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Pickering emulsions stabilized by Shellac-Based nanoparticles

Abstract:

This study explored the potential of modified shellac nanoparticles (NPs) for stabilizing Pickering emulsions. We modified shellac with two types of Jeffamine®: Jeffamine® M600 and Jeffamine® ED2003, producing two NP types, Sh-M600 and Sh-ED2003, with sizes ranging from 127 to 183 nm. These NPs were used to form oil-in-water (o/w) emulsions with isopropyl myristate (IPM). Emulsion stability was assessed under both ambient and accelerated conditions. Emulsions stabilized by Sh-M600 NPs with up to 40% oil content remained stable for 6 months, whereas those stabilized by Sh-ED2003 NPs showed remarkable stability, sustaining 65% oil content over the same period and under harsh accelerated conditions without phase separation. Cryo-SEM imaging confirmed NP accumulation at the interface for all emulsion types, while interfacial tension measurements showed reduced values in the presence of NPs, supporting NP adsorption. The calculated adsorption energies revealed the superiority of Sh-ED2003 over Sh-M600, contributing to enhanced emulsion stability. Furthermore, rheology measurements revealed that the apparent viscosity of emulsions stabilized by Sh-ED2003 NPs was consistently greater than that of emulsions stabilized by Sh-M600 NPs across all oil percentages. We suggest that differences in viscosity are influenced by the molecular weight of Jeffamine® linked to shellac chains within NPs, which contributes to the observed differences in stability. This study highlights the potential of tailored NPs for robust emulsion stabilization, underscoring their relevance across diverse applications.

Biography

Keren Delmar has completed her B.Sc. in Biochemical engineering cum laude from the Technion, Israel Institute of Technology and then proceeded to complete her M.Sc. in NanoScience & Nanotechnology Summa cum laude from the Technion focusing on controlled release of hydrophobic drugs from nanocarriers embedded in hydrogels and published two articles regarding this subject. After graduating she worked as a project manager in the R&D department at Dexcel Pharma and developed drug products for the US market. Today she is completing her PhD in the chemical engineering dept. and teaching undergraduate students of this department polymer courses