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Self-Assembled Nanogels for Biomedical Applications

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Nanogels, or hydrogel nanoparticles, have gained considerable attention as one of the most promising nanoparticulate drug delivery system. Different polymers have been used, in our group, for nanogels preparation, such as dextrin [1], mannan [2], glycol chitosan and hyaluronic acid. Generically, hydrophilic polymers have been modified with hydrophobic chains, and after lyophilization, dispersed in water, allowing self-organization into nanogels. This procedure avoids the use of any organic solvent.

Dextrin nanogels have been tested for different biomedical applications such as carriers of contrast agents in magnetic resonance imaging (γ-Fe_2O_3) or drugs (curcumin).

Curcumin possess potent anti-inflammatory, anti-tumor and anti-oxidative properties. Despite all these promising characteristics, a major problem with curcumin is the very low solubility in aqueous solutions, which limits bioavailability and clinical efficacy. Dextrin nanogel demonstrated to serve as an effective ‘‘nanocarrier’’ for the formulation of lipophilic curcumin by increasing its water solubility, improving its stability, and controlling its release profile.

The *in vivo* application of iron oxide nanoparticles presents limitations, due to their large surface area to volume ratio which lead to adsorption of plasma proteins and agglomeration. Surface coverage by amphiphilic polymers intend to increase the blood circulation time by minimizing or eliminating the protein adsorption to the nanoparticles. Superparamagnetic iron oxide nanoparticles were stabilized in dextrin nanogel, producing a nanomagnetogel. Formulations with different iron content, high stability in physiological conditions, diameter ≈ 140 nm and superparamagnetic performance were obtained. Relaxivity studies demonstrated high longitudinal and transversal relaxation times, important features of contrast agents for MRI.

References

[1] Gonçalves C, Martins JA, Gama FM, “Self-assembled nanoparticles of dextrin substituted with hexadecanethiol”, *Biomacromolecules* (2007) 8:392-398.

[2] Ferreira SA, Carvalho V, Costa C, Teixeira JP, Vilanova M, Gama, FM, “Self-assembled Mannan Nanogel: Cytocompatibility and Cell Localization”, *Journal of Biomedical Nanotechnology*, accepted.