The interplay of nanocomposites co-assembly with peptide-based gels as a strategy towards on-demand drug release

Sérgio R. S. Veloso[1]
Miguel A. Correa-Duarte[2], Paula M. T. Ferreira[3], Elisabete M. S. Castanheira[1]
[1] *Centre of Physics of Minho and Porto Universities (CF-UM-UP), Campus Gualtar, 4710-057 Braga, Portugal*
[2] *CINBIO, Universidade de Vigo, 36310 Vigo, Spain.*
[3] *Centre of Chemistry (CQUM), University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal.*
sergioveloso96@gmail.com

Self-assembled peptide-based hydrogels are highly advantageous as nanocarriers for antitumour drug delivery, owing to the low critical gelation concentration, easy tailoring of the mechanical properties, biocompatibility and similarity to the extracellular matrix [1]. The solvent pockets allow the encapsulation of composites, such as magnetic nanoparticles and liposomes. The combination of gels with magnetic nanoparticles towards magnetic gels provides a means for the real-time remote control of gels' properties. These properties can be further improved through the combination with liposomes as it enables the compartmentalization of drugs that can be released in a sequential and on-demand manner [2,3].
However, implementing a stimulus can become a cumbersome task. Often, it requires screening different structures to obtain gels with suitable properties, and drugs might not be well encapsulated and/or cause undesirable effects on the gel's properties. To overcome this challenge, a design strategy was developed that enabled the modulation of release of the chemotherapeutic drug doxorubicin through the interplay of (di)phenylalanine-coated magnetic nanoparticles, PEGylated liposomes and doxorubicin co-assembly in dehydropeptide-based gels. The co-assembly of the nanoparticles with the gel network is displayed in figure 1. The integration of liposomes as storage units enabled the tuneability of both passive and active doxorubicin release through a thermal and low-frequency alternating magnetic field trigger, which makes this design strategy promising for future developments on the control of drug release.

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FIGURES

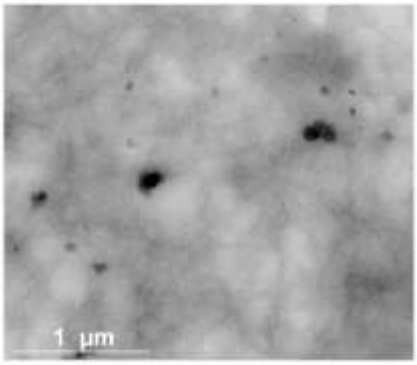

Figure 1: Transmission electron microscopy image of phenylalanine-coated nanoparticles co-assembled with the hydrogel network.

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