

Antimicrobials

Antimicrobials

Introduction:

- Antimicrobials are agents that kill microorganisms or inhibit their growth, playing a critical role in treating and preventing infections in humans, animals, and plants.
- This group includes antibiotics, antivirals, antifungals, and antiparasitics, each with varying mechanisms of action depending on the type of microorganism they target.

Mechanism of Action:

Antimicrobials exert their effects on microorganisms through various mechanisms:

1. Inhibition of Cell Wall Synthesis:

- Antibiotics like penicillins and cephalosporins target bacterial cell walls, essential for bacterial integrity and survival.
- Inhibiting cell wall synthesis causes bacteria to burst and die.

2. Inhibition of Protein Synthesis:

- Antibiotics such as tetracyclines and macrolides bind to bacterial ribosomes, interfering with protein production necessary for bacterial growth and function.

3. Alteration of Cell Membranes:

- Antifungals like amphotericin B bind to components of fungal cell membranes, increasing permeability and causing leakage of cellular contents.

4. Inhibition of Nucleic Acid Synthesis:

- Drugs like quinolones and rifampicin interfere with DNA or RNA synthesis, crucial for bacterial replication and transcription.

5. Antimetabolites:

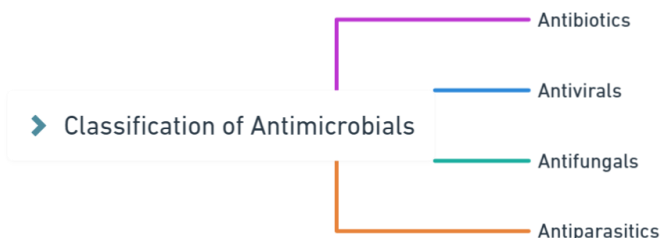
- Sulfonamides act as antimetabolites, inhibiting folate synthesis, a vital process for bacterial DNA synthesis and replication.

6. Interference with Pathogen Metabolism:

- Some antimicrobials disrupt specific biochemical pathways essential for the microorganism's energy production or replication.

Classification of Antimicrobials:

- Antimicrobials are classified based on the type of organisms they target, their chemical structure, and their mechanism of action:



1. Antibiotics:

- Specifically target bacteria.
 - A. **Broad-spectrum:** Effective against a wide range of bacteria.
 - B. **Narrow-spectrum:** Effective against specific types of bacteria.

2. Antivirals:

- Target viruses.
- Categorized based on the stage of the viral life cycle they affect, such as viral entry inhibitors or nucleoside analogs that inhibit viral replication.

3. Antifungals:

- Used against fungal infections.
- Include classes like polyenes, azoles, and echinocandins, differing in their mechanisms of action.

4. Antiparasitics:

- Target parasitic infections caused by organisms like protozoa and helminths.
- Examples include metronidazole for Giardia infections and mebendazole for worm infections.

- This comprehensive approach to antimicrobials highlights their mechanisms of action a

Potassium Permanganate (kmno4)

Preparation:

- Potassium permanganate is industrially prepared by reacting manganese dioxide (MnO_2) with potassium hydroxide (KOH) and a strong oxidizing agent like potassium nitrate (KNO_3) or oxygen.
- The mixture is heated to form potassium manganate (K_2MnO_4), which is then oxidized to potassium permanganate:



Properties:

- Dark purple or almost black crystalline solid.
- Highly soluble in water, forming a purple solution.

- Strong oxidizing agent.
- Stable in dry form but decomposes in the presence of organic material or reducing agents.

Uses:

- As an antimicrobial and antiseptic for treating skin infections, ulcers, and wounds.
- In dilute solutions for disinfecting water.
- In the treatment of fungal infections such as athlete's foot.
- Used in treating certain parasitic skin conditions.

Storage:

- Store in a cool, dry place away from organic materials and reducing agents.
- Keep in a tightly sealed container to avoid exposure to moisture and contaminants.

Boric Acid (H_3BO_3)

Preparation:

- Boric acid is prepared by reacting borax (sodium tetraborate decahydrate) with a mineral acid such as hydrochloric acid:



Properties:

- White, odorless crystalline powder.
- Slightly soluble in cold water and more soluble in hot water.
- Weakly acidic, with mild antiseptic and antifungal properties.
- Chemical formula: H_3BO_3 .

Uses:

- As an antiseptic for minor cuts and burns.
- In ophthalmic preparations to treat eye infections.
- As a buffering agent in various pharmaceutical formulations.
- Used in the treatment of yeast infections in dilute concentrations.

Storage:

- Store in a cool, dry place.
- Keep in a well-sealed container to avoid moisture absorption.

Hydrogen Peroxide (H_2O_2)

Preparation:

- Industrially, hydrogen peroxide is prepared by the anthraquinone process, where anthraquinone is hydrogenated to form anthrahydroquinone, which reacts with oxygen to produce hydrogen peroxide:



Properties:

- Colorless liquid with a slightly sharp odor.
- Miscible with water in all proportions.
- Acts as a weak acid and strong oxidizing agent.
- Typically, available as a 3% solution for medicinal use.
- Chemical formula: H_2O_2 .

Uses:

- As an antiseptic for cleaning wounds to prevent infection.
- As an oral rinse for mouth ulcers and gingivitis.
- In higher concentrations, used for sterilizing medical equipment.
- As a bleaching agent in the cosmetic industry.

Storage:

- Store in a cool, dark place, away from light and heat to prevent decomposition.
- Keep in a well-sealed, non-metallic container, typically brown or opaque to protect from light.

Assay of Hydrogen Peroxide (H_2O_2)

Purpose:

- To determine the concentration or purity of hydrogen peroxide using permanganate titration.

Procedure:

1. Prepare a Standard Solution:

- Dissolve a known amount of potassium permanganate (KMnO_4) in water to create a solution of known concentration.

2. Prepare the H_2O_2 Sample:

- Dilute an accurate volume of the H_2O_2 sample with water, as concentrated H_2O_2 can be hazardous.

3. Add Acid:

- Add a known volume of sulfuric acid (H_2SO_4) to the diluted H_2O_2 sample to create an acidic environment for the reaction.



FREE PREVIEW

[Click here to visit our website](#)

PHARMACY PREMIUM NOTES

Complete subject
and semesters are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app



Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHopeNotes

Instagram

@firsthope.official

[Click here to follow >](#)

YouTube channel

FirstHope-Pharmacy / Live streams

[Click here to watch >](#)

WhatsApp channel

Follow FirstHope on WhatsApp

[Click here to join >](#)

FirstHope website

firsthopenotes.com

[Click here to visit >](#)

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.