FAQ: Fiber Fineness

8. Explain decitex and calculate the fineness in decitex of cotton fiber having diameter of 20 µm.

Answer:

Decitex: The no. of one gram in 10,000 meters of fiber. Like 10,000 meters of fiber weighs 2 gram means, the count will be 2 decitex.

Decitex: $7.85 * 10^{-3} * \rho * d^2$

$= 7.85 * 10^{-3} * 1.52 * 20^2$

= 4.78 decitex

9. 2 km of wool fiber weighs 850 mg. What will be the Gravimetric Diameter of wool in micron? Consider the specific gravity of wool is 1.31 g/cc. (Assume average fiber length 52 mm)

Answer:

$$d_{grav} = \sqrt{(97190 * W / \sum hn)}$$

$$= \sqrt{(97190 * 850) / 200000)}$$

$$= 20.32\ \mu m$$

10. Calculate the percentage change in the airflow rate if same mass of cotton of 3.5 micronaire is packed in a chamber of an airflow instrument with volume 17.5 cm^3 in place of 20 micron wool fibers in the same chamber. Specific gravities of wool and cotton are 1.31 and 1.51 respectively. Consider that the cross-sections of both the fibers are circular and also make all other necessary assumptions.

Answer:

Assumption

Airflow $\propto 1/S$

3.5 micronaire means 3.5×10^{-6} gm per 2.54 cm

$\Pi\ d^2 \times 2.54 \times 1.52 = 3.5 \times 10^{-6}$

By solving the above equation by means of 'd'

d = 10.7 μm

Surface area provided by wool = Total volume

$\pi/4 * dw^2 * lw = W / 1.31$

$lw = (W*4) / (1.31*\pi) * dw^2$

$Sw = \pi*dw*lw = (4*W) / 1.31*dw = [4\ W / 1.31*20] \propto [1/(1.31*20)]$

Similarly,

$Sc = \pi*dc*lc = (4*W) / 1.*dc = [4\ W / 1.51*10.7] \propto [1/(1.51*10.7)]$

Airflow $\propto 1/S$

Airflow of wool $\propto$ 1.31 x 20 = 26.2

Airflow of cotton $\propto$ 1.51 x 10.7 = 16.157

% of drop of air flow = [(26.2 – 16.157)/ 26.2] x 100 = 38.33%

11. A 5.2 micronaire cotton fiber is tested in a Vibroscope with the free distance between the clamp and the support being 1 inch. What will be the mass of the weighing clip (in mg) to have a natural fundamental frequency of vibration of the fiber sample of 2.7 kHz? Make all the necessary assumptions.

Answer:

Formula is

$M = (wg / \lambda^2 f^2) * 9 * 10^5$

$5.2 = (Wg / 2.54^2 * 2700^2) * 9 * 10^5$

$Wg = (5.2 * 2.54^2 * 2700^2) / 9 * 10^5$

= 272 dynes or 186 mg