



UNIT V
PRESERVATION BY COOLING

Topic: Freezing Time Calculations

The more general form of Plank's equation for calculation freezing time is:

$$\text{Freezing time} = \frac{L + PD}{V D} \left\{ \frac{RD^2}{fk} + \frac{D}{fk} \right\}$$

Where

L = Heat to be extracted between the initial freezing point and final temperature (kcal/kg).

V = Specific volume of fish (m³/kg)

D = Temperature difference between the initial freezing point of the fish and the refrigerating medium (°C)

D = Thickness of product in direction of prevailing heat transfer (m)

f = Surface coefficient of heat transfer (including effect of packaging) (kcal/h.m °C)

k = Thermal conductivity of frozen fish (kcal/h m°C)

P and R= Constants which depend on shape

Values for shape constants P and R

Shape	P	R
Sphere	0.167	0.042
Infinite Cylinder	0.167	0.042
Infinite Slab	0.500	0.250