LNCT GROUP OF COLLEGES

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Designation: Assistant Professor

Department: Pharmacy

Subject: P'ceutical Organic Chemistry-1

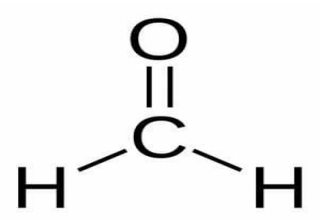
Subject Code: BP-202T

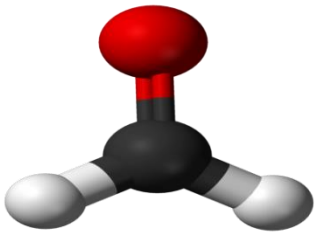
Unit: IVth

Topic: Structure and Uses of Aldehydes.

Lecture: 30/03/2020

Structure and uses of Formaldehyde





Structure of formaldehyde (methanal)

Formaldehyde (systematic name - **methanal**) is an organic compound with the formula CH_2O (H−CHO). It is the simplest of the aldehydes (R−CHO). It is an organic chemical which contains hydrogen, oxygen and carbon atoms.

Physical Properties

- It is colorless liquid.
- At room temperature it is a flammable liquid.
- It has a strong pungent odor.

Chemical Properties

- Formaldehyde reacts with a base like sodium hydroxide forms sodium formate and methanol. The chemical equation is given below.

$$\underset{\text{Formaldehyde}}{\mathbf{2\,HCHO}} + \underset{\text{sodium hydroxide}}{\mathbf{NaOH}} \rightarrow \underset{\text{sodium formate}}{\mathbf{HCOONa}} + \underset{\text{methanol}}{\mathbf{CH_3OH}}$$

- Formaldehyde react with ammonia to produce hexamethylenetetraammine and water. The chemical equation is given below.

$$\underset{\text{Formaldehyde}}{6HCHO} + \underset{\text{ammonia}}{4NH_3} \rightarrow \underset{\text{hexamethylenetetraammine}}{(CH_2)_6N_4} + 6H_2O$$

Method of Preparation

Methanol and oxygen react at 450 °C in presence of silver as catalyst to form formaldehyde

$$\underset{\text{Methanol}}{2\ CH_3OH} + O_2 \rightarrow \underset{\text{formaldehyde}}{2\ CH_2O} + 2\ H_2O$$

Formaldehyde Uses

Because it is highly chemically reactive, formaldehyde has many uses in science and industry. These uses include:

Formaldehyde Uses in Biology

Formaldehyde is often used in biology to preserve tissue specimens. Formaldehyde is useful for this purpose as it kills all bacteria and fungi, and can preserve the shape of a specimen by bonding with proteins and DNA.

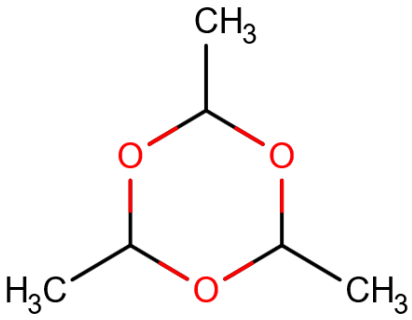
Formaldehyde Uses in Medicine

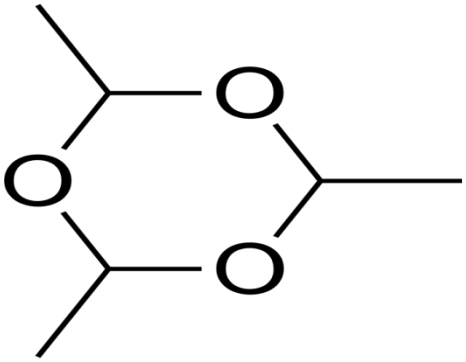
- Used as an antiseptic, as it kills most bacteria and fungi.
- Used in the treatment of warts and some parasites.
- Used in the production and sterilization of some vaccines.
- A formaldehyde precursor is sometimes used as an alternative to antibiotics in the treatment of urinary tract infections. The kidneys turn this precursor into formaldehyde, which is then excreted into the urinary tract instead of circulating in the blood.
- Used in some personal hygiene products to prevent bacterial growth.

Formaldehyde Uses in Industry

- Used as a reactant to produce many artificial materials such as resins, plastics, and other industrial chemicals.
- Used to treat clothes to make fabrics crease-resistant.
- Used to produce materials used in numerous parts of car manufacture.
- Used in the production of plywood, carpeting, and building insulation.
- Used in the production of sanitary paper products such as napkins, paper towels, and tissues.
- Used to make chemicals used in paints and explosives.
- Used to prevent bacterial and fungal growth in animal feed for commercial farming.
- Used in the development of some types of photography film.

Structure and uses of Paraldehyde





Structure of Paraldehyde

Paraldehyde is the cyclic trimer of acetaldehyde molecules and belongs to the family of aldehydes. Chemical Formula is $C_6H_{12}O_3$. IUPAC name of paraldehyde 2,4,6-trimethyl-1,3,5-trioxane.

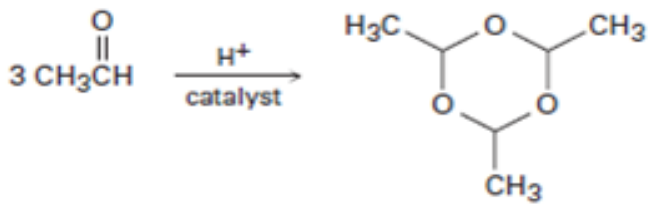
Properties

- A colourless liquid, with sweet odor and boiling point is 128 °C.
- It is sparingly soluble in water and highly soluble in ethanol.
- Paraldehyde slowly oxidizes in air, turning brown and producing an odour of acetic acid.
- It quickly reacts with most plastics and rubber.
- It regenerates acetaldehyde on distilling with conc. Sulphuric acid.

$$\underset{\text{Paraldehyde}}{C_6H_{12}O_3} \rightarrow \underset{\text{Acetaldehyde}}{3CH_3CHO}$$

Method of Preparation

Acetaldehyde treated with conc. Sulphuric acid at room temperature give Paraldehyde.

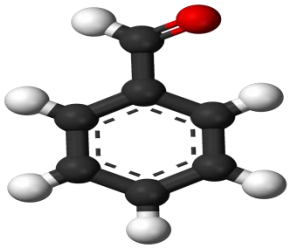


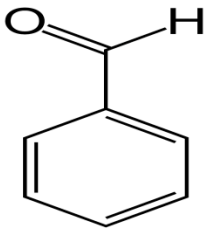
Paraldehyde

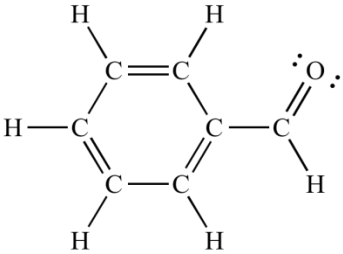
Uses of Paraldehyde

- Paraldehyde is used in resin manufacture.
- It is used as a preservative.
- It has been used in the treatment of epilepsy.
- It is used as an effective central nervous system depressant.
- It is used in the preparation of aldehyde fuchisn dye.
- It is also used as solvent in industries.

Structure and uses of Benzaldehyde







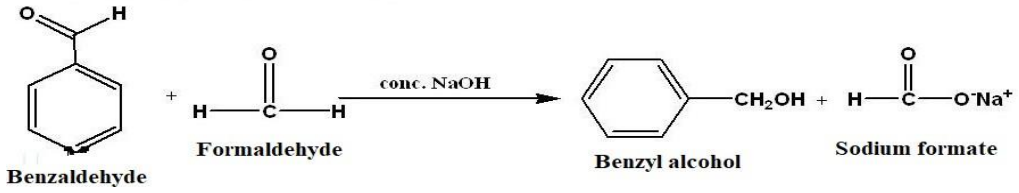
Structure of Benzaldehyde

Benzaldehyde (C_6H_5CHO) is an organic compound consisting of a benzene ring with a formyl substituent. It is the simplest aromatic aldehyde and one of the most industrially useful.

Systematic IUPAC name is Benzenecarbaldehyde.

Properties

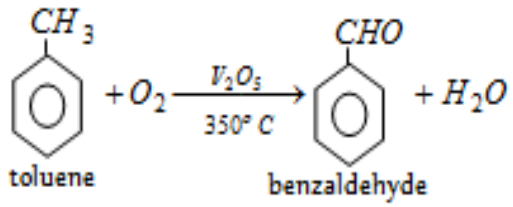
- It is a colorless liquid with a characteristic almond-like odor.
- Boiling point is 179 °C.
- It is soluble in ethanol and diethyl ether.
- Benzaldehyde react with formaldehyde to give benzyl alcohol.



Method of Preparation

By oxidation of Toluene

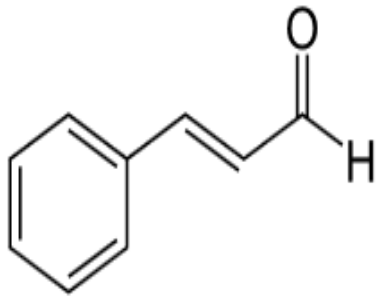
Oxidation of toluene is done with air and diluted with nitrogen (to prevent complete oxidation) at 350° C in the presence of Vanadium pentoxide as catalyst.

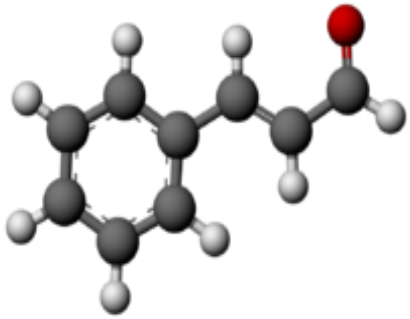


Uses of Benzaldehyde

- Benzaldehyde is commonly employed to confer almond flavor to foods and scented products.
- It is sometimes used in cosmetics products.
- Benzaldehyde is used chiefly as a precursor to other organic compounds, ranging from pharmaceuticals to plastic additives.
- Benzaldehyde is also a precursor to certain acridine dyes.
- Benzaldehyde is used in the preparation of cinnamaldehyde, mandelic acid and styrene.
- Benzaldehyde is used in the preparation of aniline dye malachite green.
- Benzaldehyde is used as a bee repellent.

Structure and uses of Cinnamaldehyde





Structure of Cinnamaldehyde

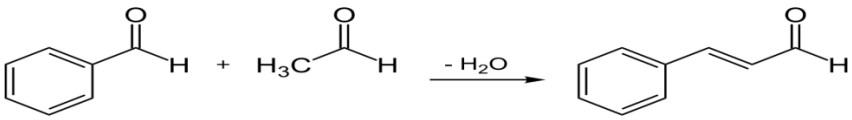
Cinnamaldehyde is an organic compound with the formula $C_6H_5CH{=}CHCHO$. IUPAC name 3-phenylpropenal. Occurring naturally as predominantly the *trans* (*E*) isomer, it gives cinnamon its flavor and odor. This pale yellow, viscous liquid occurs in the bark of cinnamon trees and other species of the genus Cinnamomum.

Properties

- **Cinnamaldehyde** (C_9H_8O) is pale yellow, viscous liquid with boiling point 252° C
- It has cinnamon-like odor.
- Soluble in ether, chloroform.
- Insoluble in petroleum ether, miscible with alcohol, oils

Method of Preparation

Benzaldehyde react with acetaldehyde to give Cinnamaldehyde .



Uses of Cinnamaldehyde

- The most obvious application for cinnamaldehyde is as flavoring in chewing gum, ice cream, candy, eliquid and beverages
- It is also used in some perfumes of natural, sweet, or fruity scents.
- Cinnamaldehyde has been tested as a safe and effective insecticide against mosquito larvae.
- Trans-cinnamaldehyde works as a potent fumigant.
- Cinnamaldehyde is also known as a corrosion inhibitor for steel and other ferrous alloys in corrosive fluids such as hydrochloric acid.
- The compound is also added to a number of cosmetics and home care products to improve their odor. Such products include deodorants, detergents, mouthwashes, perfumes, soaps, and toothpastes.