

Does PEGylation impede phospholipid degradation?

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PEGylation (by conjugating or coating polyethylene glycol (PEG)) on the surface of drug-delivery nanoparticles have been widely applied to prevent non-specific protein absorption, increase vesicle blood circulation time, and sustain drug release. However, the effects of PEGylation for different nanoparticle systems are controversial. In order to de-couple the complicated non-linear effects of PEGylation on sustained drug release, we have systematically investigated the planner interfacial organization of phospholipid monolayers containing various amount of PEG conjugation before and after enzyme-catalyzed degradation of the lipids using X-ray reflectivity and grazing incidence X-ray diffraction techniques. The results reveal that PEG has limited effects on molecular packing and enzyme adsorption to the interface. The densely packed PEG markedly hindered microphase separation and formation of the palmitic acid- Ca^{2+} complexes, appearing as a “leaking hole” for hydrophilic drug release, after enzyme-catalyzed degradation of the phospholipids. The study provides molecular level information for design and optimization of drug-delivery nanovesicles.

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