University of Mosul
College of Petroleum & Mining Engineering

Title of the lecture

Lecture Three

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Refining Processes

1. Physical Separation Processes

1.1. Crude Distillation

Crude oils are first desalted and then introduced with steam to an atmospheric distillation column. The atmospheric residue is then introduced to a vacuum distillation tower operating at about 50 mmHg, where heavier products are obtained.

Refining Processes

1.2. Solvent Deasphalting

This is the only physical process where carbon is rejected from heavy petroleum fraction such as vacuum residue. Propane in liquid form (at moderate pressure) is usually used to dissolve the whole oil, leaving asphaltene to precipitate. The deasphalted oil (DAO) has low sulphur and metal contents since these are removed with asphaltene.

Refining Processes

1.3. Solvent Extraction

In this process, lube oil stock is treated by a solvent, such as N-methyl pyrrolidone (NMP), which can dissolve the aromatic components in one phase (extract) and the rest of the oil in another phase (raffinate). The solvent is removed from both phases and the raffinate is dewaxed.

Refining Processes

2. Chemical Catalytic Conversion Processes

2.1. Catalytic Reforming

In this process a special catalyst (platinum metal supported on silica or silica base alumina) is used to restructure naphtha fraction (C6–C10) into aromatics and isoparaffins. The produced naphtha reformate has a much higher octane number than the feed. This reformate is used in gasoline formulation and as a feedstock for aromatic production (benzene–toluene–xylene, BTX).

Refining Processes

2.2. Hydrotreating

This is one of the major processes for the cleaning of petroleum fractions from impurities such as sulphur, nitrogen, oxy-compounds, chlorocompounds, aromatics, waxes and metals using hydrogen. The catalyst is selected to suit the degree of hydrotreating and type of impurity. Catalysts, such as cobalt and molybdenum oxides on alumina matrix, are commonly used.

Refining Processes

2.3. Catalytic Hydrocracking

For higher molecular weight fractions such as atmospheric residues (AR) and vacuum gas oils (VGOs), cracking in the presence of hydrogen is required to get light products. In this case a dual function catalyst is used. It is composed of a zeolite catalyst for the cracking function and rare earth metals supported on alumina for the hydrogenation function. The main products are kerosene, jet fuel, diesel and fuel oil.