SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai

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Coimbatore -641035

COURSE NAME : PHARMACEUTICAL MICROBIOLOGY - BP303 T

B.PHARM II YEAR / III SEM

UNIT 2

SUB TOPIC : EQUIPMENTS EMPLOYED IN LARGE SCALE INDUSTRY

Equipment employed in large-scale sterilization

Autoclave:

Autoclaves are widely used for large-scale sterilization in healthcare and laboratory settings.

They use high-pressure steam to kill microorganisms. Autoclaves come in various sizes, from small benchtop units to large industrial models, and they can accommodate a range of items, including equipment, glassware, and media

The Fundamental Difference: AIR REMOVAL

Effectiveness determines Class N, S, or B.

STEAM

AIR

Effective sterilization requires steam to contact every surface. Trapped air acts as an insulator, creating cold spots and risking contamination.

GRAVITY DISPLACEMENT (Simplest)

PRE-VACUUM CYCLE (Advanced)

CLASS N

N for "Naked"

Method: GRAVITY DISPLACEMENT. Steam fills the chamber, pushing heavier air out.

Best For: UNWRAPPED SOLID ITEMS (e.g., glassware, scalpels).

Key Limitation: CANNOT STERILIZE WRAPPED, HOLLOW, OR POROUS ITEMS.

CLASS S

S for "Special"
(Manufacturer Defined)

Method: ACTIVE AIR REMOVAL (e.g., Steam Pulses). More effective than gravity, less thorough than pre-vacuum.

Best For: SPECIFIC LOADS as defined by the manufacturer.

Key Limitation: LIMITED VERSATILITY; SUITABILITY MUST BE VALIDATED.

CLASS B

B for "Big"
(Versatile)

Method: PRE-VACUUM CYCLE. Powerful vacuum pump removes air before steam introduction.

Best For: ALL LOADS, including WRAPPED KITS, HOLLOW INSTRUMENTS, POROUS TEXTILES.

Key Benefit: HIGHEST ASSURANCE OF AIR REMOVAL & STERILITY.

UNDERSTANDING THE TRADE-OFFS

SIMPLICITY vs. VERSATILITY
Class N (Simple, reliable) vs. Class B (Maximum versatility, more complex).

CYCLE RELIABILITY
Class B actively confirms air removal for highest assurance. Class N gravity cycles can fail with improper loading.

COST & MAINTENANCE
Class B is more expensive due to vacuum system. Class N is generally less costly.

MAKING THE RIGHT CHOICE

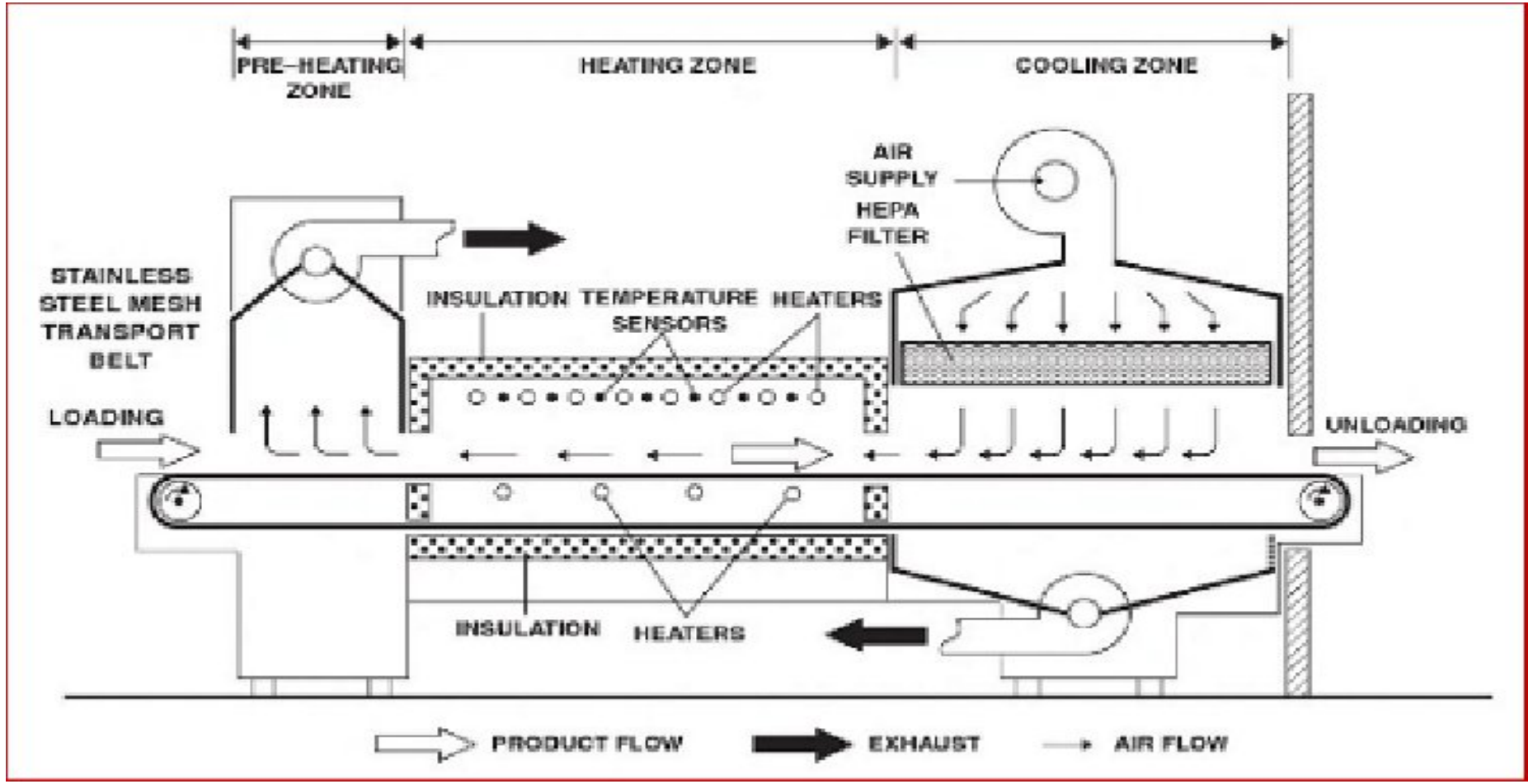
BASIC LAB RESEARCH: Class N (Media, glassware, unwrapped items)

CLINICAL APPLICATION (Medical, Dental, Vet): Class B (Wrapped kits, textiles, hollow items)

SPECIFIC INDUSTRIAL APPLICATION: Class S (Validated for particular load)

Dry Heat Sterilizers:

Dry heat sterilizers use hot air to achieve sterilization. They are suitable for heat-resistant items that cannot be exposed to moisture, such as glassware, metal instruments, and certain powders

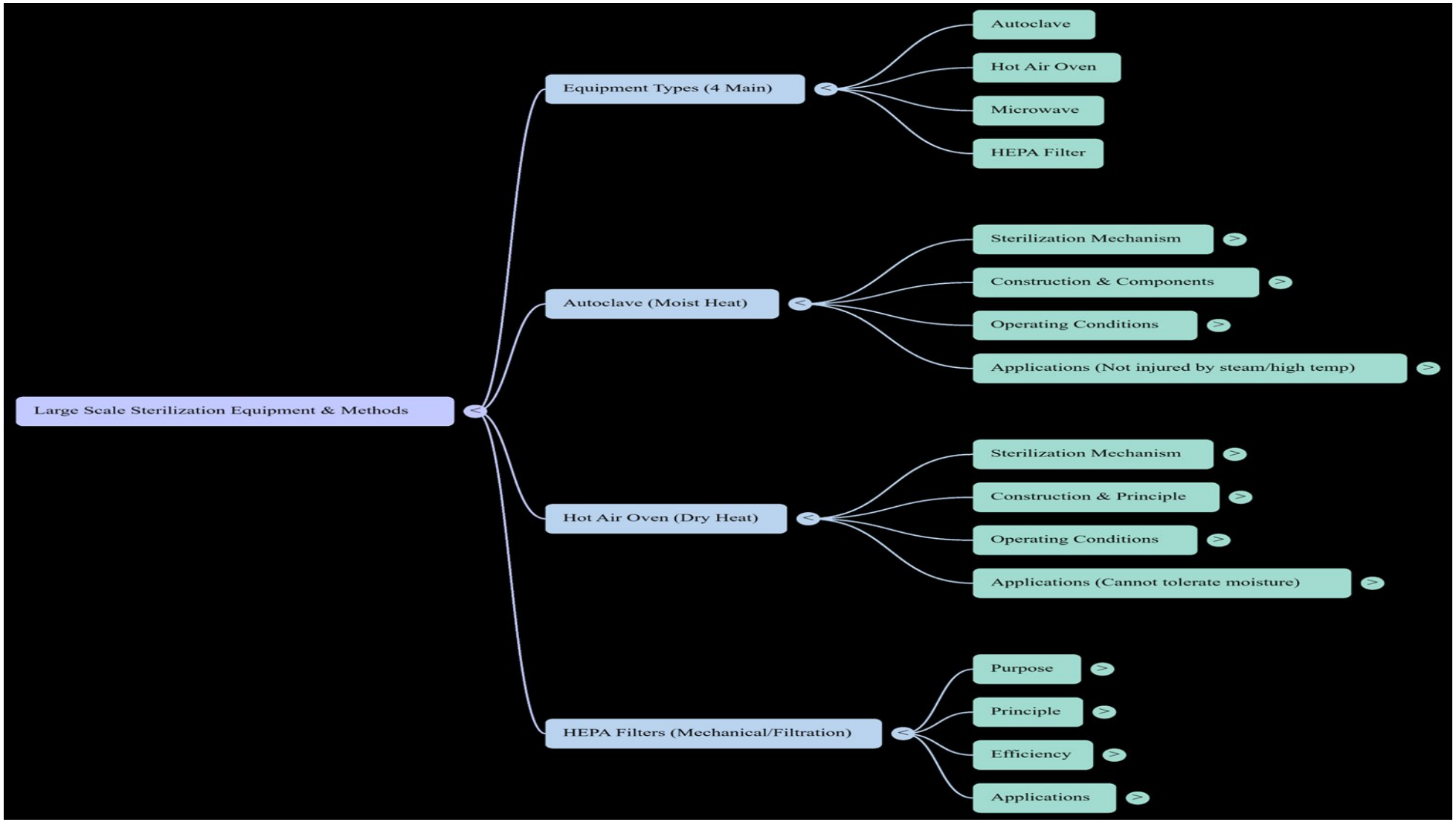


Dry heat sterilizers are commonly used in pharmaceutical manufacturing and research laboratories.

Dry heat sterilizers consist of an insulated chamber with heating elements that generate and maintain high temperatures.

ADVANTAGES OF DRY HEAT STERILIZERS

- **Moisture-Free Process**: Dry heat sterization is ideal for items that cannot tolerate moisture. It prevents the risk of material degradation, such as rusting or oxidation of metal instruments.
- **Compatibility**: This method is suitable for a wide range of materials, including glass, metals, and certain plastics.
- **Minimal Residue**: Unlike steam sterilization, dry heat sterilization doesn't leave behind residues that could potentially interact with the product.


Large Scale Sterilization Equipment & Methods
Equipment Types (4 Main)
Autoclave
Hot Air Oven
Microwave
HEPA Filter
Autoclave (Moist Heat)
Sterilization Mechanism
Construction & Components
Operating Conditions
Applications (Not injured by steam/high temp)
Hot Air Oven (Dry Heat)
Sterilization Mechanism
Construction & Principle
Operating Conditions
Applications (Cannot tolerate moisture)
HEPA Filters (Mechanical/Filtration)
Purpose
Principle
Efficiency
Applications

Tunnel Sterilizers:

Tunnel sterilizers, also known as continuous sterilizers, are used for the large-scale sterilization of packaged products.

ADVANTAGES OF TUNNEL STERILIZERS

- **High Throughput:** These systems can process a large number of containers in a continuous manner, making them suitable for high-volume production.
- **Uniform Sterilization:** Proper design ensures that containers receive uniform heat distribution, resulting in consistent and reliable sterilization.
- **Energy Efficiency:** Tunnel sterilizers are designed to meet regulatory standards for pharmaceutical manufacturing.

Filtration Systems:

Large-scale filtration systems incorporate various filters, such as membrane filters or depth filters, to remove microorganisms from the liquid or gas stream.

ADVANTAGES OF FILTRATION

Suitable for Heat-Sensitive Materials: Filtration is ideal for materials that cannot withstand high temperatures used in methods like autoclaving.

Preserves Product Quality: Since filtration doesn't involve extreme temperatures, it helps maintain the quality, stability, and functionality of sensitive pharmaceutical products.

Versatile: Filtration can be applied to various substances, including liquids, gases, and air.

Scalability: Filtration systems are adaptable to both small-scale and large-scale production processes.

Minimal Chemical Usage: Uniike some sterilization methods that require chemicals, reducing the risk of chemical residue in the final product.

Large-scale irradiation facilities employ specialized equipment that can handle high volumes of products, such as medical devices, pharmaceuticals, and certain food products.

Chemical Sterilization Systems:

Large-scale chemical sterilization systems are used in industries such as healthcare, pharmaceuticals, and food processing.

ASSESSMENT QUESTIONS

Question 1

The Steam Zap Challenge

Professor Sparkle needs to clean a pile of surgical tools in a hospital. She wants to use super-hot steam under pressure to kill all germs. Which sterilization method should she choose?

a) Dry Heat Sterilization

b) Steam Sterilization

c) Radiation Sterilization

d) Chemical Sterilization

Question 2: The Heat Wave Her

The Squad must sterilize metal tools that can handle high temperatures without moisture. Which equipment uses hot air, like a super-powered oven, to make things germ-free?

Dry Heat Oven

a) Plasma Sterilizer

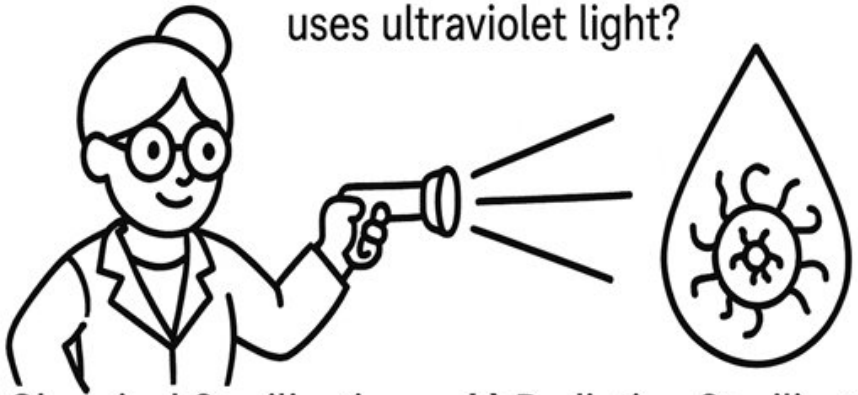
b) Dry Heat Oven

c) Autoclave

d) Chemical Vapor Sterilizer

Question 3: The Light Beam Battle

In Sparkle City's water factory, germs are hiding in the water. Professor Sparkle decides to use powerful light rays to destroy them. Which sterilization method uses ultraviolet light?



a) Chemical Sterilization
b) Radiation Sterilization
c) Dry Heat Sterilization
d) Filtration Sterilization

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THE GAS CLOUD QUEST

Some delicate tools can't handle heat or water, so the Crew uses a special gas to wipe out germs. Which method uses a gas like ethylene oxide to sterilize equipment?

a) Steam Sterilization

b) Gas Sterilization

c) Radiation Sterilization

d) Dry Heat Sterilization

THE FILTER TRAP ADVENTURE

The Crew needs to make a big batch of liquid medicine germ-free without using heat or chemicals, Which method uses super-fine filters to trap bacteria?

a) Filtration Sterilization

b) Steam Sterilization

c) Dry Heat Sterilization

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THANK YOU