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NOMENCLATURES

Dimension are given in terms of mass(M), length(L) and time(T).

a : Constant

A : Area (L^2)

c : Constant

C : Constant

C_f : Final concentration (ML^{-3})

C_o : Initial concentration (ML^{-3})

C_S : Saturation concentration (ML^{-3})

$\bar{d}_p$: Average particle dimeter (L)

d_p : Particle diameter (L)

D_a : Impeller diameter (L)

D_{AB}, D_V : Diffusion coefficient (L^2T^{-1})

g : Gravitational acceleration (LT^{-2})

H : Height of liquid in the vessel (L)

k : Mass transfer coefficient (LT^{-1})

m_1, m_2 : Weight of α-napthol pellets (M)

ΔM : α -napthol weight lost during diffusion (M)

M_A, M_B : Molecular weight of species A and B $(M\ mole^{-1})$

n : Number of particles

n_c : Number of baffled

n_p : Number of blades of agitator

N : Rotation speed (T^{-1})

N_c : Critical speed of rotation (T^{-1})

p,q : Exponents

p : Power (ML^2T^{-3})

t : Time (T)

T : Tank diameter (L)

V : Volume of liquid in the vessel (L^3)

V_ω : Velocity of fluid relative to impeller blade tip (LT^{-1})

V_c : Fluid velocity leaving impeller periphery (LT^{-1})

V_r : Radial component of fluid velocity (LT^{-1})

V_p : Peripheral impeller velocity (LT^{-1})

γ : Angle between the plane of an inclined impeller blade and the plane in which the impellers rotation

β : Angle between the plane of an inclined impeller blade and the plane in which the impeller rotates.

δ : Film thickness (L)

θ : Temperature (θ)

μ : Liquid viscosity $ML^{-1}T^{-1}$

ν : Kinematic viscosity (L^2T^{-1})

ρ_1 : Liquid density (ML^{-3})

ρ_s : Solid density (ML^{-3})

ω : angular velocity (T^{-1})

Commonlly used Dimensionless Groups

Re_p : Reynolds number refer to solid particle ($\frac{d_p T\omega\rho}{\mu}$)

Re_a : Reynolds number refer to agitator ($\frac{D^2 a\omega\rho}{\mu}$)

Re_T : Reynolds number refer to tank ($\frac{T^2 \omega\rho}{\mu}$)

Sc : Schmidt number ($\frac{\mu}{\rho_l D_v}$)

Sh_p : Sherwood number ($\frac{kd_p}{D_v}$)

APPENDIX 1

DETERMINATION OF DENSITY

In this work the density of α-napthol is measured at room temperature (27°C) using water displacement principle, as follows : The dry empty pyconometer is weighed. Ten pellets of α -napthol of known weight are carefully dropped into the filled pyconometer and the water displacement of α-napthol pellets which over flowed from the pyconometer is wiped off using a clean towel. The final weight of the pyconometer with α-napthol pellets and water is determined. The density value can then be easily calculated, as follows

Weight of empty pyconometer, m_1 = 13.6151 g.
Weight of pyconometer + water, m_2 = 24.0421 g.
Weight of α-napthol pellets , m_3 = 1.4345 g.
Weight of pyconometer + water
+ α-napthol pellets, m_4 = 24.3519 g.
Density of water = 1.0000 g/cc
Volume of α-napthol measured by
water displacement, $m_2-(m_4-m_3)$ = 1.1247 g.
Density of α -napthol = m/V
= 1.4345/1.1247
= 1.2754 g/cc

The density value obtained from twenty experimental results of which the error is within ± 0.005%

APPENDIX 2

DIMENSIONAL ANAYLSIS OF MASS TRANSFER CORRELATION

In solid-liquid agitation the entire mass transfer relation can be expressed by five independent variables as follows :

$$k = f(d_p, \mu, \rho, D_V, \omega)$$

where D_V is the diffusion coefficient of a solid in liquid

ω is the rotation speed of the agitator.

Let $k = C\, d_p^{\,a}\, \mu^b\, \rho^c\, D_V^{\,d}\, \omega^e$

where C is a constant. The dimensions of each term may be expressed in term of Mass M, length L, and time T units.

Equate the exponents for mass, length and time, respectively, to give

$$(LT^{-1}) = (L)^a (ML^{-1}T^{-1})^b (ML^{-3})^c (L^2T^{-1})^d (T^{-1})^e$$

therefore,

$M : 0 = b+c$

$L : 1 = a-b-3c+2d$

$T : -1 = -b-d-e$

therefore

$b = -c$

$d = 1-b-e$

$a = -1+2e$

Express the k in term of the exponents derived above to give

$$k = C\, d_p^{(-1+2e)}\ \mu^{-c}\ \rho^{c}\ D_V^{(1+c-e)}\ \omega^{e}$$

therefore,

$$k = C d_p^{-1} D_V^{+1} \left(\frac{d_p^2 \omega\rho}{\mu}\right)^{e} \left(\frac{\mu}{D_V}\right)^{e} \left(\frac{\rho D_V}{\mu}\right)^{c}$$

Rearrange the term to give

$$\frac{k}{D_V} d_p = C \left(\frac{d_p^2 \omega\rho}{\mu}\right)^{e} \left(\frac{\mu}{\rho D_V}\right)^{e-c}$$

Let $p = e$, $q = e-c$, and rewrite equation as

$$\frac{kd_p}{D_V} = C \left(\frac{d_p^2 \omega\rho}{\mu}\right)^{p} \left(\frac{\mu}{\rho D_V}\right)^{q}$$

therefore,

$$Sh = f\ (Re_p,\ Sc)$$

BIOGRAPHY

Miss Penkha Saetun was born on May 1, 1956 at Mahasarakam. She received a Bachelor of Science Degree from The Faculty of Science, Khonkaen University in 1978. She is at present a tutor at The Department of Industrial Agriculture, Kasetsart University.