NOMENCLATURE

\( A_d \) Area of the dispersed phase droplets at any instant in the column, \((m^2)\)

\( a \) Effective interfacial area of contact between the phases, \((m^2/m^3)\)

\( a_1, a_2, a_3 \ldots a_9 \) Indices

\( b \) Coalescence factor

\( b_1, b_2, b_3 \) Indices

\( C \) Concentration of a liquid stream, \((kg/mole/m^3)\)

\( (\Delta C)_{lm} \) Logmean concentration driving force, \((kg/mole/m^3)\)

\( C_1, C_2, C_3, C_4, C_T \) Constants

\( c \) Continuous phase

\( C^* \) Concentration at equilibrium, \((kg/mole/m^3)\)

\( C_{cl} \) Concentration of the continuous phase stream at the bottom of the column, \((kg/mole/m^3)\)

\( C_{c2} \) Concentration of the continuous phase stream at the top of the column, \((kg/mole/m^3)\)

\( C_{d1} \) Concentration of the dispersed phase stream at the bottom of the column, \((kg/mole/m^3)\)

\( C_{d2} \) Concentration of the dispersed phase stream at the top of the column, \((kg/mole/m^3)\)

\( C_R \) Constriction factor

\( d \) Dispersed phase

\( d_{32} \) Sauter-mean diameter of the droplets, \((m)\)

\( (\Delta \gamma) \) Difference in interfacial tension

\( (\Delta C) \) Difference in concentration

\( D \) Diffusivity of the solute, \((m^2/s)\)
Dp \quad \text{Drop size, m}

Dr \quad \text{Rotor disc diameter, m}

Ds \quad \text{Stator ring opening, m}

Dc \quad \text{Column diameter, m}

E \quad \text{Extraction factor}

Fr \quad \text{Froude number, } (N^2 D_r / g), \text{ Dimensionless}

g \quad \text{Acceleration due to gravity, } (m/s^2)

Gf \quad \text{Geometry group, Dimensionless}

(D_p/D_r)^{2.1} (D_r/D_c)^{2.5} (D_c/Z_c)^{0.75}

(HTU)_{oc} \quad \text{Overall height of transfer units, m}

k_1, k_2, k_6, k_7 \quad \text{Constants}

k_c \text{ and } k_d \quad \text{Individual area based coefficients (for continuous and dispersed phases) for mass transfer, (m/s)}

k_c^a \text{ and } k_d^a \quad \text{Individual volumetric mass transfer coefficients (for continuous and dispersed phases), (m/s)}

K, K_1, \ldots, K_8 \quad \text{Constants}

K_{oc} \quad \text{Overall area based mass transfer coefficient for continuous phase, (m/s)}

K_{oc}^a \quad \text{Overall volumetric mass transfer coefficient based on dispersed phase, (s^{-1})}

K_{oc}^a* \quad K_{oc} a / [(g^3 \Delta \rho^3) / (\rho_c^2 \gamma)]^{0.25}, \text{ Dimensionless}

m \quad \text{Equilibrium distribution coefficient, } C_d / C_c

Mo \quad [(\mu_c^4 g)/(\gamma^3 \Delta \rho)], \text{ Dimensionless}

n, n_1, n_2, \ldots, n_5, n_6 \quad \text{Indices}

N \quad \text{Rotord speed, (rps)}

N_{A} \quad \text{Average rate of mass transfer, (kgmole/s)}

Re_R \quad \text{Reynold's number, } (N_d r^2 \rho_c / \mu_c), \text{ Dimensionless}

RMS \quad \text{Root Mean Square}
s \quad \text{Rate of surface renewal for mass transfer}

(Sc)_c \text{ and } (Sc)_d \quad \text{Schmidt Number (based on continuous and dispersed phase), } (\mu/\rho \cdot D)

T \quad \text{Retention time of dispersed phase}

U_c \text{ and } U_d \quad \text{Superficial velocities of continuous and dispersed phases, } (\text{m/s})

U_d^* \quad U_d/[(\gamma \Delta \rho g)/(\rho_c^2)]^{0.25}, \text{ Dimensionless}

U_0 \quad \text{Characteristic velocity, } (\text{m/s})

U_0^* \quad U_0/[(\gamma \Delta \rho g)/(\rho_c^2)]^{0.25}, \text{ Dimensionless}

U_s \quad \text{Slip velocity}

U_s^* \quad U_s/[(\gamma \Delta \rho g)/(\rho_c^2)]^{0.25}, \text{ Dimensionless}

U_i \quad \text{Drop terminal velocity, } (\text{m/s})

\nu \quad \text{Voidage of packing}

V \quad \text{Effective volume of the column, } (\text{m}^3)

V_d \quad \text{Volume of dispersed phase droplets, } (\text{m}^3)

x \quad \text{Power dissipation, } \text{W/kg}

Z_c \quad \text{Compartment height, } m

Z_T \quad \text{Contact / dispersion height, } (\text{m})

\textbf{Greek letters}

\varepsilon \quad \text{Fractional dispersed phase hold-up}

\gamma \quad \text{Interfacial tension, } (\text{mN/m})

\mu \quad \text{Viscosity, } (\text{Pa.s})

\rho \quad \text{Density, } (\text{kg/m}^3)

\Delta \rho \quad \text{Difference in density, } (\text{kg/m}^3)

\eta \quad \text{Compartment efficiency}

\psi_1 \quad \{U_d / (\gamma \Delta \rho g / \rho_c^2)^{0.25}\}^{1.0} (1+(U_c/U_d))^{0.15}

\psi_2 \quad (N^2 D_v g)^{0.33} (\mu_c^4 g^3 \gamma^3 \Delta \rho)^{0.07} (\rho_c/\Delta \rho)^{0.2}
\[ \psi_3 = \left( \frac{U_d}{\gamma \Delta \rho g / \rho_c} \right)^{0.25} \left( 1 + \left( \frac{U_c}{U_d} \right) \right)^{0.07} \]

\[ \psi_4 = \left( \frac{U_d}{\gamma \Delta \rho g / \rho_c} \right)^{0.35} \left( 1 + \left( \frac{U_c}{U_d} \right) \right)^{0.02} \]

\[ \psi_5 = \left( \frac{(Sc)_d^{1/2} + m(Sc)_c^{1/2}}{1} \right)^{-1} \]

**Subscripts**

- **c**  
  Continuous phase

- **d**  
  Dispersed phase

- **f**  
  Flooding