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ERRATUM

Professor S. Okamura of Nagoya University has pointed out an error in Equations (12) and (13) in the article "The Role of Porosity in Filtration: IV, Constant Pressure Filtration," [*A.I.Ch.E. Journal*, **6**, 595 (1960)]. The incorrect equation was written as

$$\frac{q_i}{q_1} = \frac{1 - m_i s}{1 - ms} \tag{1}$$

In deriving this equation a compaction effect was neglected. In Figure 1 an increase in cake thickness from L to $L + dL$ in time $d\theta$ is shown. At the same time the thickness increases by dL, the original cake is compacted to thickness L'. The amount of cake laid down must equal dL'. Use of dL rather than dL' led to the error in the original derivation.

The mass of cake deposited is

$$dw = \rho_s (1 - \epsilon_i)\, dL' \tag{2}$$

Since $w = \rho_s(1 - \epsilon_{av})\, L$, dw is also given by

$$dw = \rho_s(1 - \epsilon_{av})\, dL - \rho_s L d\epsilon_{av} \tag{3}$$

Equating (2) and (3) one obtains

$$dL' = \frac{1 - \epsilon_{av}}{1 - \epsilon_i} dL - \frac{L}{1 - \epsilon_i}\, d\epsilon_{av} \tag{4}$$

The fraction of freshly deposited cake which flows out of dL into the cake is given by

$$\frac{dL' - dL}{dL'} = \frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}} - \left[\frac{1 - \epsilon_i}{1 - \epsilon_{av}}\right]\left[\frac{L(d\epsilon_{av}/dL)}{1 - \epsilon_{av} - L(d\epsilon_{av}/dL)}\right] \tag{5}$$

If the average porosity is constant, the last term in (5) is zero.

The flow rate q_i at the surface layer can be obtained as follows

q_i = liquid flow rate in slurry — rate of liquid deposited in dL' + rate of liquid squeezed out of dL' (6)

It was previously demonstrated in the original derivation on a unit area basis that

$$\text{liquid flow rate in slurry} = \frac{1 - s}{\rho s}\frac{dw}{d\theta} \tag{7}$$

$$\text{rate of liquid deposited} = \frac{m_i - 1}{\rho}\frac{dw}{d\theta} \tag{8}$$

Equations (7) and (8) were Equations (9) and (10) in the original derivation. The liquid squeezed out of dL' and added to the internal flow rate is

$$\frac{dL' - dL}{dL'}\left(\frac{\epsilon_i}{1 - \epsilon_i}\right)\frac{1}{\rho_s}\frac{dw}{d\theta} \tag{9}$$

When ϵ_{av} is constant, this becomes

$$\left(\frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}}\right)\left(\frac{\epsilon_i}{1 - \epsilon_i}\right)\frac{1}{\rho_s}\frac{dw}{d\theta} \tag{10}$$

then

$$q_i = \left[\frac{1 - s}{s} - (m_i - 1) + \frac{\rho}{\rho_s}\left(\frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}}\right)\left(\frac{\epsilon_i}{1 - \epsilon_i}\right)\right]\frac{1}{\rho}\frac{dw}{d\theta} \tag{11}$$

or

$$q_i = \left[\frac{1 - m_i s}{s} + \frac{\rho}{\rho_s}\left(\frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}}\right)\left(\frac{\epsilon_i}{1 - \epsilon_i}\right)\right]\frac{1}{\rho}\frac{dw}{d\theta} \tag{12}$$

From Equation (8) of the previous article the flow rate q_1 at the medium was found to be

$$q_1 = \left(\frac{1 - ms}{\rho s}\right)\frac{dw}{d\theta} - \frac{w}{\rho}\frac{dm}{d\theta} \tag{13}$$

If ϵ_{av} is constant, $dm/d\theta$ is zero. For this special case q_1 reduces to the first term on the right-hand side of (12). Dividing q_1 into q_i one obtains

$$\frac{q_i}{q_1} = \frac{1 - m_i s}{1 - ms} + \frac{\rho}{\rho_s}\,\frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}}\,\frac{\epsilon_i}{1 - \epsilon_i}\,\frac{s}{1 - ms} \tag{14}$$

$$= \frac{1 - m_i s}{1 - ms}\left[1 + \frac{\epsilon_i - \epsilon_{av}}{1 - \epsilon_{av}}\,\frac{m_i - 1}{1 - m_i s}\, s\right] \tag{15}$$

When s approaches its limiting, maximum value $1/m_i$, q_i/q_1 approaches ϵ_i instead of zero as previously assumed.

In discussing a flow rate variation for the data of Grace (*1*) for zinc sulfide, q_1 was calculated to be 8.27, q_i obtained from Equation (1). Since $\epsilon_i = 0.94$, the variation was much smaller. Use of Equation (15) indicates that the flow ratio in this example was only about 1.05. The values in Table 1 of "The Role of Porosity in Filtration: IV" should be modified in accordance with (15). In general q_1 will not be over twice the value of q_i.

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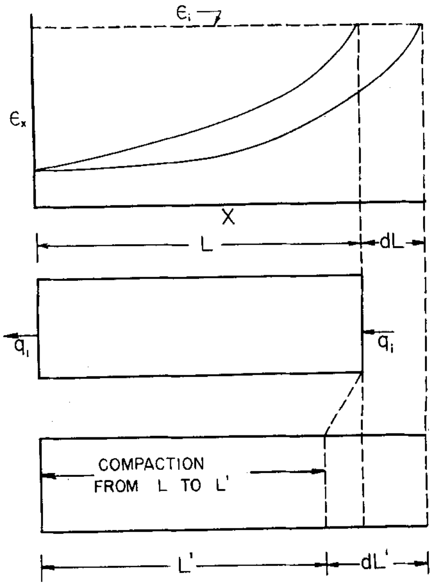

Fig. 1.