Diffusion

$$\xi_{fD} = 2Pe^{-2/3} + 1.24\left(\frac{d_p}{d_f}\right)^{2/3}(KuPe)^{-1/2} \quad Pe = \frac{d_f U_0}{D_p} = \frac{3\pi d_f U_0 \eta d_p}{kTC_c}$$

Gravitational Settling

$$\xi_{fG} = G_f\left(1 + \frac{d_p}{d_f}\right)\sin\alpha \quad G_f = \frac{V_{TS}}{U_0} = \frac{\rho_p d_p^2 C_c g}{18\eta U_0}$$

Electrostatic Deposition

$$\xi_{fE} = 1.5\left(\frac{(\varepsilon_f - 1)}{(\varepsilon_f + 1)}\frac{q^2}{12\pi^2\eta U_0 \varepsilon_0 d_p d_f^2}\right)^{1/2}$$

, $\varepsilon_o = 8.85 \times 10^{-12}\ C^2/N{\cdot}m^2$

Total Single-Fiber Collection Efficiency

$$\xi_{f\Sigma} = 1 - (1 - \xi_{fp})(1 - \xi_{fI})(1 - \xi_{fD})(1 - \xi_{fG})(1 - \xi_{fE})$$

Penetration $P_n = 1 - \eta_f = \exp\left(-\eta_{f\Sigma}\frac{4\alpha_s}{\pi d_f}H_f\right)$

Pressure Drop $\Delta P = \frac{64\eta H_f U_0 \alpha_s^{1.5}(1+56\alpha_s^3)}{d_f^2}$, (for $0.006 < a_s < 0.3$)

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