Gas Sterilization

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Gas Sterilization

- **What is it?** A method that uses gases to kill all microorganisms, including bacteria, viruses, and spores.
- **Why use it?** For items that cannot withstand the high heat and moisture of an autoclave.
- **Common Uses:**
  - Reusable surgical instruments (e.g., delicate scopes).
  - Medical and electrical equipment.
  - Surface sterilization of powders.

Main Gases Used:

Feature	**Ethylene Oxide (ETO)**	**Formaldehyde (LTSF)**
Commonality	**Much more common** internationally	Less common
Safety Risk	**Explosive**, highly toxic	Toxic, but less explosive risk
Penetration	Good for porous loads, but slower than steam	Good penetration in steam mixture
Process	Can be done at lower temperatures	Requires slightly higher temperature (70-75°

Ethylene Oxide (ETO)

- **Why is it Popular?**
  - It's a recognized and trusted method (approved in British Pharmacopoeia).
  - Has a broad spectrum biocidal activity.
- **How Does it Kill Microbes? (Principle)**.
  - ***Simple Explanation:*** It damages the DNA and proteins of microorganisms, so they can't grow or reproduce
- **Safety First!**
  - **Highly Explosive** in pure form with air.
  - **Solution:** It is mixed with other gases like **CO_2** or **HFC** to make it safe to handle..

ETO Sterilizer - How It Works

- **The Machine:** A strong, leak-proof, and explosion-proof chamber.
- **The Process Steps:**
  - **Remove Air:** A vacuum removes air from the chamber.
  - **Add Moisture:** Steam is added to condition the load (microbes are easier to kill when humid).

- **Add Gas:** ETO gas is pumped in and circulated.
- **Wait (Exposure Time):** The gas is left for a specific time to sterilize everything.
- **Remove Gas:** The toxic gas is sucked out and safely vented.
- **Aeration:** Filtered, clean air is pumped in to remove any leftover gas from the sterilized items.

Disadvantages of Ethylene Oxide

Toxic & Hazardous:

- **Carcinogenic** (can cause cancer).
- **Mutagenic** (can cause genetic mutations).
- **Teratogenic** (can harm a developing fetus).

Other Downsides:

- **Long Cycle Time:** The process and aeration take hours, unlike an autoclave.
- **Low Penetrating Power:** Doesn't penetrate through thick, solid materials well.
- **Pungent Smell.**
- **Material Absorption:** Items can absorb the gas and must be aired out before use to protect patients and staff.

Formaldehyde (Low Temperature Steam & Formaldehyde - LTSF)

How is the Gas Made?

- By heating **Formalin** (a liquid solution of formaldehyde) with steam at 70-75°C.

The LTSF Sterilizer:

- Uses steam at sub-atmospheric pressure (lower than normal pressure).
- Similar process to ETO: Air removal → Formaldehyde release → Sterilization period → Gas removal with steam → Drying with vacuum and sterile air.

Toxicity:

- Similar toxicity profile to ETO but absorbs less into materials.


Any Questions?