LETTERS TO THE EDITOR

To the Editor:

Regarding D. Ajinkya's suggestions for changing the Journal's format [*AIChE J.*, 21, 1236 (1975)]—may I demur?

I, too, have been an eager young Shell researcher, with long night shifts available for leisurely study of the literature while tending autoclaves and stills. I, too, have struggled to review for your readers the coverage, the apparent good and bad points, and the flavor of a new book (and have been still dissatisfied with the final version). But it is as an appreciative reader of the Journal that I write this.

Nearly all Engineers of my acquaintance must budget their reading time. Until senescence, most like to include reading papers outside their current narrow specialties, but usually not too far afield. Such people, I believe, are efficiently served by your present format. Whether Harding Bliss' or Harrison Howe's ways were better is not answerable because they enjoyed milieus different from yours. Like them, you provide intellectual adventures in each issue, and occasionally information of immediate usefulness.

That authors do not write well is your problem, but not your fault. That industrially employed engineers write at all is remarkable. In my experience, most industrial research is not published, partly from diffidence or sloth of the investigator, partly because it is seldom as complete as he (and the editor and readers) would like. But that's another problem. And sufficient unto the day are the problems thereof!

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To the Editor:

Chandrasekhar and Hoelscher [*AIChE J.*, 21, 103, (1975)] have studied the transfer of acetic acid from water to toluene and claimed that the interface of this system provides a mass transfer resistance of about 10^4 s/cm. This interfacial resistance was also investigated by Ward and Brooks [*Trans. Faraday Soc.*, 48, 1124 (1952)] and it was reported that they could not measure this resistance because it was too small.

The validity of the work by Chandraseklar and Hoelscher (1975) should be questioned on the following grounds.

(1) Their mathematical model to evaluate the interfacial resistance is as follows (with minor corrections):

$$\frac{\partial C_i}{\partial x} = D_i \frac{\partial^2 C_i}{\partial x^2}$$

$$\begin{array}{lll} i = 1 & \text{for the water phase} & x \geq 0 \\ \phantom{i = {}}2 & \text{for the toluene phase} & x < 0 \end{array} \qquad (1)$$

$$\text{I.C. 1:}\quad \text{At}\quad t = 0 \quad x > 0 \quad C_1 = C_o$$

$$x < 0 \quad C_2 = 0$$

$$\text{B.C. 1:}\quad \text{At}\quad x = 0 \quad C_1 = C_2$$

or

$$D_1 \frac{\partial C_1}{\partial x} + h(C_2 - C_1) = 0$$

$$\text{B.C. 2:}\quad \text{At}\quad x = \infty \quad C_1 = C_o$$

$$x = -\infty \quad C_2 = 0$$

$$\text{B.C. 3:}\quad \text{At}\quad x = 0$$

$$D_1 \frac{\partial C_1}{\partial x_1} = D_2 \frac{\partial C_2}{\partial x_2}$$

Boundary condition 1 is not correct, and it should be written as

$$C_1 = kC_2$$

or

$$D_1 \frac{\partial C_1}{\partial x} + h(kC_2 - C_1) = 0$$

where k is the equilibrium distribution coefficient. This value was given by Ward and Brooks (1952) and is much greater than unity. By comparing the correct boundary condition to the assumed boundary condition 1, one easily notices that the wrong boundary condition would give a higher interfacial resistance. The boundary condition 2 is also questionable because the solute had reached the outer boundary of one phase in their experiment.

(2) They seem to suggest that the thickness of interfacial layer is on the order of 0.1 mm. This is very large compared with 10Å, the value assumed by Ward and Brooks (1952).

(3) Their Equation (5) is not correct, but should be written as

$$\left.\frac{\partial C_1}{\partial x}\right|_{x=0} = \frac{(D_2/D_1)^{1/2}}{1 + (D_2/D_1)^{1/2}} C_o h_1 \left[1 - \frac{3h_1}{\sqrt{\pi}} \sqrt{D_1 t} \right]$$

(4) They claimed that the maximum mass flux occurs, not at the interface, but at regions further away from it. This is contradictory to the observation by Ward and Brooks (1952) and also their own mathematical model. Even though the solution of the above Equation (1) may easily be obtained under the correct boundary conditions, we will not present the solution here.

They suggested that the interfacial disturbance may occur due to heat flux, but not a mass flux. It is well known that interfacial disturbances may occur due to heat fluxes *and/or* mass fluxes. Ward and Brooks also did not notice a disturbance in the same system but this does not negate the possibility of disturbances in other systems. Furthermore, interfacial disturbances may or may not occur depending upon the direction of the solute transfer [Sternling and Scriven *AIChE J.*, 5, 514 (1959)].

NOTATION

C = solute concentration
D = solute diffusivity
h = interfacial transfer coefficient
h_1 = $h/D_1 \{1 + (D_1/D_2)^{1/2}\}$
k = equilibrium distribution constant
t = time
x = coordinate normal to interface

Subscripts

o = initial condition
1 = aqueous phase
2 = organic phase

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