

STABILIZATION OF PICKERING EMULSIONS BY BIODEGRADABLE PLGA NANOPARTICLES: INTERFACIAL STRUCTURE

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What happens at an interface stabilized by PLGA nanoparticles? We formulated Pickering emulsions stabilized by biodegradable and biocompatible poly(lactic-co-glycolic acid) (PLGA) nanoparticles (NP). We performed a physicochemical comparison of two types of emulsions: the first one stabilized by bare PLGA NP, i.e. PLGA NP without surfactants or any other polymer than PLGA, and the second one by sterically-stabilized PLGA-poly(vinyl alcohol) (PVA) NP, i.e. PLGA NP with PVA as NP stabilizers. Polymer stabilizers such as PVA are very commonly used to prepared PLGA NP. Both emulsions had medium chain triglycerides as the oil phase, at a ratio of 10% w/w. Using bottle-test, dynamic light scattering, confocal microscopy and interfacial analysis, we observed that the emulsions demonstrated very different structures at macroscopic, microscopic, and interfacial scales, depending on the type of NP used. Indeed, the emulsion layer was significantly thicker when using PLGA NP rather than PLGA-PVA NP. This was attributed to the formation and coexistence of multiple water-in-oil-in-water (W/O/W) and simple oil-in-water (O/W) droplets, using a single step of emulsification, whereas simple O/W emulsions were obtained with PLGA-PVA NP. The latter NP were more hydrophilic than bare PLGA NP because of the presence of PVA at their surface. Moreover, PLGA NP only slightly lowered the oil/water interfacial tension whereas the decrease was more pronounced with PLGA-PVA NP. The role of PVA is paramount: PVA chains at the PLGA-PVA NP surface could probably partially desorb from the NP and adsorb at the interface, inducing the interfacial tension decrease. This work has direct implications in the formulation of Pickering emulsions and stresses the paramount influence of the physicochemical nature of the NP surface into the stabilization of these systems.

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