9.7 Drugs

9.7.1 Introduction

A drug is any substance (other than food that provides nutritional support) that, when inhaled, injected, smoked, consumed, absorbed via a patch on the skin, or dissolved under the tongue causes a temporary physiological (and often psychological) change in the body.

In pharmacology, a drug is a chemical substance of known structure, other than a nutrient of an essential dietary ingredient, which when administered to a living organism, produces a biological effect. A pharmaceutical drug, also called a medication or medicine, is a chemical substance used to treat, cure prevent, or diagnose a disease or to promote well-being. Traditionally drugs were obtained through extraction from medicinal plants, but more recently also by organic synthesis. Pharmaceutical drugs may be used for a limited duration, or on a regular basis for chronic disorders.

9.7.2 Classification of Drugs

These are classified as follows:

(i) **On the basis of Molecular Targets:**

Drugs generally interact with drugs targets (bimolecules) such as proteins, carbohydrates, fats, nuclic acids ects.

(ii) **On the basis of Drug Action:**

Involve the action Such type involve the action of a drug on a particular biochemical process for example all antihistamines block the action of the histamine which causes inflammation in the body.

(iii) **On the basis of Chemical Structure:**

Drugs which have common structural features they often have similar pharmacological activity.

(iv) **On the basis of Pharmocological Effect:**

Usually these types of drugs are used by doctors because they provides them the whole range of drugs available for the treatment of a particular type of problems eg. Anticeptics kill the growth of microbs.

9.7.3 Paracetamol

9.7.3.1 Synthesis

Paracetamol is one of the most common drugs used in the world and is manufactured in huge quantities. The starting material for the commercial manufacture of paracetamol

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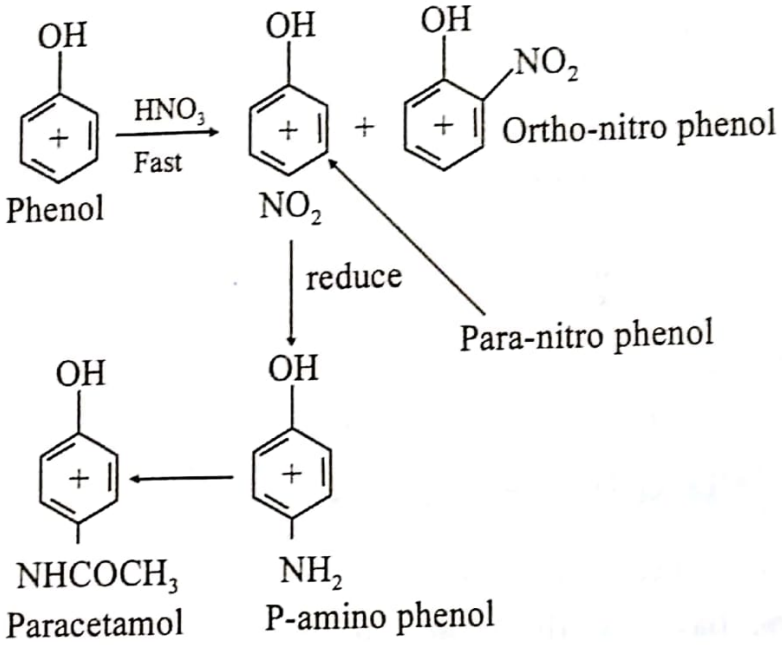
is phenol, which is nitrated to give a mixture of the ortho and para-nitrotoulene. The o-isomer is removed by steam distillation and the p-nitro group reduced to a p-amino group. This is then acetylated to give paracetamol.



9.7.3.2 Properties

Physico- Chemical Properties

(i) Origin of the substance-synthetic

(ii) Chemical structure

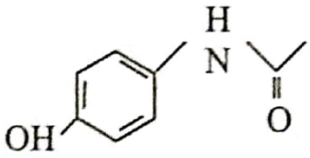
Chemical name: N-Acetyl-p-amino phenol

Other Chemical Name

4' – Hydroxyacetanilide

4' – Hydroxyacetanilide parmol

4 – Acetamino phenol



Paracetamol

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Molecular Formula – $C_8H_9NO_2$

Molecular weight – 151.2

1. Physical Properties

(i) **Colour :** White

(ii) State/form : Solid - crystals

(iii) Melting point : 169 to 170.5

(iv) Taste : Slightly bitter taste

(v) Odor : Odorless

(vi) **Solubility in water :** Very slightly soluble in cold water but greater solubility in hot water.

(vii) Solubility in Organic Solvents

- Soluble in methanol, ethanol, dimethyl formamide, ethylene dichloride, acetone, ethyl acetate.
- Slightly soluble in ether.
- Insoluble in petroleum ether, pentane, benzene.

2. Chemical Properties

- Paracetamol is part of the class of drugs known as aniline analgesics.
- Paracetamol can relieve pain in mild arthritis, but has no effect on the underlying inflammation, reducess, and swelling of the joint. It has analgesic properties comparable to those of a spirin, while its anti-inflammatory effects are weaker.

9.7.3.3 Uses

(i) Paracetamol is a pain reliever and a fever reducer.

(ii) Paracetamol is used to treat many conditions such as headache, mussle aches, arthritis, backache, toothaches, cold and fevers.

9.7.4 Aspirin

9.7.4.1 Synthesis

The synthesis of aspirin is classified as an esterification reaction. Salicylic acid is treated with acetic anhydride, an acid derivative, causing a chemical reaction that turns salicylic acid's hydroxyl group into an ester group (R–OH $\longrightarrow$ R–$OCOCH_3$). This process yields

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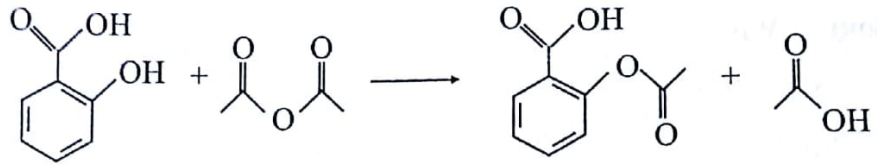
aspirin and acetic acid, which is considered a byproduct of this reaction. Small amounts of sulfuric acid (and occasionally phosphoric acid) are almost always used as a catalyst. This method is commonly employed in undergraduate teaching labs.



9.7.4.2 Properties

1. Physical Properties

Aspirin, an acetyl derivative of salicylic acid, is a white, crystalline, weakly acidic substance, with a melting point of 136 °C (277 °F) and a boiling point of 140°C (284 °F). Its acid dissociation constant (pKa) is 3.5 at 25 °C (77 °F).

2. Chemical Properties

Aspirin decomposes rapidly in solutions of ammonium acetate or the acetates, carbonates, citrates, or hydroxides of the alkali metals. It is stable in dry air, but gradually hydrolyses in contact with moisture to acetic and salicylic acids. In solution with alkalis, the hydrolysis proceeds rapidly and the clear solutions formed may consist entirely of acetate and salicylate.

Formula	$C_9H_8O_4$
Molar mass	180.158 g/mol
3D model (JSmol)	Interactive image
Density	1.40 g/cm3
Melting point	136 °C (277 °F)
Boiling point	140 °C(284 °F) (decomposes)
Solubility in water	3 mg/mL (20 °C)

9.7.4.3 Uses

Aspirin belongs to the group of medications called analgesics (pain relievers), antipyretics (fever reducers), anti-inflammatories (inflammation reducers), and platelet aggregation inhibitors (anticlotting agents). It works by interfering with the production of compounds in the body that cause pain, fever, inflammation, and blood clots.

Aspirin is used to treat pain, and reduce fever or inflammation. It is sometimes used to treat or prevent heart attacks, strokes, and chest pain (angina).

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