PHARMACOLEARN

It's Important to Know!

BP304T — Pharmaceutical Engineering

B.Pharm Semester 3 · Unit 5 — Materials of construction and corrosion

Unit V: Materials of construction and corrosion

Materials

Pharmaceutical equipment may use metals, glass, plastics, elastomers or composite materials. Selection considers strength, temperature, pressure, corrosion resistance, cleanability, surface finish, extractables, leachables and compatibility with product and cleaning agents. Ferrous and non-ferrous metals differ in iron content and performance. Specific grade selection should be checked against the material specification.

Glass can provide chemical resistance and transparency but may be fragile. Plastics may be light and corrosion-resistant but can absorb substances, swell or release extractables. Elastomers require attention to compatibility and compression set. Material claims must be linked to the actual grade and process.

Corrosion

Corrosion is deterioration caused by chemical or electrochemical reaction with the environment. It may be uniform, galvanic, pitting, crevice, intergranular, erosion-corrosion or stress-related. Water, oxygen, acids, alkalis, salts, temperature, differential metals and surface damage can influence rate.

Control methods include material selection, passivation, coatings, inhibitors, cathodic or anodic protection, design that avoids stagnant zones, and control of cleaning and process conditions. A control method must not introduce product contamination.

Plant layout and material handling

Plant layout should support logical movement of people and materials, segregation, cleaning, maintenance, utilities, safety and waste control. Material handling may use conveyors, bins, pumps, lifts or pneumatic systems. Dust, cross-contamination, ergonomic risk and containment must be considered.

Unit V: Frequently asked questions

Q: What is galvanic corrosion?

A: It is electrochemical corrosion that can occur when dissimilar conductive metals contact each other in an electrolyte.

Q: Why is stainless steel grade important?

A: Composition and surface condition influence corrosion resistance, cleanability and compatibility with the process environment.

Q: What is the purpose of plant layout design?

A: It organises people, materials, equipment, utilities and waste so that safety, quality, flow and maintenance are supported.

Unit V: Key takeaways

- Material selection is a product-contact and process decision.
- Corrosion may be chemical, electrochemical or mechanically assisted.
- Stagnant zones and dissimilar metals can increase risk.
- Layout affects contamination control, safety and efficiency.
- Grade-specific compatibility must be verified.

Unit V: Practical correlation

Practical correlation: equipment qualification. A product-contact vessel should be assessed for material grade, surface finish, cleaning, corrosion, extractables and maintenance history. The acceptance criteria are set out in the approved specification.