



Cycletime Tips - General

Volume 32: Plastic Sterilization

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According to the Webster's dictionary, the word sterilize means: to free from living organisms and especially microorganisms.

This procedure is most typically required for medical products. The number of plastic disposables in use is continually growing as this eliminates the need for multiple sterilization cycles of the device.

The three sterilization methods prevalent in the industry today are:

- Heat (dry heat or steam autoclave)
- Gas - ETO (ethylene oxide gas)
- Irradiation (gamma and electron beam)

Heat - Many thermoplastics cannot be sterilized by heat because their softening point is generally below the recommended 250° F to 270° F, so most disposables are commonly treated with irradiation or ETO. Heat is typically applied to products that require multiple sterilizations. It is also important to clean off aggressive biochemicals prior to autoclaving, as the combined effect of heat and chemicals can damage the polymer.

ETO - Ethylene Oxide is a colorless gas that is widely used and harmless to most plastics. ETO penetrates the microorganism and chemically reacts with its protein. This reaction disrupts the cell's metabolism so that it can no longer survive. Since pure ETO is extremely toxic and explosive, it is often mixed with an inert gas. The four major factors that affect ETO sterilization are gas concentration, moisture, time, and temperature.

Irradiation - both gamma and electron beam sterilization energize the microbial cell and cause reactions within the RNA and DNA chains. The cell is then rendered unable to reproduce and will eventually destroy the microorganism.

The e-beam radiation electrons are accelerated in a single direction whereas gamma rays travel through the product in all directions. Thus, an e-beam can be controlled to irradiate a product in sensitive or thin walled areas. The dosage rates are typically 100 times greater than they are for gamma. Hence, e-beam is faster; and it takes only a few minutes to sterilize a product compared to several hours for gamma.

Very thick or very dense objects may be difficult for e-beam to penetrate. An e-beam can sterilize to a depth of a few inches, while gamma rays penetrate completely. The major factors that influence sterilization are dose rate and time.

Sterilization Methods For Thermoplastics

	ETO	Irradiation	Heat
ABS	yes	Good	no
Acetal	yes	Poor	no
SAN	yes	Good	no
Nylon	yes	Good	yes*
PC	yes	Good	yes*
PC/PET	yes	Good	yes*
PC/ABS	yes	Good	no
PE	yes	Good	no
PET	yes	Good	yes*
PMMA	yes	Fair	no
PP	yes	Fair	yes*
PPS	yes	Excellent	yes
PS	yes	Excellent	no
PVC	yes	Good	no
TPU	yes	Excellent	no

*temperature conditions must be verified to be compliant with specific material