

IN VITRO MODELLING PREPARATION OF POLYMERIC HYDROGEL SCAFFOLDS SYSTEM FOR HUMAN JOINT DISEASE.

Aleena Ijaz¹, Edvinas Krugly¹

¹Kaunas University of Technology, Faculty of Chemical Technology, Department of Environmental Technology, Kaunas, Lithuania
aleenaijaz370@gmail.com

Osteoarthritis is one of the most painful human joint diseases, characterized by joint tissue interactions, inflammation, and biomechanical cartilage degradation. Conventional in vivo models do not support combined biochemical and biomechanical conditions of joint tissues and also lack physiological relevance. This study aims to create an integrated polymeric scaffold and hydrogel system to construct an in vivo model for human joint disease. Melt electro-writing (MW) technique is used for the fabrication of poly (ϵ -caprolactone) (PCL) scaffolds to check the pore size and fiber alignment of scaffolds. Alginate-based hydrogels were prepared for human joint tissue modelling because of their biocompatibility properties, and the requirements are also less harsh. To produce hydrogels through crosslinking, calcium chloride (CaCl) is crosslinked with alginate. Different concentrations of alginate were checked for crosslinking in 15-30 min at room temperature. The compatibility of these hydrogels was checked with and without polymeric scaffolds, and their morphology and porosity. The results vary with concentration, but do not show major changes. However, as the concentration increased, the hardness also increased. Currently, methyl cellulose-based hydrogels are prepared with a thermal gelation procedure. Different concentrations of screening gels are used for gelation to create a reproducible gel. Nowadays, check the mechanical strength and water absorption of these hydrogels. To check structural properties through characterization methods, which include optical microscopy, SEM, and ImageJ analysis. To improve the hydrophilicity and cell adhesion of the surface modification of scaffolds using melt electrospinning (ME). And FTIR analysis to check the crosslinking results for the formation of hydrogels. The purpose of polymeric-hydrogel scaffolds systems is to shift away from traditional single-material systems and toward hybrid biomaterials that better mimic complex tissue interactions.

Keywords: Osteoarthritis; polymeric scaffolds; hydrogel; melt electro-writing; alginate.