

MODULE -7

Isomerization, Alkylation, and Polymerization

Q1: What is isomerization?

A1: Octane numbers of the LSR naphtha [C₅-180°F (C₅-82°C)] can be improved by the use of an isomerization process to convert normal paraffin to their isomers.

Q2: Why low temperature is required for alkylation when we use H₂SO₄ as catalyst?

A2: Low temperature required for H₂SO₄ because at higher temperature forms tar due to oxidation-reduction reactions.

Q3: What are the catalysts and conditions are used in polymerization reaction?

A3: Sulfuric acid, copper pyrophosphate, or phosphoric acids are used as catalyst in the process at 15°C to 22°C and 150 to 1200 psi, depending on feedstock and product requirement.

Q4: What is thermal polymerisation?

A4: Thermal polymerization is regarded not as effective as catalytic polymerization but has the advantage that it can be used to polymerize saturated materials that cannot be induced to react by catalysts. The process consists essentially of vapor phase cracking of, say, propane and butane followed by prolonged periods at high temperature (50°C to 59°C) for the reactions to proceed to near completion.

Q5: What is the feed stock for the isomerization?

A5: Lightest naphtha feed stock (SRG) with pentanes, hexanes, & small amounts of heptanes. Feed often debutanized —"Debutanized Straight Run". Sulfur & nitrogen must be removed since catalysts employ an 'acid site' for activity.

Q6: What are the products of isomerization?

A6: Isoparaffins & cycloparaffins and small amounts of light gasses from hydrocracking

Q7: What is catalytic alkylation?

A7: Catalytic alkylation process is used in refineries to upgrade light olefins (produced from catalytic crackers as well as from cokers) and isobutene into a highly branched paraffins. In petrochemical industry It is used to produce alkylate benzenes and other petrochemical products.

Q8: Why Alkylation is important in refining process?

A8: Alkylation is an important refining process for the production of alkylates, a high-octane gasoline blending component. Alkylate product is a mixture of branched hydrocarbons of gasoline boiling range. Alkylate has a motor octane (MON) of 90-95 and a research octane (RON) of 93-98. Because of its high octane and low vapor pressure, alkylate is considered an excellent blending component for gasoline.

Q9: What is the feed stock for alkylation process?

A9: The feed to alkylate unit is usually cracked LPG from the FCCU unit. The FCCU's LPG is fractionated into a C3/C4 splitter to remove propane and lighter components.

Q10: What are the catalyst used for alkylation process?

A10: Alkylation process are conducted by Lewis acids like sulphuric acid, hydrofluoric acid, aluminium chloride (obsolete). Highly exothermic reaction $HP = - (630 \text{ to } 700 \text{ Btu/lb for isobutene alkylation})$.

Q11: What is polymerisation?

A11: Polymerization is a process in which a substance of low molecular weight is transformed into one of the same composition but of higher molecular weight, maintaining the atomic arrangement present in the basic molecule.

Q12: Why Polymerisation is an important process in gasoline manufacturing?

A12: Most gasoline formulations require inclusion of some light naphtha to meet the front-end distillation and octane specifications. However, C5/C6 normal paraffins in this boiling range have low octane, which make them very difficult to include in the gasoline formulation. Branched chain C5 and C6 hydrocarbons have higher octane, making them more suitable for inclusion in gasoline.

