

as diffusion in the liquid film at the surface of the matrix is predictably fast and should be reasonably similar from liquid to liquid. In a more general case in which the film is any type of material, the duration would be comparably dependent on the permeant's diffusivity through it. Regardless and eventually, a transition period is reached at which the matrix gradually assumes control of the process, ultimately with the release rate being proportional to the square root of time. In this model, it is assumed that $Q \gg C_S$, where Q is once again the total drug concentration and C_S is the drug's solubility in the matrix. The expression for the quantity of drug released within an area A is

$$M_t = Q A h_m \quad [18]$$

where h_m is the thickness of the zone of depletion within the matrix. This quantity is related to time through the following expression:

$$h_m^2 + 2 \frac{D_m h_m}{\omega K} = 2 \frac{D_m C_S t}{Q} \quad [19]$$

In this equation, D_m is the drug's diffusion coefficient in the matrix, ω is the mass transfer coefficient, and K is the external phase/matrix partition coefficient. (In the original paper, Roseman and Higuchi attributed the mass transfer resistance to an aqueous boundary layer and thus assumed ω to be D_{bl}/h_{bl} . Clearly, another value could be given to this resistance, justifying the generalizations made in the text.) Two limiting cases were presented. During the initial, usually fleeting, period the receding boundary within the matrix, characterized by h_m , is sufficiently thin that

$$2 \frac{D_m}{K \omega} \gg h_m$$

In this circumstance the amount of drug released is

$$M_t = A C_S K \omega t \quad [20]$$

This equation discloses that the release of the drug is directly proportional to the drug's solubility in the matrix and the mass transfer coefficient. Zero-order release is predicted, as the excess of solid drug ensures the maintenance of a saturated solution at the releasing surface. When differentiated for time, an expression for the instantaneous rate of release is obtained.