

Modeling and Simulation of Drug Release Through Polymer Hydrogels

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Abstract

Polymer hydrogels are commonly used as carriers or vehicles for controlled release of drugs, primarily because of their bio-compatibility and because rate of drug release can be controlled by manipulating polymer properties like molecular weight, cross linking ratio etc. Swollen hydrogels can contain up to 99.5% of water by weight, making them ideal for drug delivery by the subcutaneous route. It has been shown experimentally that drugs can be released for prolonged period of time through polymer hydrogels [1, 2]. Sustained drug release will be instrumental in eliminating the side effects and repeated dose of drug by injection and thus can increase the quality of life of patients. Modeling and simulation will not only help in understanding the factors influencing the drug release kinetics but also help in reducing the number of experiments. However, there is a lack of a detailed modeling environment which can be used to predict drug release rate through polymer hydrogels as a function of polymer properties and system variables. In the past models were developed for predicting the rate of swelling of pH sensitive hydrogels [3-6] and for diffusion of solvent and drug through hydrogels. Here, we have carried out modeling and simulation studies using COMSOL Multiphysics® to predict the rates of swelling and drug release as functions of polymer properties and system variables like pH. The model was tested with published experimental data and the model predictions are reasonably close to the data. The model is generic in nature and will be useful for the design of polymer hydrogels for controlled release of different drug molecules.

Reference

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