F0 OR EQUIVALENT EXPOSURE TIME AT 121°C

F0 is the equivalent exposure time at 121.11°C of the actual exposure time at a variable temperature, calculated for an ideal microorganism with a temperature coefficient of destruction equal to 10 °C.

"FO means the equivalent amount of time, in minutes at 121°C or 250 F, which has been delivered to a product by the sterilization process".

For the practical calculation of F0, "a z-value of 10°C or 18 F is assumed; the term z-value means the slope of the thermal death time curve and may be expressed as the number of degrees required to bring about a tenfold change in the death rate". In most cases, the exact value of 121.1 °C is replaced by an approximated 121 °C.

Furthermore, the knowledge of the temperature values as the continuous function of elapsing time is generally not available, and F0 is calculated as follows:

$$F0 = \Delta t \Sigma 10^{\frac{T-121}{Z}}$$

where:

Δt = time interval between two next measurements of T

T = temperature of the sterilized product at time t

z = temperature coefficient, assumed to be equal to 10°C

If we assume a sterilization lasting 15 minutes, constantly at 121°C, we obtain:

$F0 = 15 \times 10^{\frac{121-121}{10}}$ = 15 indeed according to the definition of F0.

If we assume sterilization lasts 15 minutes, constantly at 115°C, we instead obtain:

$F0 = 15 \times 10^{\frac{115-121}{10}}$ =3.76

Therefore, a 15 minutes sterilization at 115°C is equivalent, in terms of lethal effect, to 3.76 minutes at 121°C; this can be easily expected if z = 10. Similarly, if we assume a 15 minutes sterilization constantly at 110°C,

$F0 = 15 \times 10^{\frac{110-121}{10}}$ =1.19

If we assume sterilization lasts 15 minutes, constantly at 124°C, we instead obtain:

$F0 = 15 \times 10^{\frac{124-121}{10}}$ =29.9

Therefore, a 15 minutes sterilization at 124°C is equivalent, in terms of lethal effect, to 29.9 minutes at 121°C; this can be easily expected if z = 10.

It has to be emphasized that the mathematical equivalence between different levels of temperature keeps a biological value if and only if the exposure in all conditions is actually to moist-heat, i.e. if there is actual presence of saturated steam on the surface or inside the object to be sterilized.