

## MODULE-4

### Thermal and catalytic cracking

**Q1:** Define the term 'Gas Oil'?

**A1:** It is the general term for describing any distillable refinery stream boiling above 350°F. Diesel, turbine and jet fuels are blended from gas oils. Higher boiling gas oils are called heavy gas oils.

**Q2:** What is HCO?

**A2:** HCO is the short form of the term Heavy Cycle Oil. It is the fraction of FCC product liquid distilling above 640°F.

**Q3:** What is LCO?

**A3:** LCO stands for Light Cycle Oil. It is a fraction of FCC product liquid distilling between 430°F and above 640°F.

**Q4:** What is LPG?

**A4:** LPG stands for Liquefied Petroleum Gas. Generally, any light hydrocarbon fuel that must be compressed to keep it from boiling away. Commercial LPG usually contains mixtures of propane ( $C_3H_8$ ) and butane ( $C_4H_{10}$ ).

**Q5:** What is Visbreaking?

**A5:** Visbreaking is a mild form of thermal cracking, significantly lowers the viscosity of heavy crude-oil residue without affecting the boiling point range. Residual from the atmospheric distillation tower is heated (800°-950° F) at atmospheric pressure and mildly cracked in a heater.

**Q6:** What is catalytic cracking ?

**A6:** It major secondary refining process of conversion of heavy fractions ( vgo 370°C+) into lighter fuel products (LPG,gasoline,diesel)circulating fluid bed reactor system (reactor-regenerator configuration).It is a multi component catalyst system in which catalyst tailored for each unit based on unit objectives and constraints.

**Q7:** What is thermal cracking ?

**A7:** It is process of cracking of heavy residues under severe thermal conditions. Liquid products are highly olefinic, aromatic and have high sulfur .Hydrogen treatment required for the liquid products to improve properties .Thermal cracking follows free radical mechanism.

**Q8:** What are the feed for vibreaking?

**A8:** Feed stock: Asphalt, Short residuum to residuums,and medium oil.

**Q9:** What are the main reaction involved in catalytic cracking?

**A9:** (a)Cracking of Paraffins  
(b)Naphthenes and side chain of aromatics .  
(c)Isomerisation of olefinsDehydrogenation of Naphthenes and Olefins  
(d)Cyclization and condensation of olefins .Alkylation and dealkylation .

**Q10:** What are the different type of catalytic cracking used in industries?

**A10:** (1)Fixed bed, Houdry  
(2)Moving beds-Air lift-Thermofer catalytic cracking Houdry flow.  
(3)Fluidized Beds  
(a)Gulf Resrearch(Fluid catalytic cracking ) FCC,UOP,Texaco.  
(b)Kellog(Ortho flow)  
(c)ESSO-Flexi cracking  
(d)Standard –Ultra cracking.

**Q11:** what are the different type of catalyst used in fluid catalytic cracking(FCC)?

**A11:**FCC catalyst is a fine powder made up primarily of silica and alumina and containing acid sites that enable the catalyst to crack heavy hydrocarbons to gasoline and lighter products without formation of excessive amount of coke. These were replaced with present day zeolite catalysts with greatly increased activity, stability, and improved selectivity.

**Q12:** How the olefin reactivity varies with carbon number in cracking?

**A12:** Olefins cracks at a much faster rate compared to paraffins and subject to rapid isomerization.

**Q13:** What are the advantages of zeolites catalyst over amorphous silica-alumina ?

**A13:** (1) Higher activity: factor of 100 higher than amorphous silica-alumina catalyst.  
(2) Higher gasoline yield at a given conversion however octane number of gasoline obtained from zeolite cracking is lower by 2-3 numbers compared to amorphous catalyst. (3) Production of gasoline containing a large number of paraffin and aromatic hydrocarbons.

**Q14:** What is the effect of temperature and pressure on cracking?

**A14:** Pressure retards cracking reactions. But in practice a positive pressure of 10 to 15 Kgs/cm<sub>2</sub> is used to minimize coke formation. Recycling increases refractory nature of stocks and hence recycling should not exceed 2 to 3 times of fresh stock for economic operation

**Q15:** How the paraffin reactivity varies with carbon number in cracking?

**A15:** Rate of reaction increases with carbon number but rate of coke formation also increases with (carbon number) molecular weight characterized by high production of C<sub>3</sub> and C<sub>4</sub> in the cracked gas