



Process Descriptions of Refinery Processes

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Introduction

Refinery and Distillation Processes

Process Description of the Crude Distillation Unit

Crude Oil Desalting

The purpose of refinery is :

Separate the crude oil into different “fractions” or saleable components.

Shift the original component ratio and properties to meet the customer’s demand and

Remove the impurities detrimental to product quality.

Types of refinery processing

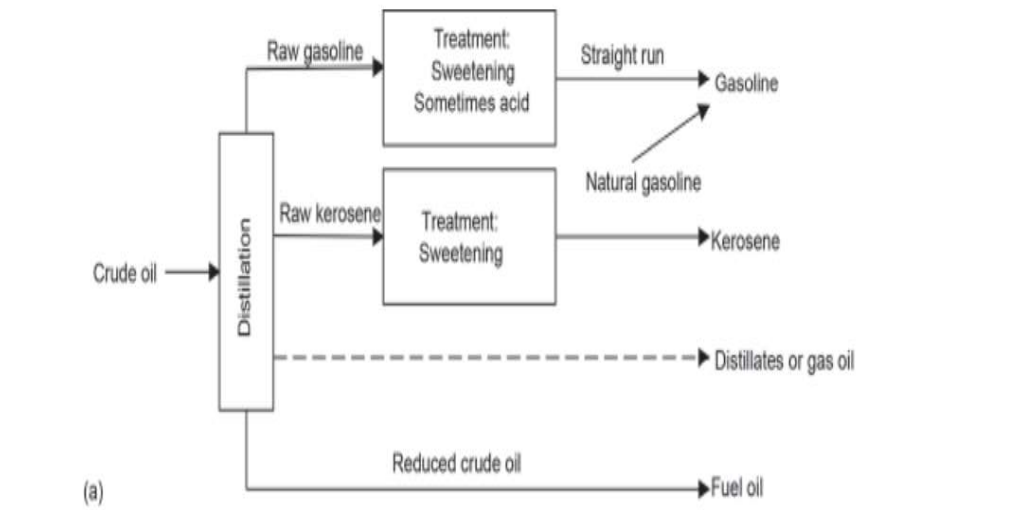
Skimming of Topping Processing

Cracking Processing

Lubricating Oil Processing

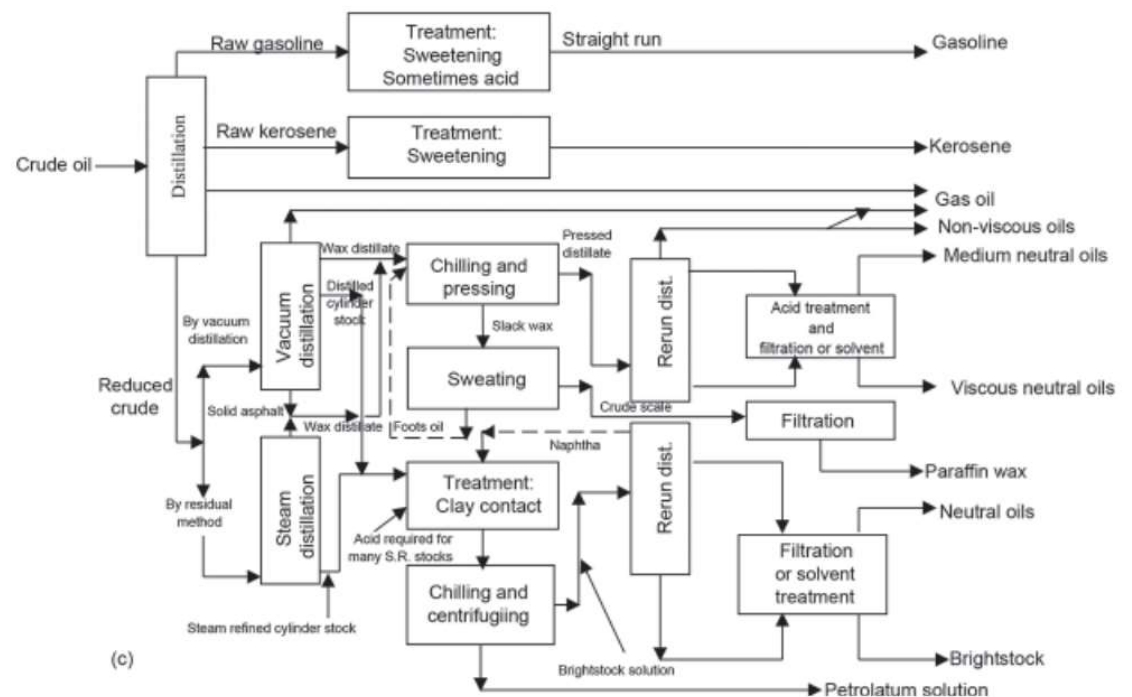
Skimming or Topping Processing (Figure a):

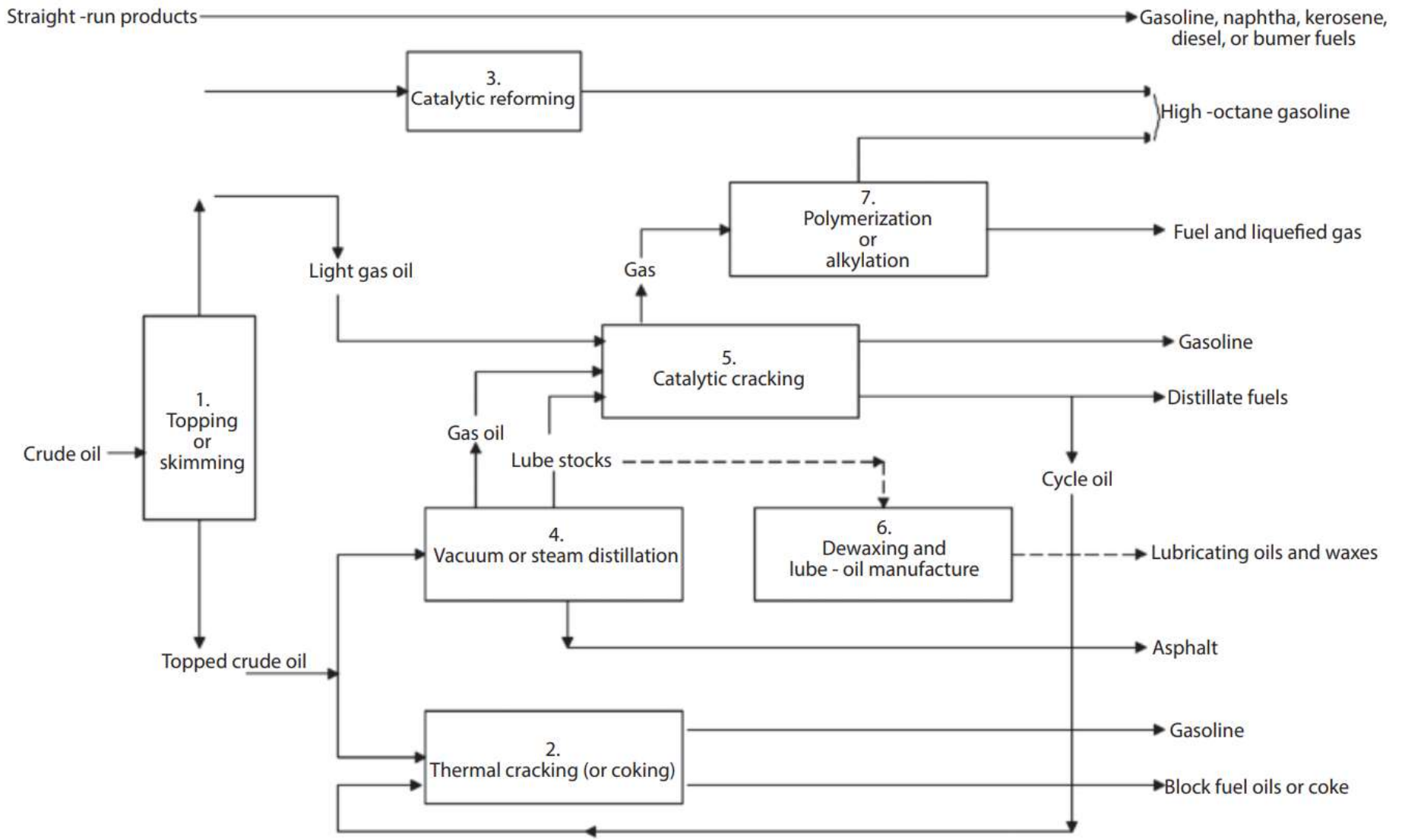
This occurs by simple atmospheric - pressure distillation; the crude oil is separated into gasoline, kerosene and fuel oil, or reduced crude oil, and sometimes reformer charge stock, jet fuel or gas oil. Topping is often practiced on all types of crude oil.



Lubricating-oil Processing (Figure c):

This process involves topping with the manufacture of lubricants from the residue of the crude oils. Paraffin-base crude oils are generally processed for lubricants, while mixed-base oils are often processed by solvent extraction in Figure c. Naphthalene oils are processed for lubricants only under the most favorable condition.

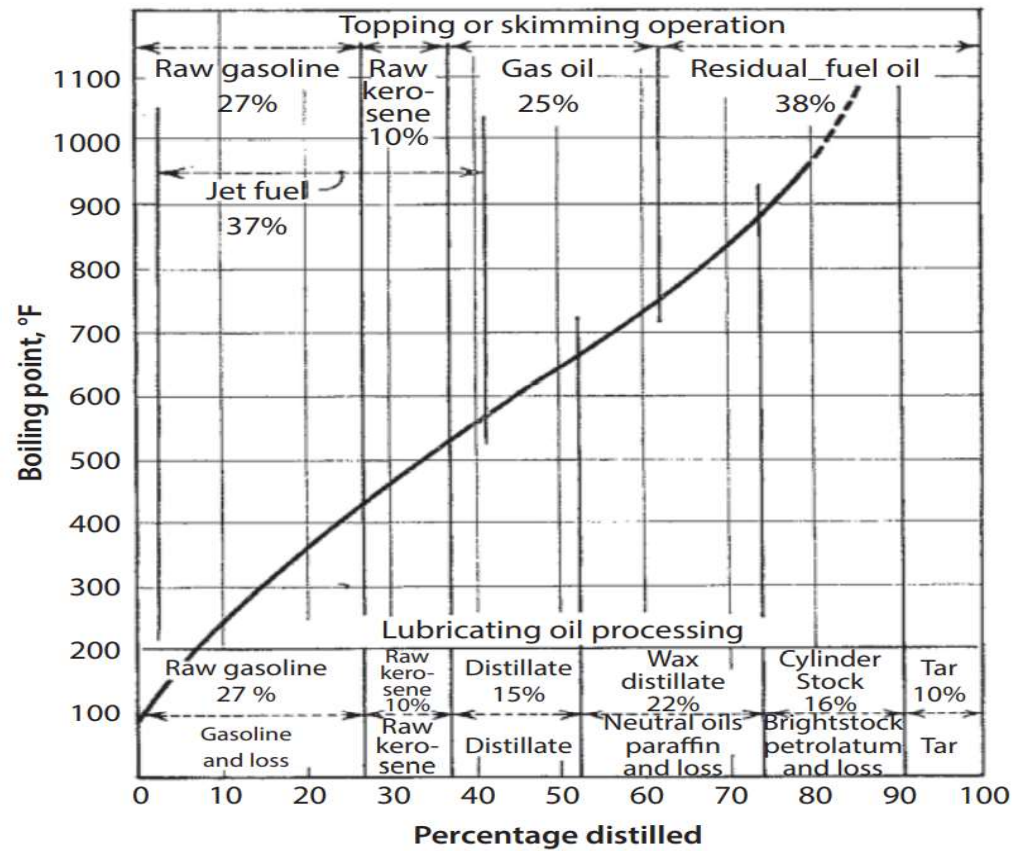


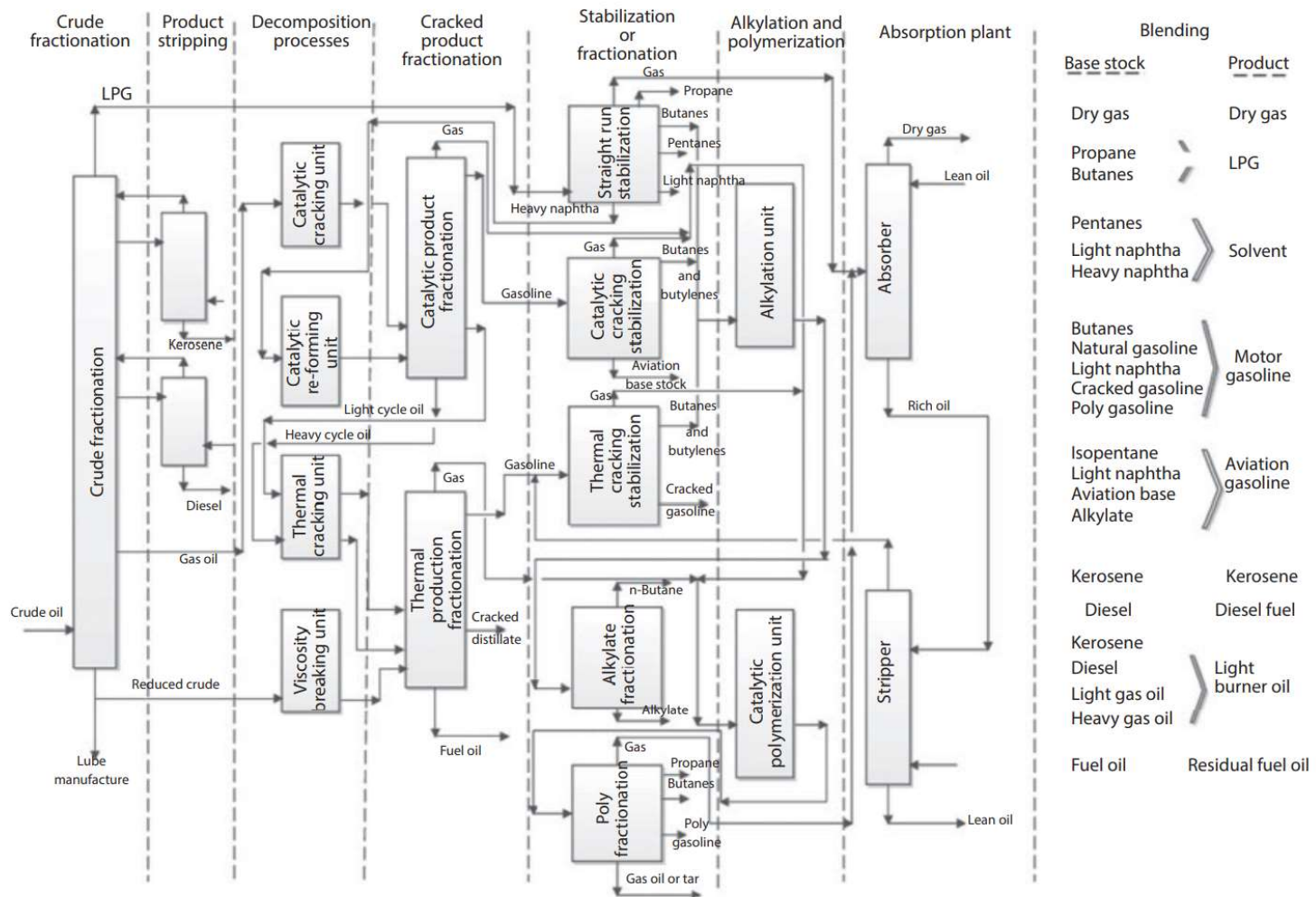


Important Points about the Processing

- Characteristics provide the methods of processing that are employed for the different base of oils and the products that are manufactured.
 - Paraffin-base oils are particularly adaptable for the manufacture of lubricating oils.
- Lubricating oils are produced from mixed-base oils, but acid and solvent treatment is usually necessary.
- Vacuum distillation or precipitation of asphalt by liquid propane is suited to the processing of mixed and naphthalene-base oils because most of the asphalt or tarry material may be left behind as a residue, and the cleaned lubricating-oil stocks can be treated more cheaply than asphalt-bearing stocks.
- Naphthalene-base oils produce good asphalt and are usually in large quantities to justify their manufacture.
- The gasoline from naphthalene crude oils is usually antiknock and may be sold directly as premium-grade motor fuel.

illustrates the boiling range of refinery products of Texas mixed-base crude oil at 31.7°API,





Flow diagram of a refinery facility for light oils (mainly gasoline, kerosene and distillates).

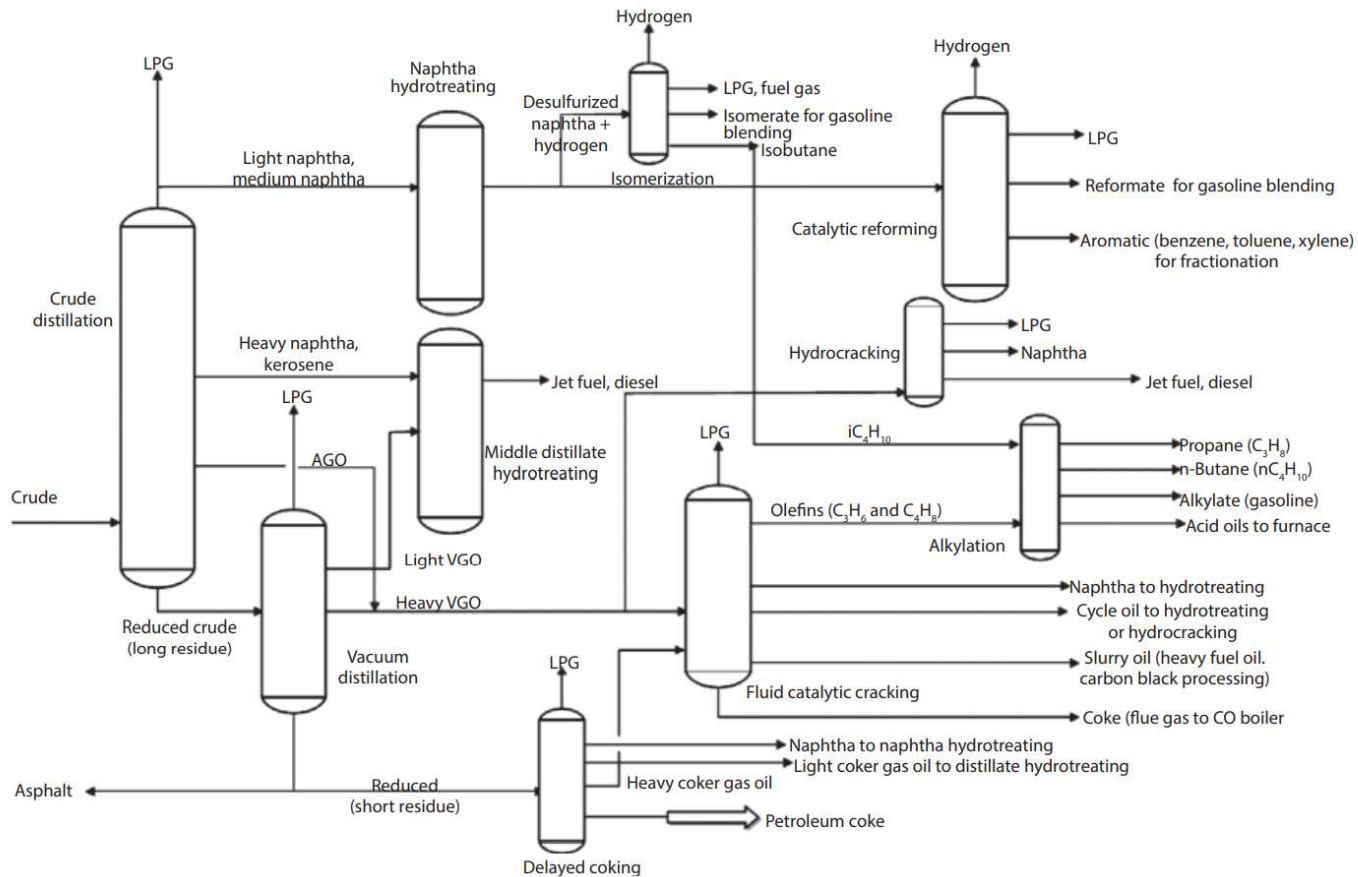
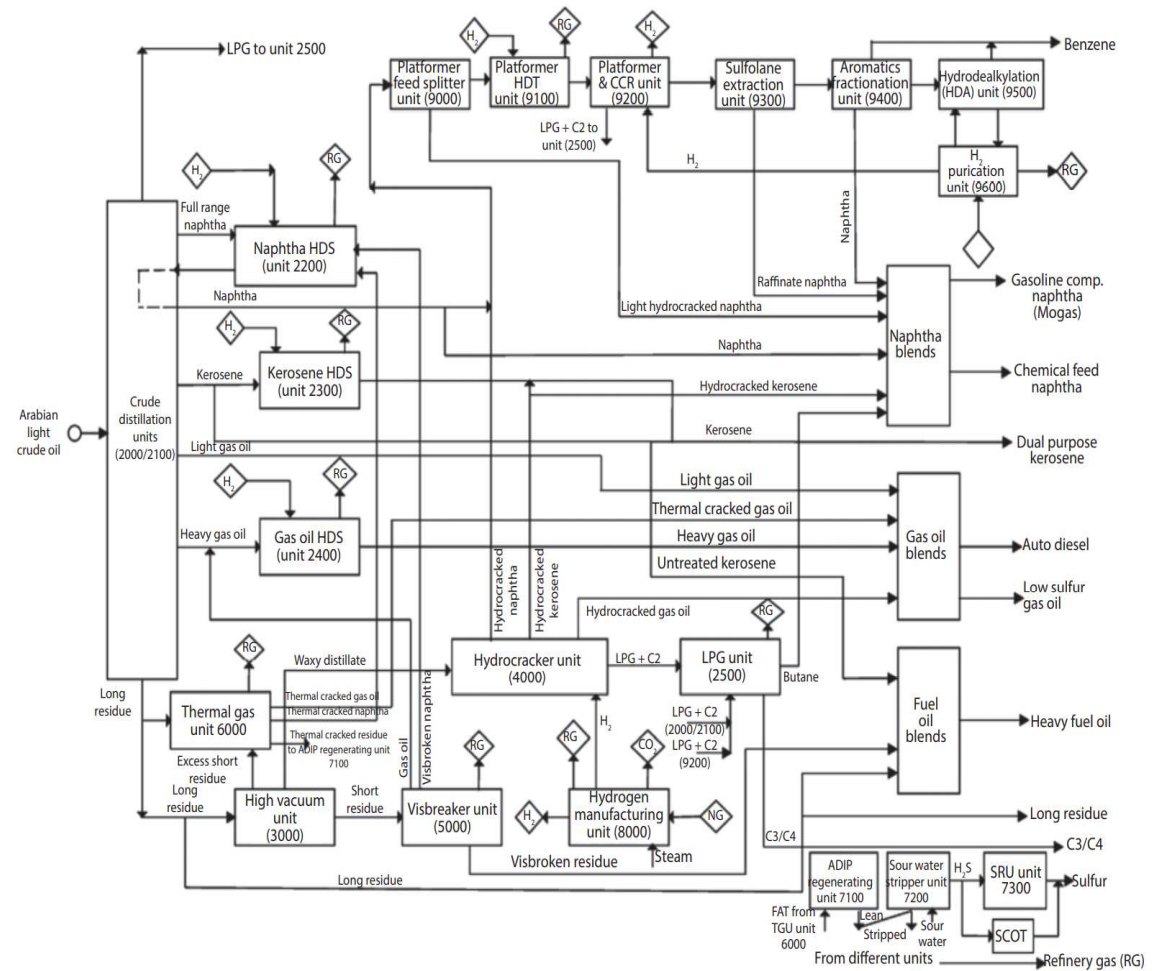


Figure shows a process flow diagram of a refinery unit, involving three main processes as separation, conversion, and treating

Process Description

Figure show a process flow diagram of a complex refinery unit involving further processing as crude product handling and auxiliary facilities. Here, the feed is Arabian light crude oil from tank farm, which is processed in the crude distillation unit. The first physical separation process produces distillate streams of Liquefied petroleum gas (LPG), naphtha, kerosene, light gas oil, heavy gas oil and long residue.



Functions of some units

The hydrodesulfurizer units

- Remove the sulfur components contained in the naphtha, kerosene and heavy gas oil.

The high-vacuum unit (HVU)

- processes long residue, which comes from the mild-vacuum columns of the crude distillers.

hydrocracker unit (HCU)

- The main product is a waxy distillate comes from (HVU) which is used as feed to the hydrocracker unit (HCU). The unit also produces short residue and black wash oil to be used as feed-to the visbreaker unit (VBU).

The visbreaker unit(VBU)

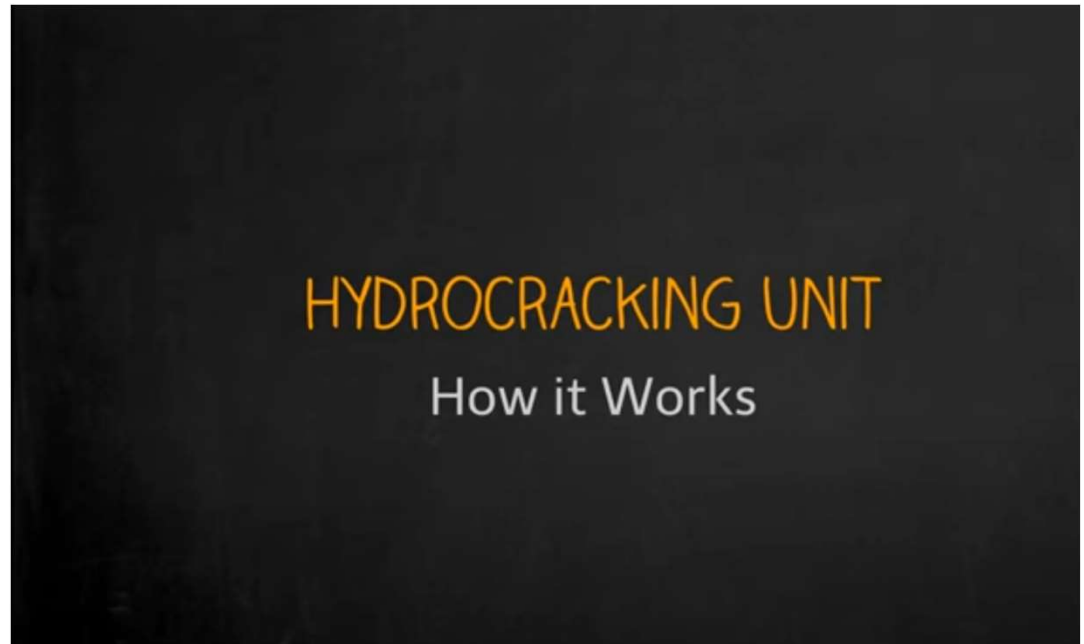
- The visbreaker unit processes the short residue from the HVU, alternatively, long residue from the crude distillers. The resulting products are naphtha and gas oil, and the visbroken residue goes for blending either with kerosene or gas oil to be used as fuel oil.

Steps of Hydrocracking


The first section of hydrocracking unit consists of a hydrocracker and fractionating unit, sour gas and LPG treating units such as aqueous di-isopropanolamine (ADIP).


The ADIP treating system consists of:


- ADIP Gas Absorption Systems
- LPG ADIP Extraction Systems
- ADIP Regeneration Section



First Section of Hydrocracking

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- The hydrocracker takes a heavy waxy distillate feed from the high-vacuum unit (HVU) and converts it in the reactors by using a catalyst under highly exothermic reaction to LPG and light gases, naphtha, and kerosene and gas oil.

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- The separation of the final products is achieved in the fractionating unit. Naphtha is sent to storage as platformer feed, while the kerosene is sent to storage together with the kerosene from the hydrodesulfurization unit of the crude distillation unit (CDU).

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- Hydrocracker gas oil is also sent to storage with the gas oil from the hydrodesulfurization unit of the CDU. The LPG (gas and liquid) is treated in the ADIP unit before being pumped to LPG unit

Second Section of Hydrocracking

The second section consists of:

- hydrogen manufacturing unit (HMU),
- LPG unit,
- sour water strippers,
- regeneration units,
- sulfur recovery units (SRU).

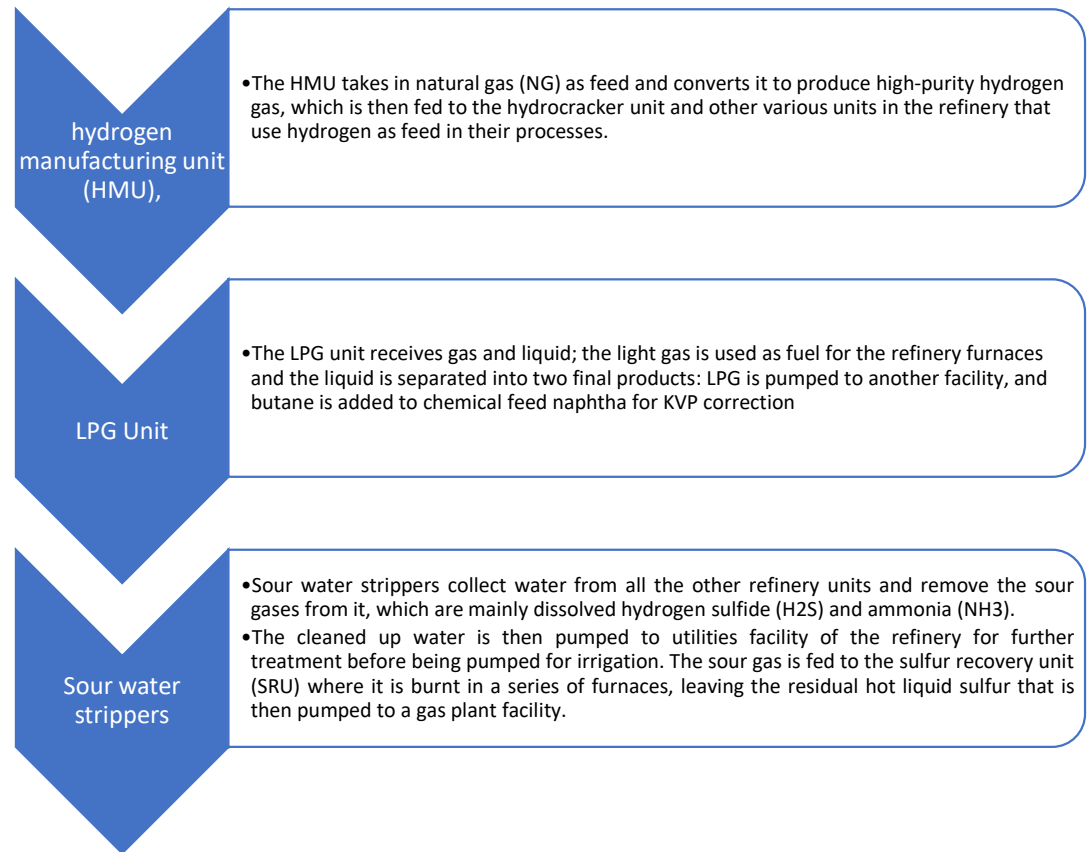


Table summarizes the various processes in a typical refinery

Separation	Crude oil desalting/dewatering Atmospheric distillation Vacuum distillation Light ends recovery.
Conversion	Thermal cracking–coking, visbreaking Catalytic cracking Hydrocracking Steam cracking Catalytic reforming Isomerization Alkylation and polymerization.
Treating	Hydrodesulfurization Hydrotreating Extraction Bitumen blowing Lube oil manufacture (large or specialist refineries only).
Crude and product handling	Unloading Storage Blending Loading.
Auxiliary facilities	Boiling/process heaters Hydrogen production Sulfur recovery and production Cooling towers Compressor engines Power generation Blow down system Wastewater treatment Flares.