whether the solution vehicle is functionally well mixed or is marked with steep gradients. It must be realized that the typical application thickness of a topical product is on the order of 20 μm (13). Diffusion of even a small amount of drug from such a thin application results in a rapidly decreasing drug concentration in the donor phase, resulting in non-steady-state kinetics. There is scant information in the literature about topical drug delivery under these circumstances. Flynn et al. (15) have deduced a solution to the problem of diffusion from a solution ointment through a resistant membrane into a sink. The boundary conditions are as follows:

$$C = 0, \quad x = 0$$

$$K = \frac{C_{sc}}{C_v}, \quad x = h_{sc}$$

$$\frac{C_v}{\partial t} = D_{sc}\left[\frac{\partial C_{sc}}{\partial x}\right], \quad x = h_{sc}$$

The initial conditions to the problem are

$$C = C_0, \quad h_v > x > h_{sc}$$

$$C = 0, \quad h_{sc} > x > 0$$

where $x = 0$ is defined as the membrane-sink interface, h_v and h_{sc} are the thicknesses of the vehicle and stratum corneum (membrane), respectively, and D_{sc} is the drug's diffusivity within the stratum corneum. It is assumed that the drug is diffusionally well mixed within the vehicle. The following concentration–distance–time relationship was deduced:

$$\frac{M_t}{M_\infty} = \sum_{n=1}^{\infty}\left[\frac{2K}{h_v}\right]\frac{\left[1 - \exp^{(-D_{sc}\beta_n^2 t)}\right]}{\cos\beta_n h_{sc}\left[h_{sc}\left\{\beta_n^2 + \left[\frac{K}{h_v}\right]^2\right\} + \frac{K}{h_v}\right]} \qquad [24]$$

where β_n are the roots of $\beta_n h_{sc}\tan(\beta_n h_{sc}) = Kh_{sc}/h_v$. This equation is an adaptation of the solution to an analogous heat transfer problem (16). Computer simulations have been presented that show the effects of varying the parameters in the equation (15). The ratio K/h_{sc} was shown to affect fractional drug release with time.