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A TWO-LAYER MODEL FOR DRUG DELIVERY FROM A TRANSDERMAL PATCH

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Systemic delivery of drugs by percutaneous permeation (or transdermal drug delivery) offers several advantages compared to oral release or hypotermic injection, guarantees a controlled release rate that can provide a constant concentration for a long period of time, improves patient compliance, and represents an attractive alternative to oral administration [1]. The drug released from a transdermal patch must be carefully tailored to achieve the optimal therapeutic effect and to deliver the correct dose in the required time. To this aim, it is important to understand the mechanism of drug permeation from the patch (or vehicle) across the skin [2].

A two-phase mathematical model describing the dynamics of a substance between two coupled media of different properties and extents is proposed. As a matter of fact, the drug elution depends on the properties of the "vehicle-skin" system, taken as a whole, and modelled as a two-layer system. The diffusion and the reversible binding and unbinding processes in both layers are described with a system of four partial differential equations. Additional flux continuity at the interface and clearance conditions into systemic circulation are imposed. A Sturm-Liouville problem is solved and an analytical solution is given in the form of an infinite series expansion.

The present model points out the role of the diffusion and reaction parameters, which control the complex transfer mechanism and the drug kinetics across the two layers. Drug mass are given and their dependence on the physical parameters are discussed.

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