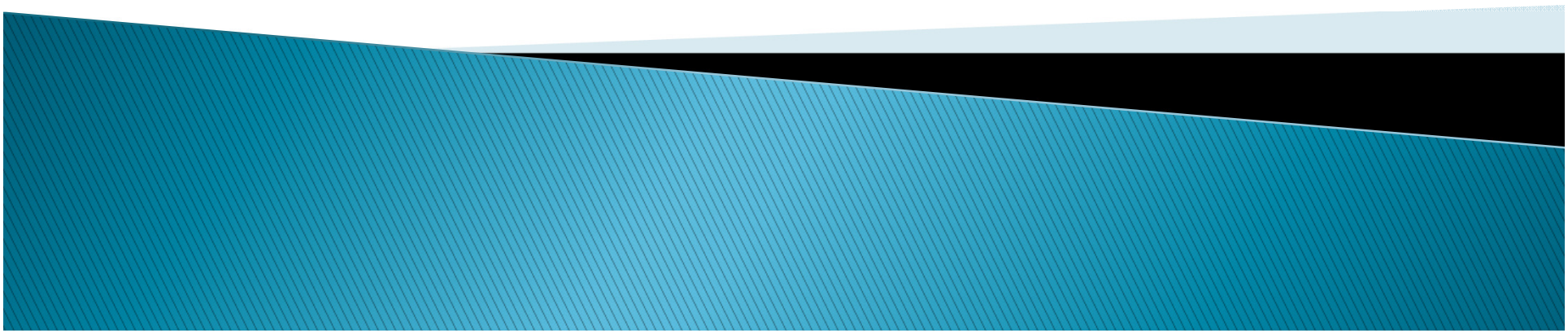
FDE 208 Heat Transfer and Thermal Processes

Sterilization



Determination of conditions of thermal process

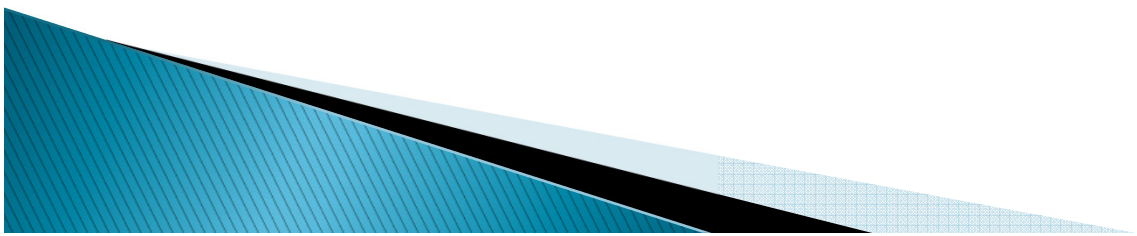
- The conditions to be determined ⟹ temperature and time

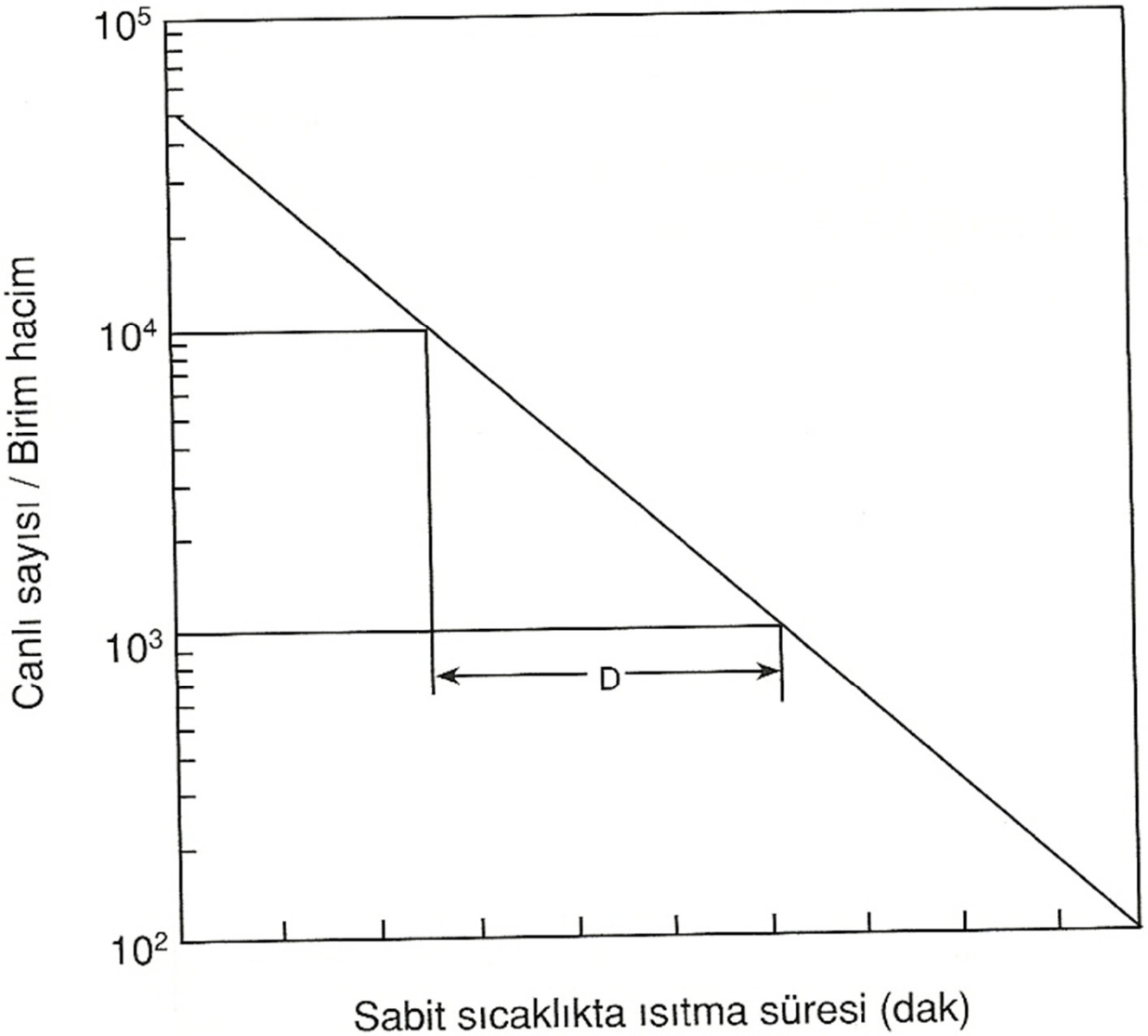
- The determination of these conditions is performed within four steps:
  - The detection of thermal resistance of target m/o experimentally
  - The detection of heat penetration of the food package experimentally
  - The calculation of the conditions of theoritical heat treatment
  - Testing the accuracy of these conditions

The detection of thermal resistance of target m/o

- The target microorganism is the most heat resistant organism among the ones which causes spoilage.

- The food is heated at a certain temperature during different processing times. And final alive m/o is counted to detect the thermal resistance of target m/o.



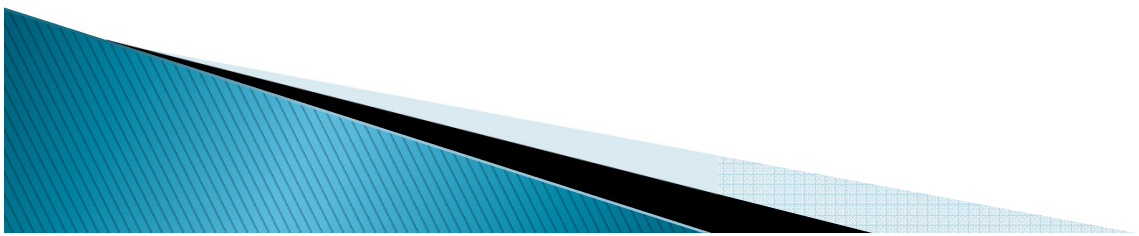

10^5
10^4
10^3
10^2
Canlı sayısı / Birim hacim
D
Sabit sıcaklıkta ısıtma süresi (dak)

- D value: **D-value** refers to **decimal reduction time** and is the time required at a certain temperature to kill 90% of the organisms being studied.

$$D = \frac{t}{\log N_o - \log N}$$

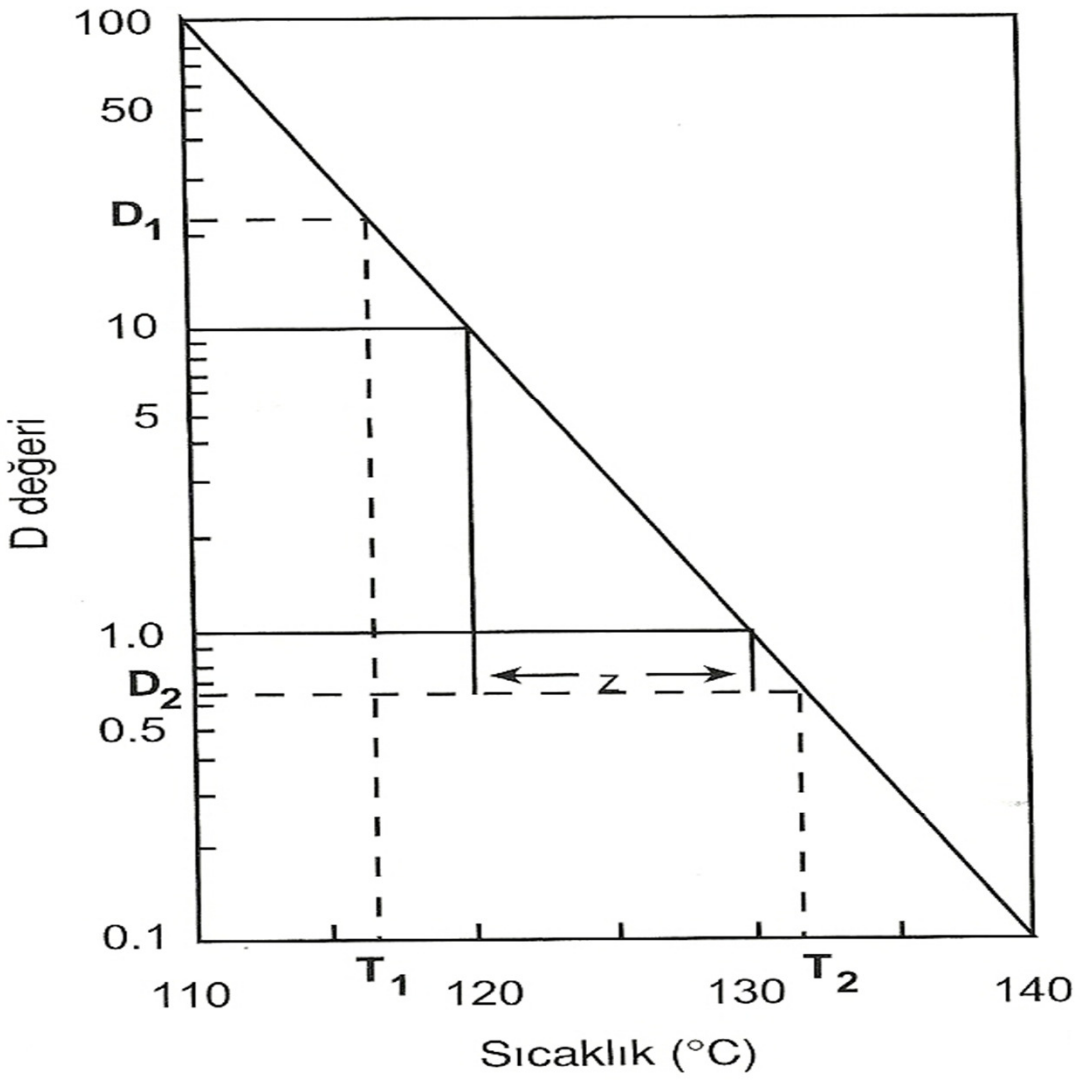
- Example:

The spores of a m/o were inoculated to a medium(tube) at a level of 10000/ml. The amount of the inoculation was given as 3 ml. The tube was kept at 115 C for 14 min in an oil bath. If the alive organism count was reported as 12/ml after 14 min, calculate D value.



- Z value: The z-value of an organism is the temperature, that is required for the thermal destruction curve to move one log cycle. It is the reciprocal of the slope resulting from the plot of the logarithm of the D-value versus the temperature at which the D-value was obtained.
- (Bir m/o'nın belli bir sıcaklıktaki D değerinin 10 misli kısalması için sıcaklığın ne kadar yükseltilmesi gerektiğini ifade eden değer)

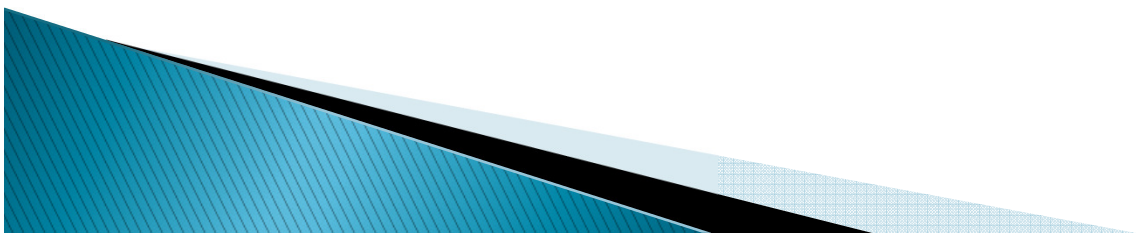
$$z = \frac{T_0 - T}{\log D_T - \log D_o}$$



Şekil 3.3 Termal direnç eğrisi

- Example:

If the D values of a m/o were given as following; D_{115}=4.8 min, D_{121}=1.2 min, calculate Z value.



- Sterilization value (S_d) (decimal reduction time):

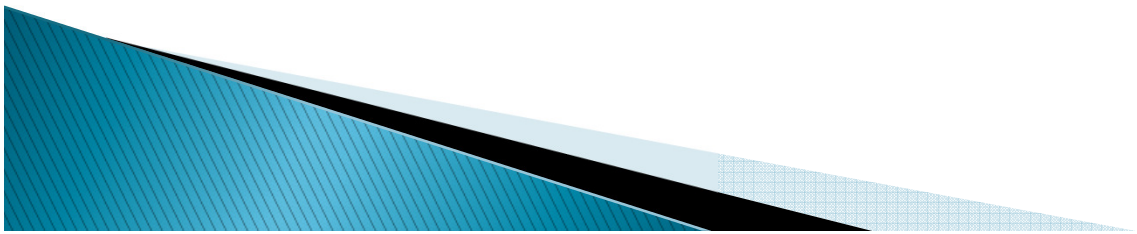
$$D = \frac{t}{\log N_o - \log N}$$

$S_d = \log (N_o/N) = t/D$

- F_T value: the required heat treatment time to reach to a certain sterilization value.
- (Herhangi bir sabit sıcaklıkta belli bir sterilizasyon değerine ulaşmak için uygulanması gereken ısıtma süresi)

$$F_T = D_T S_d$$

F_T: F value

D_T: D value of the target m/o at T

S_d: sterilization value