Aqueous foams stabilized by chitin nanocrystals

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The aim of the present study was to explore the potential use of chitin nanocrystals, as colloidal rod-like particles, to stabilize aqueous foams. Chitin nanocrystals (ChN) were prepared by acid hydrolysis of crude chitin and foams were generated mainly by sonication of the respective dispersions. The foamability of the chitin nanocrystals was evaluated and the resulting foams were assessed for their stability, in terms of foam volume reduction and serum release patterns, during storage. Additionally, the samples were studied with light scattering and optical microscopy in order to explore the bubble size distribution and morphology of the foam. Nanocrystal concentration and charge density was varied to alter the packing of the crystals at the interface. At low concentrations of ChNs, foams were stable against coalescence and disproportionation for a period of three hours, whereas at higher concentrations, the foams were stable for several days. The enhanced stability of foams prepared with ChNs, compared to surfactant-stabilized foams, can be mainly attributed to the irreversible adsorption of the ChNs at the air–water interface, thereby providing Pickering stabilization. Both foam volume and stability of the foam were increased with an increase in ChNs concentration, and at pH values around the chitin’s pKα (pH 7.0). Under these conditions, the ChNs show minimal electrostatic repulsion and therefore a higher packing of the nanocrystals is promoted. Moreover, decreased electrostatic repulsion enhances network formation between the ChNs in the aqueous films, thereby providing additional stability by gel formation. Overall, ChNs were proven to be effective in stabilizing foams, and may be useful in the design of Pickering-stabilized food grade foams.