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Biopolymeric matrices for structural and functional stabilization of bacteriophages

Victor M. Balcão[1,2], Ana R. Moreira[1], Carla G. Moutinho[1,2], José A. Teixeira[2]

[1]Bioengineering and Biopharmaceutical Chemistry Research Group, Fernando Pessoa University, Porto, Portugal; [2]IBB - Institute for Biotechnology & Bioengineering, Centre Biological Engineering, University of Minho, Braga, Portugal

In the recent past years, bacteriophage research has experienced a renaissance due to their potential application in the pharmaceutical field, especially with the increase of bacterial resistance to antibiotics and the possibility to take part in new methods of early detection and diagnosis of bacterial infections. In that context, the structural and functional stabilization of bacteriophages using biopolymeric microporous hydrogels represents a promising research focus with a broad potential biomedical/ biopharmaceutical application. The scope of this work was to develop biopolymeric non-toxic phage-hydrogels of agar and sodium alginate, obtained at neutral pH and mild polymerization conditions, in order to offer adequate characteristics to the maintenance of phage's lytic activity. Disc-like phage-hydrogels were prepared, with a phage and polymer concentration of 1.3×10^8 PFU/ml and 1.5% (w/v), respectively. Regarding the alginate hydrogels, $CaCO_3$ (22.5 mM) and GDL (48 mM) were also included in the formulation. Agar hydrogels were prepared naturally by jellification, as a function of temperature lowering, and alginate hydrogels were prepared by internal gelation. The matrices were inoculated with a suspension of susceptible (host) bacteria and incubated at 37 ºC for 24h. Observation of bacterial lawn's lysis demonstrated that bacteriophages kept their lytic activity, being the method of physical entrapment able to promote their stabilization. Cryo-SEM analysis revealed that both types of phage-hydrogels present interconnective microporous network, which guaranties a facilitated access of the phages to the bacteria, ensuring an efficient lysis of the host bacteria present in the surface of the hydrogels.The developed hydrogels also present appropriate physical and chemical properties for a wider variety of applications in the field of pharmaceutical sciences, such as controlled release of (macro)molecules, cell immobilization and 3D support for tissue regeneration.