Flexural properties

The behaviors shown by textile materials (fibre, yarn and fabric), when it is subjected to bending, are known as flexural properties.

a) Flexural rigidity:

Flexural rigidity is the resistance of a textile fibre against bending. It can also be defined as the couple required to bend the fibre to unit curvature. The unit of flexural rigidity is N-mm^2, N-m^2 etc.

Mathematically, Flexural rigidity, $Rf = \frac{1}{4\prod} \times \frac{\eta E T^2}{\rho}$

Where, η = Shape factor

E = Specific shear modulus (in N/tex)

T = Linear density (in tex)

ρ = Density (in gram/cm^3)

Specific flexural rigidity:

The specific flexural rigidity is the flexural rigidity of a textile fibre of unit linear density. Specific flexural rigidity is usually expressed as N-mm^2/tex, N-m^2/tex etc.

Mathematically, Specific flexural rigidity $= \frac{1}{4\prod} \times \frac{\eta E (1)^2}{\rho} = \frac{1}{4\prod} \times \frac{\eta E}{\rho}$

b) Bending recovery:

The power of recovery from an immediate curvature of textile fibre is known as bending recovery. For example, nylon of 15 denier shows 100% recovery from a small curvature, whereas only 20% recovery is obtained from a large curvature.

c) Bending modulus:

Bending modulus can be defined as the ratio between bending stress and bending strain. Here, bending strain is usually expressed as degree or radian.

So, Bending modulus $= \frac{\text{Bending stress}}{\text{Bending strain}}$

Shape factor:

Shape factor is a quantity or number that indicates the thickness or cross-section of a fibre. Shape factor is usually expressed by η.

If $\eta = 1$, then the fibre is round shaped.

If $\eta > 1$, then the fibre thickness is increased.

If $\eta < 1$, then the fibre thickness is reduced.

Shape factor of different fibres:

Fibre	Shape factor	Fibre	Shape factor
Viscose	0.74	Acetate	0.67
Wool	0.80	Nylon	0.91
Silk	0.59	Glass	1.0