Al-Mustaqbal University

College of Engineering and Engineering Technologies

Department of Chemical Engineering and Petroleum Industries

Name of the substance: Chemicals from petroleum

Lecture number: Six

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Differences Between HDPE And LDPE:

Polyethylene is one of the five major synthetic resins. At present, my country is the world's largest importer of polyethylene and the second largest consumer. Polyethylene is mainly divided into three categories: high-density polyethylene (HDPE), low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE.(

1. *Appearance difference between HDPE and LDPE:*

HDPE: As for HDPE, this plastic material is generally opaque. After biting with teeth, white stubble marks will appear in the crack. The material is relatively brittle and hard, and it is used for more product packaging.

LDPE: LDPE is relatively soft, has good toughness, good transparency, smooth hand feeling, and less sound when torn by hand.

2. *The difference between using HDPE and LDPE:*

HDPE: HDPE can be used as drawing grade, injection grade, hollow grade and blown film grade. Its relative plastic products are: fishing nets, barrels, oasis bottles and packaging bags.

LDPE: LDPE plastics are generally used to make film products, generally used for industrial films, covering films, agricultural films, etc.

3. *The difference between the physical properties of HDPE and LDPE:*

In terms of odor and toxicity, they are both non-toxic, tasteless and odorless. Fortunately, it is non-toxic and harmless to the body. Plastic people can put a hundred hearts on them.

4. *.The difference between HDPE and LDPE mechanical properties:*

HDPE has high strength, good toughness and strong toughness, and is close to PP and tougher than PP. Used for extrusion packaging films, ropes, woven bags, fishing nets, water pipes; For injection molding of low-grade daily necessities and shells, non-load-bearing components, plastic boxes, and turnover boxes; For extrusion blow molding containers, hollow products, and bottles.

The mechanical properties of LDPE are relatively poor.

5. *Differences in heat and cold resistance*: Good heat and cold resistance, at room temperature and even at -40F low temperature, excellent impact resistance, low temperature embrittlement temperature < -90°C, low temperature. heat="" resistance,="" low="" temperature="" embrittlement="" temperature<><"">=

6. *The difference between HDPE and LDPE softening point:*

HDPE: 125-135 °C, LDPE: 90-100 acid, alkali, corrosion‹

7. *Organic solvent performance difference:*

HDPE: Corrosion resistant to strong oxidants. Corrosion resistance to acids, alkalis and various salts; Insoluble in any organic solvent, etc.

LDPE is resistant to acid, alkali and salt solution corrosion, but has poor solvent resistance

PVC **:** Polyvinyl Chloride (PVC or Vinyl) is a high-strength thermoplastic material. It is widely used in applications such as pipes, medical devices, and wire & cable insulation...the list is endless. It is the world's third-most widely produced synthetic plastic polymer.

Methods of obtaining vinyl chloride : Due to the importance of this monomer, all methods have been followed in order to manufacture this compound. Currently, the necessary basic materials are chlorine and acetylene or ethylene. Chlorine can be used in elemental form. It is prepared from the electrolysis of alkali metal chlorides or in the form of hydrochloric acid. There are four synthesis methods: A- Removal of hydrogen chloride from 1,2-dichloroethane under the influence of alkalis or by thermal decomposition.

1- Under the influence of alkalis

2- By thermal decomposition, which is carried out at high temperatures (450-500 oC) and in the presence of an iron intermediate according to the following reaction:

B- Starting with acetylene: It is carried out by reacting HCl with acetylene at a temperature of 150-200 °C, and it is carried out in the gaseous state at the mentioned temperature and in the presence of an intermediate of mercury chlorine or in an aqueous medium at a temperature of 20-25 °C. This method does not give secondary products.

C- Starting with ethylene: by chlorinating ethylene, we obtain 1-2 dichloroethane at the level (40-60 oC) and iron trichloro as an intermediate.

By removing HCl at a high temperature, dichloroethane gives a vinyl chloride molecule at high temperatures ranging from (400-500 oC). With aluminum oxide and activated carbon as mediators.

Ethylene can be chlorinated directly at high temperatures (500-600 oC), as shown by the following reaction:

E- The method of chlorine oxidation: as shown by the following reaction:

This reaction takes place at a high temperature of 470-500 °C

PP : Polypropylene (PP), also known as polypropene, is a thermoplastic polymer used in a wide variety of applications. It is produced via chain-growth polymerization from the monomer propylene.

Polypropylene belongs to the group of polyolefins and is partially crystalline and non-polar. Its properties are similar to polyethylene, but it is slightly harder and more heat-resistant. It is a white, mechanically rugged material and has a high chemical resistance.Bio-PP is the bio-based counterpart of polypropylene (PP).Polypropylene is the second-most widely produced commodity plastic (after polyethylene).

Polypropylene is a natural, white material that is obtained through the polymerization of propylene molecules that are obtained from “petroleum”, which in turn is considered a derivative of crude petroleum (this is through the process of obtaining large molecules by adding the molecules longitudinally

Petrochemical complexes

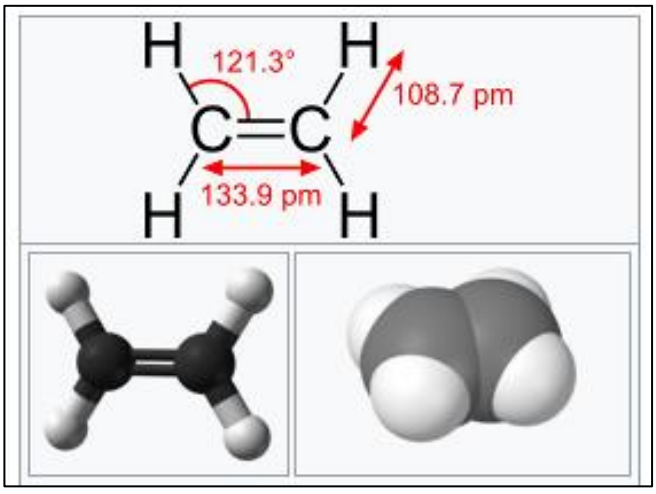
A petrochemical plant is a chemical plant that uses a petroleum-based feedstock such as LPG or other products from a petroleum refinery to produce a chemical product such as plastic or rubber. Different types of sub-plant include Petrochemical, Steam Cracker, Ammonia and Fertilizers

Ethylene

Ethylene (IUPAC name: ethene) is a hydrocarbon which has the formula C2H4 or H2C=CH2. It is a colourless, flammable gas with a faint "sweet and musky" odour when pure.[6] It is the simplest alkene (a hydrocarbon with carbon–carbon double bonds.(

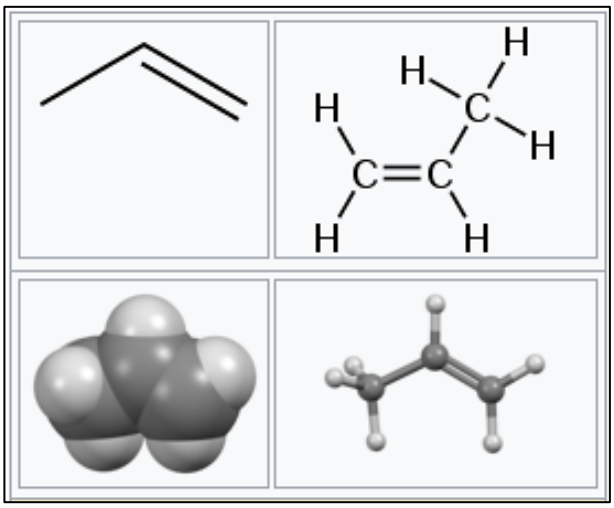
Ethylene is widely used in the chemical industry, and its worldwide production (over 150 million tonnes in 2016[7]) exceeds that of any other organic compound.[8][9] Much of this production goes toward creating polyethylene, which is a widely used plastic containing polymer chains of ethylene units in various chain lengths. Ethylene is also an important natural plant hormone and is used in agriculture to force the ripening of fruits.[10] The hydrate of ethylene is ethanol.

Structure and properties : This hydrocarbon has four hydrogen atoms bound to a pair of carbon atoms that are connected by a double bond. All six atoms that comprise ethylene are coplanar. The H-C-H angle is 117.4°, close to the 120° for ideal sp^2 hybridized carbon. The molecule is also relatively weak: rotation about the C-C bond is a very low energy process that requires breaking the π-bond by supplying heat at 50°C. The π-bond in the ethylene molecule is responsible for its useful reactivity. The double bond is a region of high electron density, thus it is susceptible to attack by electrophiles. Many reactions of ethylene are catalyzed by transition metals, which bind transiently to the ethylene using both the π and π* orbitals.[citation needed[Being a simple molecule, ethylene is spectroscopically simple. Its UV-vis spectrum is still used as a test of theoretical methods.



Propylene

Propylene, also known as propene, is an unsaturated organic compound with the chemical formula CH3CH=CH2. It has one double bond, and is the second simplest member of the alkene class of hydrocarbons. It is a colorless gas with a faint petroleum-like odor. Propylene is a product of combustion from forest fires, cigarette smoke, and motor vehicle and aircraft exhaust.

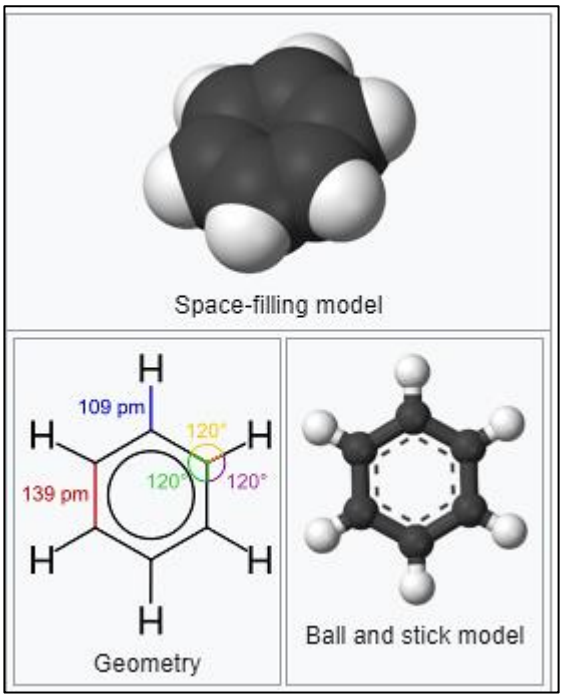


Propene is the second most important starting product in the petrochemical industry after ethylene. It is the raw material for a wide variety of products. Polypropylene manufacturers consume nearly two thirds of global production.[14] Polypropylene end uses include films, fibers, containers, packaging, and caps and closures. Propene is also used for the production of important chemicals such as propylene oxide, acrylonitrile, cumene, butyraldehyde, and acrylic acid. In the year 2013 about 85 million tonnes of propene were processed worldwide

Benzene

Benzene is an organic chemical compound with the molecular formula C6H6. The benzene molecule is composed of six carbon atoms joined in a planar hexagonal ring with one hydrogen atom attached to each. Because it contains only carbon and [hydrogen atoms, benzene is classed as a hydrocarbon.

Benzene is a natural constituent of petroleum and is one of the elementary petrochemicals. Due to the cyclic continuous pi bonds between the carbon atoms, benzene is classed as an aromatic hydrocarbon. Benzene is a colorless and highly flammable liquid with a sweet smell, and is partially responsible for the aroma of gasoline. It is used primarily as a precursor to the manufacture of chemicals with more complex structures, such as ethylbenzene and cumene, of which billions of kilograms are produced annually. Although benzene is a major industrial chemical, it finds limited use in consumer items because of its toxicity. Benzene is a volatile organic compound



C-4 (explosive)

C-4 or Composition C-4 is a common variety of the plastic explosive family known as Composition C, which uses RDX as its explosive agent. C-4 is composed of explosives, plastic binder, plasticizer to make it malleable, and usually a marker or odorizing taggant chemical. C-4 has a texture similar to modelling clay and can be molded into any desired shape. C-4 is relatively insensitive and can be detonated only by the shock wave from a detonator or blasting cap.

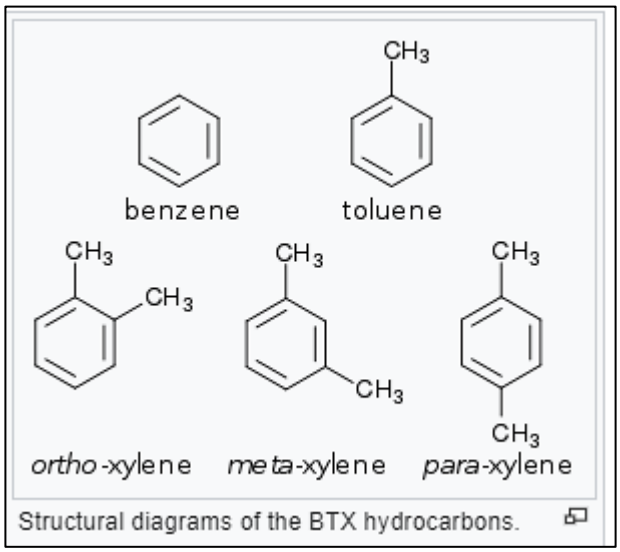
Development : C-4 is a member of the Composition C family of chemical explosives. Variants have different proportions and plasticisers and include compositions C-2, C-3, and C-4.[3] The original RDX-based material was developed by the British during World War II and redeveloped as Composition C when introduced to the U.S. military. It was replaced by Composition C-2 around 1943 and later redeveloped around 1944 as Composition C-3. The toxicity of C-3 was reduced, the concentration of RDX was increased, giving it improved safety during usage and storage. Research on a replacement for C-3 was begun prior to 1950, but the new material, C-4, did not begin pilot production until 1956.[4]:125 C-4 was submitted for patent as "Solid Propellant and a Process for its Preparation" March 31, 1958, by the Phillips Petroleum Company.

BTX

In the petroleum refining and petrochemical industries, the initialism BTX refers to mixtures of benzene, toluene, and the three xylene isomers, all of which are aromatic hydrocarbons. The xylene isomers are distinguished by the designations ortho – (or o –), meta – (or m –), and para – (or p –) as indicated in the adjacent diagram. If ethylbenzene is included, the mixture is sometimes referred to as BTEX.

The BTX aromatics are very important petrochemical materials. Global consumption of benzene, estimated at more than 40,000,000 tons in 2010, showed an unprecedented growth of more than 3,000,000 tons from the level seen in 2009. Likewise, the para-xylene consumption showed unprecedented growth in 2010, growing by 2,800,000 tons, a full ten percent growth from 2009.[1[

Toluene is also a valuable petrochemical for use as a solvent and intermediate in chemical manufacturing processes and as a high octane gasoline component



Structural diagrams of the BTX hydrocarbons.