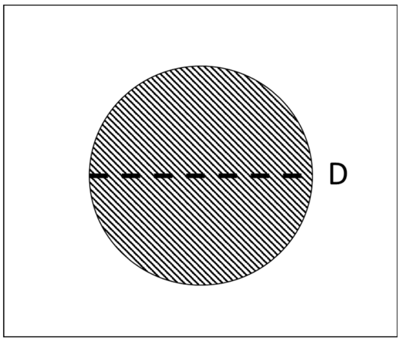
Derivation of Surface Area-To-Total Volume ratio for Fiber scaffolds, as a function of Geometric parameters, $S_{Fiber} = f\,(D_{Fiber}, \varepsilon)$

Assume that fiber scaffolds are composed of only cylindrical fibers, with the average diameter of fiber as D_{Fiber}, average length as L and number of fibers as n.



The surface area of the all fibers can be evaluated as the total surface area of all cylindrical fibers:

$$S = n \times \pi L D_{Fiber} \tag{1}$$

The porosity of scaffold (unitless) is defined as follows:

$$\varepsilon = \frac{V_{cavities}}{V_{total}} \tag{2}$$

The surface area-to-total volume (S_{Fiber}) can be expressed by its relationship with the surface area-to-solid volume ($S_{Fiber.Solid}$) and the porosity (ε) of the scaffold as follows:

$$S_{Fiber} = S_{Fiber.Solid}\,(1 - \frac{V_{cavities}}{V_{total}}) = S_{Fiber.Solid}\,(1 - \varepsilon) \tag{3}$$

The surface area-to-solid volume of fiber scaffold can be calculated as:

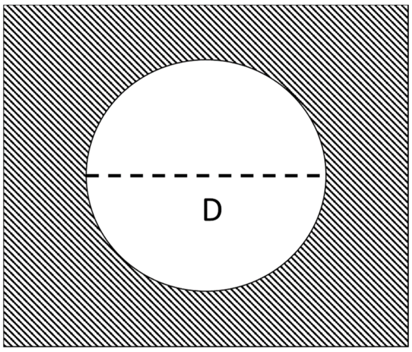
$$S_{Finer.Solid} = \frac{Surface\ Area}{Solid\ volume} = \frac{n \times \pi L D_{Fiber}}{n \times \frac{\pi D_{Fiber}^2}{4} L} = \frac{4}{D_{Fiber}} \tag{4}$$

Replacing $S_{Fiber.Solid}$ into the equation for calculating S_{Fiber} above, we obtain:

$$S_{Fiber} = \frac{4}{D_{Fiber}}(1 - \varepsilon) \tag{5}$$

Derivation of Surface Area-To-Total Volume ratio for Foam scaffolds, as a function of Geometric parameters, $S_{Foam} = f\,(D_{SaltGrain}, \varepsilon)$

Assume that foam scaffolds are composed of polymer matrix with spherical holes, with the average diameter of salt grains as $D_{SaltGrain}$ and number of holes as n.



The surface area of the foam scaffold will be evaluated as the total internal surface area of all spherical pores:

$$S = n \times \pi D_{SaltGrain}^2 \tag{6}$$

In this model, ε can be calculated as:

$$\varepsilon = \frac{V_{cavities}}{V_{total}} = \frac{n \times \pi D_{SaltGrain}^3}{6V_{total}} \tag{7}$$

So, the total number of holes can be derived as:

$$n = \frac{6V_{total} \times \varepsilon}{\pi D_{SaltGrain}^3} \tag{8}$$

Replacing *n* value into the equation for calculating *S* above, we get:

$$S = n \times \pi D_{SaltGrain}^2 = \frac{6V_{total} \times \varepsilon}{\pi D_{SaltGrain}^3} \times \pi D_{SaltGrain}^2 = \frac{6V_{total} \times \varepsilon}{D_{SaltGrain}} \tag{9}$$

Resulting in,

$$S_{Foam} = \frac{S}{V_{total}} = \frac{6\varepsilon}{D_{SaltGrain}} \tag{10}$$