Proper sterilization of packaging made with Eastar™ copolyester 6763

Medical devices must be free from bacteria to ensure patient safety and health. Sterilization, a rigorous process of eliminating these microorganisms, can subject the device—package combination to extreme temperatures, gases, radiation, and other elements that may alter the performance of certain materials. Prior to designing a medical device package, packaging engineers should first consider the method by which the packaged product will be sterilized. Engineers, therefore, need to fully understand the effects of the chosen sterilization method on packaging materials. This technical tip contains guidelines for the proper method of ethylene oxide, gamma irradiation, and electron beam (e-beam) sterilization of copolyesters. These guidelines should be followed to optimize the performance of packaging made with Eastar™ copolyester 6763.

Sterilization methods

Ethylene oxide (EtO)

- Bacteria are eliminated by penetration of EtO gas mixture into the sealed package.
- Efficiency is boosted by the use of moderately high temperature and humidity.
- Chamber gas can either be 100% EtO or EtO blends with other inert gasses.
- Typical cycle includes 18–24 hours preconditioning (110°F [43°C], 60% relative humidity), 8 hours total cycle (with the average gas dwell of 3–4 hours) all at 125°F (52°C), and a 24-hour aeration at 115°–120°F (46°–49°C).
- Recommended conditions for copolyesters: minimize cycle time; maximum chamber temperature of 130°F (54°C); maximum relative humidity of 50%.

Gamma irradiation

- Bacteria are eliminated by penetration of gamma irradiation from a cobalt-60 source.
- Gamma irradiation provides a high level of penetration at a low dosage rate without the generation of heat. Eastar is highly resistant to gamma radiation.
- Typical dose is 25 to 50 kGy (2.5 to 5 M Rads). Eastar has been sterilized up to 100 kGy without any significant physical property loss.

Electron beam radiation

- An electron beam is focused on the product. The beam scans the product to ensure uniform treatment.
- Bacteria are eliminated by penetration of high-energy electrons without heat.
- Low penetration and high dose rate
- Typical dose is 25 to 50 kGy (2.5 to 5 M Rads). Eastar 6763 has been sterilized up to 75 kGy without any significant physical property loss.
Conclusion

Gamma, e-beam, and EtO are the gentlest and most common methods for sterilizing copolyesters. However, Eastar can be successfully and safely sterilized by hydrogen peroxide vapor, peracetic acid vapor, and plasma without any significant changes in physical properties as long as proper processing conditions are used. Proper processing conditions and controls should always be used during sterilization of any copolyester. If excessive high humidity, high temperature, high energy levels, and/or long dwell times are used, increased physical aging or other degrading issues may occur. This may cause brittleness in the package material and could lead to package integrity failure.

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<th>Table 1. Radiation device specifications</th>
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<td>Property</td>
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<td>Energy spectrum</td>
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<td>Useful power range</td>
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<td>Typical dose rate</td>
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Safety Data Sheets providing safety precautions that should be observed when handling and storing Eastman products are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

It is the responsibility of the medical device manufacturer (“Manufacturer”) to determine the suitability of all component parts and raw materials, including any Eastman product, used in its final product to ensure safety and compliance with requirements of the United States Food and Drug Administration (FDA) or other international regulatory agencies.

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