Review on Particle Size Distribution

\[ d\Phi = \frac{1}{(2\pi)^{1/2}} \exp\left(-\frac{z^2}{2}\right)dz \]

\[ z = \frac{\ln D - \ln D_{\text{mean}}}{\sigma} \]

in the text, \( z = \frac{\ln D - \ln D_{\text{mean}}}{\sigma} \)

\[ \frac{d\Phi}{dz} = \text{standard normal distribution} \]

Graph of \( \frac{d\Phi}{dz} \)

area = 0.8413 - (1 - 0.3413) = \Phi(1) - \Phi(-1) = 0.4826

\[ \text{area} = \Phi(z) - \Phi(-z) = 0.9772 - (1 - 0.9772) = 0.9544 \]

Graph of \( \Phi(a) = \text{cumulative normal distribution} \)

where \( \Phi(a) = \frac{1}{(2\pi)^{1/2}} \int_{-\infty}^{a} \exp\left(-\frac{z^2}{2}\right)dz \)

\[ \Phi(0) = \frac{1}{2} \]

\[ \Phi(1) = 0.8413 \]

\[ \Phi(2) = 0.9772 \]

\[ \Phi(\infty) = 1, \Phi(-\infty) = 0 \]

\[ \Phi(-a) = 1 - \Phi(a) \]

\[ \Phi(a) = \frac{a}{a_1, a_2} \]

Pr \((a_1 < z < a_2) = \)

\[ \Delta\Phi = \Phi(a_2) - \Phi(a_1) \]

\( \text{in size range given by } z = a_1 \text{ to } z = a_2 \)
Overall collection efficiency or overall penetration

\[ \eta_o = \sum_i \eta(D_i) \frac{w_i}{\text{mass}} \quad \text{or} \quad p_o = \sum_i \eta(D_i) w_i \quad \text{or} \quad \eta_o = \sum_i \eta(D_i) \Delta \Phi_i \]

For continuous \( \eta \) and \( w \), by mass

\[ \eta_o = \int_{D_1}^{D_2} \eta(D) \frac{d\Phi}{dD} \text{ dD} \quad \text{or} \quad p_o = \int_{D_1}^{D_2} \eta(D) \frac{d\Phi}{dD} \text{ dD} \]

\[ \frac{d\Phi}{dD} = dw \]

For log-probability plot, plot \( \ln D / \mu \alpha \phi(z) \)

For \( \phi(z) = \frac{1}{2}, z = 0 \) and \( \ln D = \ln D_g = \ln D_{\text{mean}} \)

In Fig 8.10, \( p_o \approx 23 \) "typical line" \( \Rightarrow D_g = D_{\text{mean}} = 20 \mu m \)

In same Fig., for \( \phi(z) = 0.8413, z = 1 \) \( \Rightarrow D = 70 \mu m \)

\[ \ln \eta_o - \ln \eta_{20} = \frac{\ln \eta}{\ln \sigma} \quad \text{or} \quad \sigma = \frac{z}{2} = 3.5 \mu m \]

\[ \text{and} \quad \sigma = \ln \sigma = \ln 3.5 = 1.25 \]