$$C_1 = \frac{\gamma_2}{\gamma_1} C_2 \qquad [3]$$

The simplest way to estimate γ_2 and γ_1 is to measure the solubility, where S is the solubility.

$$\frac{\gamma_2}{\gamma_1} = \frac{S_1}{S_2} \qquad [4]$$

Thus, Eq. 3 becomes

$$C_1 = \frac{S_1}{S_2} C_2 \qquad [5]$$

Another way to state Eq. 5 is that equal fractions of the solubility will provide for equal activities in various vehicles. In most applications one wishes to optimize the flux in a formulation, and, the simplest way to do this is to work with saturated vehicles. An example of equal flux at saturation for markedly different solubilities is shown in Figure 1, and further use of this concept will be dealt with later by way of a practical example. Despite that the solubility of salicylic acid is 100 times greater in propylene glycol than in water, the fluxes across human epidermis are nearly the same.

C. Finite Doses and Vehicle Evaporation

Except for enclosed systems, such as transdermal patches, one is limited to a very thin film. Product application of a cream is usually limited to a few milligrams per square centimeter, because application of more material will result in a sticky film that will easily be removed by clothing and such. The consequences of thin films can be easily seen by considering the solution of the appropriate diffusion equations. If a finite dose of volume V is applied to surface of area A and it is assumed that the vehicle does not penetrate or evaporate, the equations for the flux J, are

$$V \frac{dC_V}{dt} = AD\left(\frac{\partial C}{\partial x}\right)_{x = 0} \qquad [6]$$