Aliphatic and Aromatic Hydrocarbons

Hydrocarbons (HCs) are composed of carbon and hydrogen molecules whose carbon–carbon (C–C) bonds are composed of either all single (saturated) bonds or combinations of single and multiple (unsaturated) bonds.

Hydrocarbons divided into two categories ;

- **Aliphatic & Alicyclic HCs**
- **Aromatic HCs**

Aliphatic HCs,

❖the term applies to straight, open chains of carbon atoms, rather than ring structures, the simplest of which are the saturated HCs (alkanes).

❖In addition, alkanes exist as unbranched straight chains or branched depending on the structural isomerism.

❖Multiple C–C bonds result when hydrogens are removed from the alkanes, yielding unsaturated HCs such as alkenes (double C–C bond) and alkynes (triple C–C bonds).

Alicyclic HCs

❖Are saturated, ring structures consisting of three or more carbon atoms.

❖Unlike the aromatic chemicals do not exhibit double bonds within the rings.

❖Example, cyclopropane, cyclobutane, cyclopentane and cyclohexane.

Aromatic HCs

❖Are a special class of unsaturated HCs that contain one or more planar rings, such as a benzene ring.

❖Benzene is the simplest aromatic molecule that can exist alone, attached as a substituent to other HCs (as a phenyl group), or as a substituted benzene (halogenated or methylated benzene).

❖Benzene also exists as part of more complex aromatic systems consisting of a number of fused benzene rings, such as naphthalene or anthracene.

❖The vast majority of these compounds, however, are fundamental HCs but contain additional elements (functional groups) classifying them as HC deriYatiYes,each of which possesses characteristic chemical properties.

❖The functional groups consist of halogens (such as F-, Cl-, Br-, I-), alcohols (OH), ethers (–O–),aldehydes (–CO–H), ketones (–CO–), carboxylic acids (–COOH), esters (–CO–O–)and amines (–NH2).

GENERAL SIGNS AND SYMPTOMS OF ACUTE TOXICITY

❖In general, exposure to HCs occurs primarily through inhalation, oral ingestion, and dermal routes.

❖Aliphatic and alicyclic HC gases and liquids are generally nontoxic or of low acute toxicity, with the majority of effects described as those for simple asphyxiants or pulmonary irritants (“Gases”).

❖Aromatic and halogenated HCs are associated with acute, systemic, toxic potential, including hematological and hepatorenal toxicity, attributable in part to their volatility and viscosity.

❖Some substances cause symptoms such as central nervous system (CNS) depression,narcosis, loss of consciousness, hallucination, stupor, and seizures.

❖Gastrointestinl effects involve nausea and vomiting.

❖Hematological consequences of HC toxicity result in mild hemolysis.

❖Cardiovascular sensitization to circulating catecholamines, with the risk of arrhythmias, is a consequence of exposure to high concentrations of aromatics and chlorinated Hcs.

❖Depending on the concentration of the chemical, dermal exposure produces thermal burns, requiring therapeutic intervention. Typical treatments for burn injuries, as well as use of HC ointments, such as Polysorbate 80, mineral oil, apetroleum jelly, are useful in managing the dermal trauma.

Management

❖Although no antidote is available for HC poisoning, life-threatening toxicity is managed using supportive care.

❖Because of the volatility of these chemicals, risk of aspiration pneumonitis increases with induction of vomiting, especially with administration of emetics, or with the use of gastric lavage.

PETROLEUM DISTILLATES

OCCURRENCE AND USES

❖Petroleum and petroleum distillates represent an extremely valuable natural resource consisting of a complex mixture of thousands of aliphatic and aromatic compounds.

❖Ninety percent of these petrochemicals are used for fuels for heating and transportation, as well as raw materials for the chemical industry.

❖Thus, the derivatives of petroleum are used in the manufacturing of many common substances found in household products and in the production of oils, waxes, cements, fuels (gasoline, kerosene), polymers (for plastics), paint and furniture products, and therapeutic agents (cod liver oil, mineral oil, laxatives).,

MECHANISM OF TOXICITY

❖In general, toxicity and reactivity of aliphatic and alicyclic HCs are low.

❖For instance, gaseous compounds have properties similar to pulmonary irritants or simple asphyxiants and usually produce anesthetic effects at very high concentrations.

❖Degree of cyclization or unsaturation does not correlate with toxicity. As with the simple asphyxiants, therefore, their toxicity is limited to the amount of substituted oxygen.

❖Aliphatic and alicyclic HCs are mostly flammable or combustible gases or liquid.

❖Their ability to form explosive mixtures with air decreases as the carbon number increases above 13.

AROMATIC HYDROCARBONS

OCCURRENCE AND USES

❖Aromatic HCs consist of mononuclear or polynuclear benzene rings as part of their structure.

❖They are widely distributed in petroleum and its products and are used as solvents and in the synthesis of organic chemicals.

MECHANISM OF TOXICITY

❖As with the aliphatic and alicyclic HCs, the toxicity of aromatic HCs is generally low.

❖At high concentrations, the substances affect the CNS, resulting in depression (narcosis), hallucinations, and stupor.

❖ Common routes of exposure for liquids or solids include oral ingestion, inhalation, or dermal absorption.

❖Aromatic HCs form explosive mixtures with air and are flammable with low flash points.

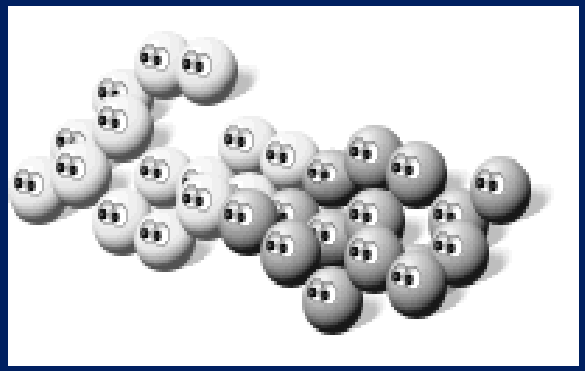
❖They react with oxidizing agents, have moderate to strong aromatic odors, and are designated priority pollutants or hazardous.

HALOGENATED HYDROCARBONS

OCCURRENCE AND USES

❖Halogenated aromatic or halogen-substituted aliphatic HCs (halocarbons) consist mostly of mononuclear benzene rings or straight, open chains of carbon atoms respectively, whose hydrogen atoms are partially or fully replaced by halogen atoms (fluorine, chlorine, bromine and iodine).

❖These liquids or solids are widely used as solvents, refrigerants, fire retardants, in organic synthesis of a variety of chemicals and in the past, as general anesthetics.



MECHANISM OF TOXICITY

❖Exposure to volatile liquid and gaseous halocarbons occurs primarily through inhalation, oral ingestion, and dermal exposure.

❖As with the aliphatic, alicyclic and aromatic HCs, the toxicity of halocarbons is generally low.

❖At high concentrations, the volatile liquids and gases appear to affect the CNS and intestinal tract, resulting in anesthesia, drowsiness, incoordination, nausea, and vomiting. Hepatic,renal, and cardiac toxicity can prove fatal.

❖Some compounds are known animal and human carcinogens.

❖Halocarbons range from noncombustible to highly flammable gases or liquids, the latter of which form explosive mixtures with air or when heated.

METHODS OF DETECTION

- Gas chromatographic (GC) techniques
- Mass spectrometry (GC-MS)


Thank You!