The mathematical modelling of affinity-based drug delivery systems

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ABSTRACT

In affinity-based delivery systems, hydrogels are chemically modified to enable them to bind to the active agent of interest. The release of the molecules from these systems is slowed by their binding to elements of the gel. In principle, varying the affinity of the molecules for the binding sites enables control of the release rate. Many of these systems can mimic the behaviour of the extracellular matrix, which acts as a natural reservoir and protective medium for growth factors and other bioactive molecules.

Mathematical models have been developed to describe drug release from a large class of affinity-based systems. In many cases, it is shown that the models can be reduced to a coupled pair of nonlinear partial differential equations. Quantitative information relating the rate of drug release to the values of the model parameters is presented. Numerical solutions are displayed that illustrate the rich variety of release behaviours the systems are capable of exhibiting. Theoretical release profiles generated by the models are compared with experimental data, and good agreement is found. It is shown that the models are capable of reproducing many of the key features of the release profiles observed in *in-vitro* release experiments.

REFERENCES

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