$$q_1 = q_1' + q_2' = \left(\exp(p_1 + p_2\varphi) + \frac{q_s K_1}{K_2 c_2 + K_3 c_3}\right) c_1 \tag{63}$$

It is well established that the retention coefficient k is proportional to the derivative of the solute concentration in the solid phase with respect to the solute concentration in the mobile phase:

$$k = \Phi \frac{\partial q_1}{\partial c_1} \tag{64}$$

The proportionality factor Φ (usually referred to as the phase ratio) is the volume ratio of stationary phase to mobile phase.

Keeping in mind that the retardation factor R_f is defined as $R_f = 1/(1 + k)$ and assuming that the mobile-phase components form an ideal mixture, the following relationship for R_f can finally be derived from Eqs. 63 and 64 (37):

$$R_f = \frac{1}{1 + \exp(p_1 + p_2\varphi) + 1/[p_3\varphi + p_4(1 - \varphi)]} \tag{65}$$

where the phase ratio Φ is incorporated in the unknown terms p_i. The performance of this model was extensively tested on many experimental results (37) taken from the literature and relating to (a) the chemically bonded 3-cyanopropyl stationary phase with 2-propanol–*n*-hexane as the mobile phase (NP-TLC), (b) the chemically bonded octadecyl stationary phase with methanol–water as the mobile phase (RP-TLC), (c) silanized silica with methanol–water as the mobile phase (RP-TLC), and (d) silanized silica impregnated with paraffin oil as the stationary phase and methanol–water as the mobile phase (RP-TLC).

The outcome of this test led to the general conclusion that the fit of the experimental data to Eq. 65 was outstanding. A typical comparison of experimental and theoretically predicted data is shown in Fig. 9.

5. Other Approaches

The general approach to solute distribution between the stationary and mobile phases proposed by Scott and Kucera (15,16) can also find application in the prediction of elution strength with binary solvent mobile phases. To demonstrate such a possibility, Eq. 33c is rewritten as

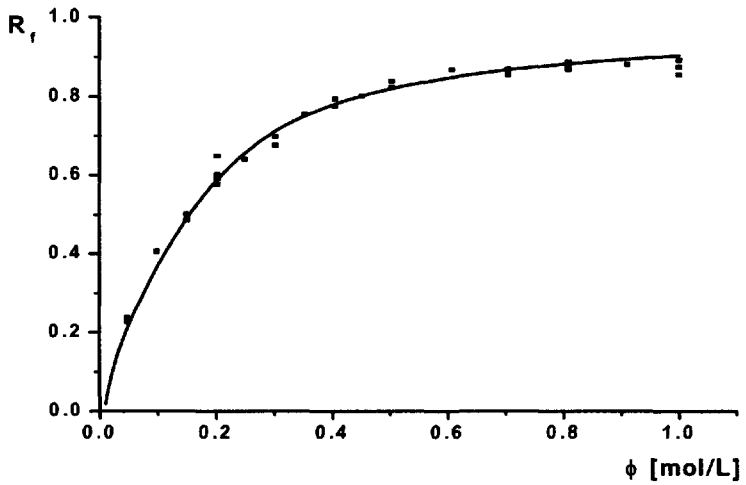

Figure 9 Relationship between R_f and φ for 1-naphthol chromatographed in system (a).