatic and hydrophobic interactions of the particles and suggests new applications for OSA-modified phytoglycogen.

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