

Chapter 11

Chemistry in Everyday Life

Day – 1

Chemistry in Everyday Life

Introduction

Chemistry influences every sphere of human life. The principles of chemistry have been used for the benefit of mankind. Think of cleanliness — the materials like soaps, detergents, household bleaches, tooth pastes, etc. will come to your mind. Look towards the beautiful clothes immediately chemicals of the synthetic fibres used for making clothes and chemicals giving colours to them will come to your mind. Food materials — again a number of chemicals about which you have learnt in the previous Unit will appear in your mind. Of course, sickness and diseases remind us of medicines — again chemicals. Explosives, fuels, rocket propellants, building and electronic materials, etc., are all chemicals. Chemistry has influenced our life so much that we do not even realize that we come across chemicals at every moment; that we ourselves are beautiful chemical creations and all our activities are controlled by chemicals.

Drugs

- **Drugs:-** These are chemicals of low molecular mass which interact with macromolecular targets and produce a biological response.
- **Medicines:-** The chemicals which are used for treatment, prevention and diagnosis of diseases and reduce suffering from pain. All medicines are drugs but all drugs are not medicines.

Drugs can be classified mainly on criteria outlined as follows:-

(a):- On the Basis of Pharmacological Effect:- This classification is based on pharmacological effect of the drugs. For example, analgesics have pain killing effect, antiseptics kill or arrest the growth of microorganisms.

(B):- On The Basis of Drug Action:- It is based on the action of a drug on a particular biochemical process. For example, all antihistamines inhibit the action of the compound, histamine which causes inflammation in the body.

(C):- On The Basis of Chemical Structure:- It is based on the chemical structure of the drug. Drugs classified in this way share common structural features and often have similar pharmacological activity.

(D):- On The Basis of Molecular Targets:- Drugs usually interact with biomolecules such as carbohydrates, lipids, proteins and nucleic acids. These are called target molecules or drug targets. Drugs possessing some common structural features may have the same mechanism of action on targets. The classification based on molecular targets is the most useful classification for medicinal chemists.

Some Important Points to Remember

- **Chemotherapy:** It refers to the treatment of diseases by the use of chemicals.
- **Antagonists** are drugs that bind to the receptor site and inhibit their natural function.
- **Agonists** are other types of drugs that mimic the natural messenger by switching on the receptor,
- **Enzymes** are Proteins which perform the role of biological catalysts in the body.
- **Receptors** are Proteins which are crucial to communication system in the body.
- Drugs can block the binding site of the enzyme and prevent the binding of substrate, or can inhibit the catalytic activity of the enzyme. Such drugs are called **enzyme inhibitors**.
- Drugs compete with the natural substrate for their attachment on the active sites of enzymes. Such drugs are called **competitive inhibitors**
- In the body drugs usually interact with bio-molecules such as carbohydrates, proteins, lipids and nucleic acids. These are called **target** molecules.
- **Lead compounds** are the compounds which are chosen for designing a drug. Source of lead compounds may be natural or these may be synthesized.

Different Medicines

Antacids

(i):- such as sodium hydrogen-carbonate or a mixture of aluminium and magnesium hydroxide. However, excessive hydrogencarbonate can make the stomach alkaline and trigger the production of even more acid. Metal hydroxides are better alternatives because of being insoluble these do not increase the pH above neutrality.

(ii):- The drugs **cimetidine (Tegamet)** and **ranitidine (Zantac)**, stimulates the secretion of pepsin and hydrochloric acid in the stomach. This resulted in release of lesser amount of acid.

Antihistamines

Synthetic drugs, **brompheniramine (Dimetapp)** and **terfenadine (Seldane)**, act as antihistamines. They interfere with the natural action of histamine by competing with histamine. Histamine is responsible for the nasal congestion associated with common cold and allergic response to pollen. Histamine is a potent vasodilator.

Neurologically Active Drugs

(i):- **Tranquillizers:** The chemical substances used in the treatment of stress, and mild or even severe mental diseases. ex. Iproniazid, phenelzine, chlordiazepoxide, meprobamate, and Equanil, valium and serotonin.. Derivatives of barbituric acid (called **barbiturates**) viz., veronal, amytal, nembutal, luminal and seconal constitute an important class of tranquilizers. These derivatives are. Barbiturates are hypnotic.

(ii):- **Antipyretics:-** The substance used to lower body temperature in high fever.

(iii):- **Analgesics:-** The substance used to relieve pain.

- Non-narcotic (non-addictive) analgesics: ex. Aspirin and paracetamol
- Narcotic drugs: ex Morphine

Antimicrobials

(i):- **Antibiotics:** The chemical substances which are produced by micro-organisms and can inhibit the growth or even destroy other micro-organisms

Bactericidal: have cidal (killing) effect on microbes. Ex. Penicillin; Aminoglycosides
Ofloxacin

Bacteriostatic: have static (inhibitory) effect on microbes. Ex: Erythromycin;
Tetracycline; Chloramphenicol.

Antibiotics are of Three Types

Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be **broad spectrum antibiotics**. *Vancomycin, ofloxacin, Ampicillin, Chloramphenicol, and Amoxycillin*

Those effective mainly against Gram-positive **or** Gram-negative bacteria are **narrow spectrum antibiotics**. Penicillin G

Antibiotics effective against a single organism or disease, they are referred to as **limited spectrum** antibiotics.

(ii):- **Disinfectants:** The chemical substances which are used to kill micro-organisms but cannot be applied on living tissues. Ex. 1% phenol, chlorine 0.2-0.4 ppm,

(iii):- **Antiseptics** are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces. Ex. furacine, soframincine, dettol is a mixture of chloroxylenol and terpineol, tincture of iodine, Iodoform, Boric acid in dilute aqueous solution is weak antiseptic for eyes.

Antifertility Drugs are the drugs which are used to prevent pregnancy and thus check population explosion. ex. Norethindrone, ethynylestradiol (novestrol).

Chemicals in Food

Chemicals are added to food for (i) their preservation, (ii) enhancing their appeal, and (iii) adding nutritive value in them:-

- **Food additives:-** These are the substances such as preservatives, sweetening agents, flavours, antioxidants, edible colours, nutritional supplements, which are added to the food to increase its shelf-life and to make it more attractive and palatable.
- **Food Preservatives** are the substances which are added to food to increase its shelf-life. These are of two types: Class I and Class II preservatives. Class I preservatives include table salt, sugar and vegetable oils while Class II preservatives are chemical preservatives such as sodium benzoate. Salts of sorbic acid and propanoic acids.
- **Artificial sweetening agents** are added to food as substitutes of sucrose. These have no nutritional value but are sweet like sucrose. These are used by persons who want to reduce the calorie intake. **Saccharin, aspartame, alitame** and **sucrolose** are some of artificial sweeteners. Alitame is a high potency sweetener.

Cleaning Agents

These are soaps and synthetic detergents. These improve cleansing properties of water. These help in removal of fats which bind other materials to the fabric or skin.

- **Soaps** are sodium or potassium salts of long chain fatty acids. Soaps do not produce lather with hard water because calcium and magnesium Salts of higher fatty acids are insoluble in water.
- **Synthetic detergents or soapless soaps:** These are sodium salt of a long chain benzene sulphonate or sodium salt of long chain alkyl hydrogensulphate. Detergents may be anionic, cationic or non-ionic. Detergents are effective even in

hard water. Detergents with straight chain hydrocarbons are biodegradable and hence are preferred.

- **Anionic Detergents:-** are sodium salts of sulphonated long chain alcohols or hydrocarbons. Ex $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{OSO}_3\text{Na}$ (Sodium lauryl sulphate), $\text{CH}_3(\text{CH}_2)_{11}\text{C}_6\text{H}_4\text{SO}_3\text{Na}$ (Sodium dodecylbenzenesulphonate).
- **Cationic Detergents:-** are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions. Cationic detergents have germicidal properties and are expensive, therefore, these are of limited use Ex. Cetyltrimethyl ammonium bromide used in hair conditioners.
- **Non-ionic detergents** do not contain any ion in their constitution. One such detergent is formed when stearic acid reacts with polyethyleneglycol. Used as Liquid dishwashing detergents.