

8.9: USES AND SOURCES OF ALKENES

Learning Objectives

- discuss the uses and sources of alkenes including catalytic cracking

USES OF ETHENE AND PROPENE

Produced from ethylene (ethene)

Chemical	Uses
ethanol	solvent; constituent of cleaning preparations; in synthesis of esters
acetaldehyde	slug killer, in the form of methaldehyde (CH_3CHO) ₄
acetic acid	manufacture of vinyl acetate polymers, ethyl acetate solvent and cellulose acetate polymers
ethylene oxide	“cellosolves” (industrial solvents)
ethylene glycol	anti-freeze; production of DacronOR
ethylene dichloride	solvent; production of vinyl chloride
vinyl chloride	manufacture of poly (vinyl chloride)— PVC
vinyl acetate	manufacture of poly (vinyl acetate) used in paint emulsions, plywood adhesives and textiles
polyethylene	“plastic” bags; toys; packaging

Produced from propylene (propene)

Chemical	Uses
isopropyl alcohol	rubbing alcohol; cosmetics; synthesis of acetone
propylene oxide	manufacture of polyurethanes; polyesters
cumene	industrial preparation of phenol and acetone
polypropylene	molded articles (e.g., kitchenware); fibres for indoor-outdoor carpeting

CATALYTIC CRACKING TO FORM ETHYLENE

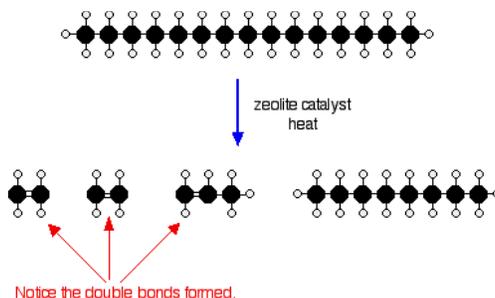
Cracking is the name given to breaking up large hydrocarbon molecules into smaller and more useful bits. This is achieved by using high pressures and temperatures without a catalyst, or lower temperatures and pressures in the presence of a catalyst. The source of the large hydrocarbon molecules is often the naphtha fraction or the gas oil fraction from the fractional distillation of crude oil (petroleum). These fractions are obtained from the distillation process as liquids, but are re-vaporized before cracking.

The hydrocarbons are mixed with a very fine catalyst powder. These days the catalysts are zeolites (complex aluminosilicates) - these are more efficient than the older mixtures of aluminium oxide and silicon dioxide. The whole mixture is then blown rather like a liquid through a reaction chamber at a temperature of about 500°C. Because the mixture behaves like a liquid, this is known as fluid catalytic cracking (or fluidized catalytic cracking). Although the mixture of gas and fine solid behaves as a liquid, this is nevertheless an example of heterogeneous catalysis - the catalyst is in a different phase from the reactants. The catalyst is recovered afterwards, and the cracked mixture is separated by cooling and further fractional distillation.

There is not any single unique reaction happening in the cracker. The hydrocarbon molecules are broken up in a fairly random way to produce mixtures of smaller hydrocarbons, some of which have carbon-carbon double bonds. One possible reaction involving the hydrocarbon $C_{15}H_{32}$ might be:



Or, showing more clearly what happens to the various atoms and bonds:

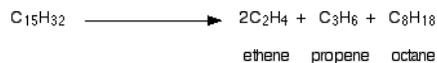


This is only one way in which this particular molecule might break up. The ethene and propene are important materials for making plastics or producing other organic chemicals. The octane is one of the molecules found in petrol (gasoline).

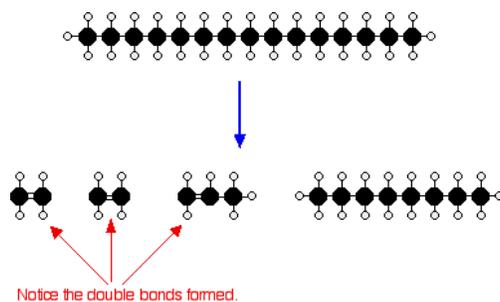
ETHENE

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This is only one way in which this particular molecule might break up. The ethene and propene are important materials for making plastics or producing other organic chemicals. You will remember that during the polymerization of ethene, thousands of ethene molecules join together to make poly(ethene) - commonly called polythene. The reaction is done at high pressures in the presence of a trace of oxygen as an initiator.



CONTRIBUTORS AND ATTRIBUTIONS

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