MODELING AND SIMULATION OF IONIC ELECTRO ACTIVE HYDROGEL ACTUATORS FOR TISSUE ENGINEERING

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Abstract

Extensive research efforts have been devoted to the development of stimuli responsive hydrogel for tissue engineering, bioengineering and medicine, because of changing properties and function in response to external stimuli and good biocompatibility. This present study focuses on the developing a model for the mechanical behavior of an electroactive hydrogel strap immersed in a solution between two electrodes, based on coupled chemical, electrical and mechanical fields. Mentioned system has an interesting application in stemcell, drug delivery and regenerative medicine and artificial tissue. Further, a finite-element method, in which ion concentration, electric potential and deformation are approximated by using continuous functions, is developed and implemented using Comsol Multiphysics. Model is in a good agreement with experiments in the literature, and describe the effect of fixed charge ions on deformation behavior of electrolyte gel. We highlight that the proposed model can be extended for wide range of tissue engineering cases.