

# Sterilization of chitosan nanogels: the protective role of sugars

Raquel Galante<sup>1,2</sup>, Carolina F Redigueri<sup>2</sup>, Irene S Kikuchi<sup>2</sup>, Pablo Vásquez<sup>3</sup>, Rogério Colaço<sup>1</sup>, Ana Paula Serro<sup>1,4</sup>, Terezinha de Jesus Andreoli Pinto<sup>2</sup>

<sup>1</sup>Instituto Superior Técnico, <sup>2</sup>Faculdade de Ciências Farmacêuticas - USP, <sup>3</sup>Instituto de Pesquisas Energéticas e Nucleares, <sup>4</sup>Instituto Superior de Ciências da Saúde Egas Moniz

*e-mail: raquel.galante@tecnico.ulisboa.pt*

A nanosystem designed for biomedical applications (e.g. injectables, ophthalmic solutions) cannot be toxic or irritating and must be sterile [1]. Therefore, sterilization is a critical but needed step, during which adverse effects can occur. Literature is very scarce with respect to sterilization effects on nanostructured systems, and even more in what concerns nanogels [1]. This work aims to evaluate the effect and effectiveness of conventional terminal sterilization methods (steam heat and gamma irradiation) on chitosan hydrogel nanoparticles. Chitosan-tripolyphosphate based hydrogel nanoparticles (CS/TPP), with broad spectrum of possible applications were produced and sterilized in the absence and in the presence of protective sugars (glucose and mannitol). Properties like size, zeta potential, absorbance, morphology, chemical structure and cytotoxicity were evaluated. The obtained results allowed concluding that steam heat is not a suitable method for sterilizing CS/TPP nanogel as it leads to severe degradation of the samples, with the appearance of multiple particle populations of different sizes, and large aggregates and sediments. Gamma rays exposure gave rise to immediate formation of visible sediments. However, upon the addition of protective sugars (glucose and mannitol 5%) a significant increase of the nanogel resistance to radiation was observed. This protective effect could be related with the formation of an antioxidant complex.

## REFERENCES

[1] Vetten, M. A.; Yah, C. S.; Singh, T.; Gulumian, M., Challenges facing sterilization and depyrogenation of nanoparticles: effects on structural stability and biomedical applications. *Nanomed.* 2014, 10, (7), 1391-9

## ACKNOWLEDGEMENTS

Conselho Nacional de Desenvolvimento Científico e Tecnológico (<http://cnpq.br/>)- (PhD grant 140863/2014 and project 400455/2014-5. Fundação para a Ciência e Tecnologia (<http://www.fct.pt/>) (M-ERA.NET/0005/2012 and PTDC/CTM-BIO/3640/2014.