COMMENTS ON THE PAPER "FLOODING VELOCITIES OF GAS-LIQUID AND LIQUID-LIQUID CONTACTORS OF COLUMN TYPE"

by Takahashi et al., J. Chem. Eng. Japan, Vol. 7, No. 3, pp. 223-225 (1974)

Dear Sir:

The authors' parameters X and Y are more general forms of the variables V_G^* and V_L^* given in their equation (3). It is therefore interesting to see how their equation (1) compares with an equation of the form

$$X^{0.5} + Y^{0.5} = C \quad (a)$$

Using the authors' correlation we may compute the expression

$$X^{0.5} + Y^{0.5} = X^{0.5} + [\exp(2.9/\ln X)]^{0.5} \quad (b)$$

which turns out to lie between 0.83 and 0.854 over the range $X=3 \times 10^{-4}$, $Y=0.7$ to $X=0.7$, $Y=3 \times 10^{-4}$ (i.e. the range covered by Fig. 4). Thus the value of C needed in (a) in order to agree with the authors' correlation is $0.842 \pm 1.5\%$, a precision far better than the accuracy of most flooding data.

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(received January 27, 1975.)

Dear Sir:

In our previous paper^{1,2}, it was found that the flooding velocities of the various gas-liquid and liquid-liquid contactors of column type could be correlated by the following Eqs. (1) and (2), and also that P_X , P_Y and S_F in Eq. (2) could be represented as shown

in Table 1.

$$Y = \exp(2.9/\ln X) \quad (1)$$

$$\left. \begin{aligned} X &= U_{LF}(P_X S_F)^{0.5} \\ Y &= U_{GF}(P_Y S_F)^{0.5} \end{aligned} \right\} \quad (2)$$

Furthermore, Eq. (1) was derived from the results of many experimental studies of packed columns in another paper^{2,3}.

As mentioned in the paper^{1,2}, Wallis has correlated the flooding velocities of wetted-wall columns by the equation

$$V_G^{*0.5} + V_L^{*0.5} = C \quad (3)$$

where $V_G^* = U_{GF} \rho_G^{0.5} (D_T g \Delta \rho)^{-0.5}$ and $V_L^* = U_{LF} \rho_L^{0.5} (D_T g \Delta \rho)^{-0.5}$.

According to the comment of Wallis, the parameters X and Y in Eq. (2) are more general forms of the variables V_G^* and V_L^* given in Eq. (3), and he has shown the following equation:

$$X^{0.5} + Y^{0.5} = C \quad (4)$$

In previous work^{1,2}, X and Y varied from 0.00054 to 0.557 and from 0.0097 to 0.681, respectively.

Rearranging these data by Eq. (4), C becomes nearly constant, as shown in Table 1. The average value of C and standard deviation are 0.832 and 0.0552, respectively. As a result, the following equation is obtained.

$$X^{0.5} + Y^{0.5} = 0.832 \quad (5)$$

The above equation is a simpler form as compared with Eq. (1). From this the flooding velocities of the various gas-liquid and liquid-liquid contactors of column type can be calculated easily by using Eqs. (5) and (2) and Table 1.

We wish to thank Professor G. B. Wallis for his comment.

Table 1 Ranges of C , $\bar{C}$ and standard deviations of C in various contactors

Type of contactor	Number of C	$C_{\max}$	$C_{\min}$	$\bar{C}$	Standard deviation of C
Gas-liquid system					
Wetted-wall column	181	0.940	0.419	0.828	0.0915
Plate column with downcomer	122	0.909	0.685	0.819	0.0397
Plate column without downcomer					
Sieve tray	117	0.943	0.771	0.851	0.0519
Sieve tray with holes of two differential diameters	78	0.917	0.745	0.839	0.0370
Turbo-grid tray	124	0.991	0.706	0.838	0.0571
Ripple tray Rectangular type	157	0.918	0.708	0.830	0.0308
Triangular type	92	0.998	0.679	0.824	0.0496
Rotational-current tray U.G.T.	37	0.892	0.792	0.835	0.0243
D.G.T.	44	0.922	0.747	0.833	0.0532
Liquid-liquid system					
Packed column	59	0.901	0.733	0.814	0.0870
Spray column	50	1.012	0.667	0.840	0.0878