Dehydropeptide-based plasmonic lipogels as bionanosystems for controlled drug release

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Abstract.

The encapsulation and control over drug release, mainly of hydrophilic drugs, is currently a major challenge in the application of peptide-based hydrogels for drug delivery, as it might require screening several gelator structures to achieve the adequate release profiles. This can be overcome through encapsulation of the hydrophilic drugs in liposomes, which provides an additional barrier to the drug diffusion, besides enabling the spatiotemporal control and enhanced drug release through a trigger, such as photothermia.

Hence, in this work, silica-coated gold nanoparticles and liposomes (storage units) were combined with dehydropeptide-based hydrogels as a proof-of-concept to afford peptide-based NIR light-responsive lipogels. Several liposomes compositions were assessed to study its influence on the final assembly properties. Gold nanospheres were used to assess the preparation method that enabled a closer proximity of the nanoparticles to the liposomes. The control over a hydrophilic drug model, 5(6)-carboxyfluorescein, was achieved by its encapsulation in liposomes, in which the use of photothermia induced the liposomes phase transition and stimulated the drug release. Further, despite the liposomes and silica-coated nanorods inducing a lower elastic modulus, strongly enhanced the gelation kinetics. Hereby, this work advances strategies for the development of peptide-based hydrogels towards controlled release of hydrophilic drugs through photothermia under NIR light irradiation.

Keywords: peptide hydrogels; self-assembly; liposomes; gold nanorods; photothermia; drug delivery.

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