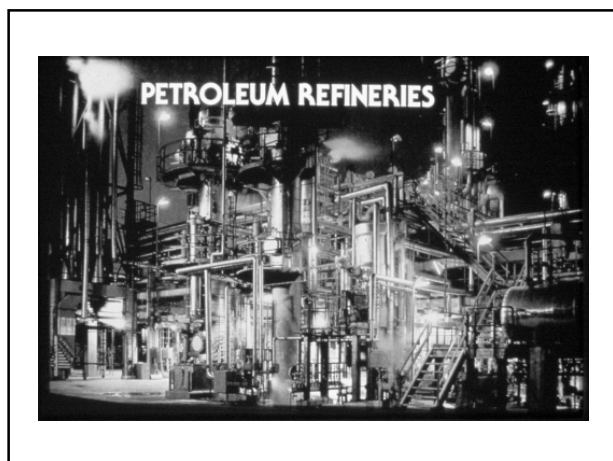


Chapter 8: Petroleum Refining

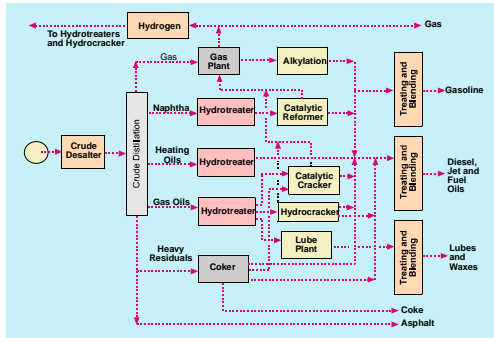
Chapter 8
Petroleum Refining



Categories of Refining Operations
<ul style="list-style-type: none">• Separation processes• Conversion processes• Treatment processes• Auxiliary processes

Chapter 8: Petroleum Refining

Typical Processing Steps



Separation Processes

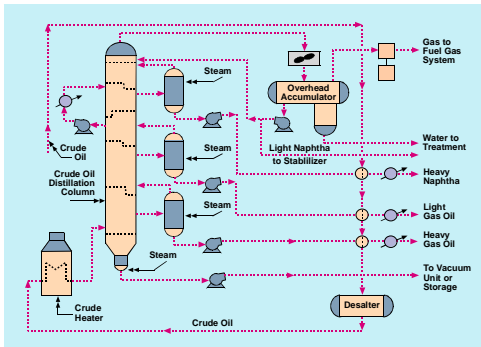
- Desalting
- Distillation
- Deasphalting

Distillation

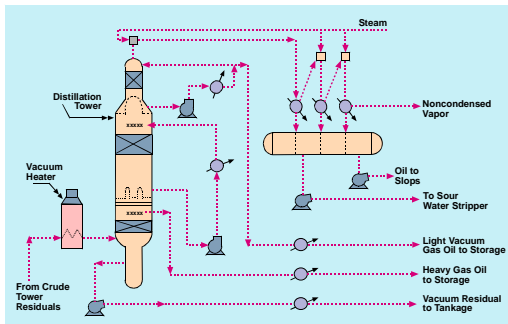
- Atmospheric distillation
- Vacuum distillation

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Atmospheric Distillation Unit



Vacuum Distillation



Deasphalting

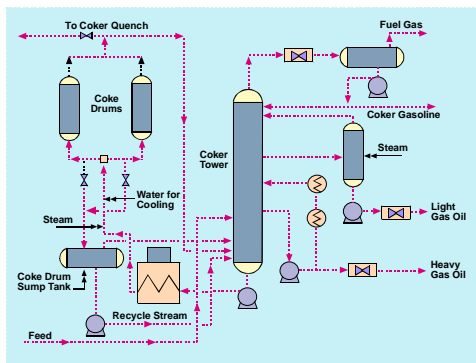
Separates asphaltic compounds using liquid-liquid extraction with liquid propane

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Conversion Processes

- Coking
- Visbreaking
- Catalytic cracking
- Polymerization
- Alkylation
- Isomerization
- Reforming

Delayed Coking Unit

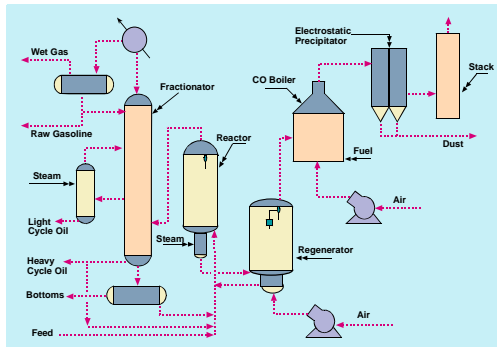


Visbreaking

- Milder form of cracking than coking
- Residues from atmospheric and vacuum distillation fed to process heater
- Thermal cracking produces residual tars, gas oils, gasoline and light gases
- Used to reduce viscosity of residual fractions for blending into fuel oils

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Catalytic Cracking Unit



Polymerization

- Catalytic conversion of olefin gases to liquid condensation products
- Provided a gasoline blending stock when octane level were low
- Rarely used today
- Polymers are valuable as additives for motor oil

Alkylation

- Branched hydrocarbons are synthesized by the catalytic addition of a paraffinic or aromatic hydrocarbon to an olefin
- The product, alkylate, is used as an antiknock additive

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Isomerization

- Rearranges feedstock molecular structure to produce branched-chain compounds from straight-chain compounds
- Process is usually applied to butane or mixtures of pentane and hexane

Reforming

- Converts straight-chain naphtha compounds to ring or branched structures
- Predominate use is the dehydrogenation of naphthenes to form aromatics

Treatment Processes

- Hydrotreating
- Amine treating
- Chemical sweetening
- Asphalt blowing

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Hydrotreating

- Removes sulfur, nitrogen and metal compounds from intermediate fractions
- In hydrodesulfurization, the petroleum stream is mixed with hydrogen and passed over a fixed-bed catalyst
- Reactor effluent is separated to recover the hydrogen and the hydrogen sulfide and ammonia

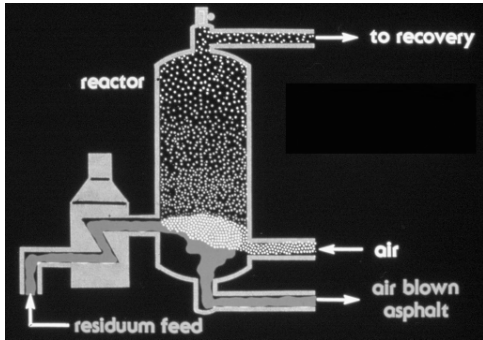
Amine Treating

- Removes acid impurities, mainly hydrogen sulfide and carbon dioxide, from intermediate fractions
- Petroleum stream is contacted with an aqueous amine solution in a tray or packed tower
- Spent amine solution is processed to regenerate the scrubbing solution and producing a concentrated acid-gas stream

Chemical Sweetening

- Sweetens distillates by extraction or conversion of mercaptans
- In conversion process, sour feed is sparged with air and passed over a fixed-bed catalyst wetted by caustic solution
- In extraction process, sour feed is contacted with caustic solution in a packed tower. Spent caustic is regenerated and mercaptans recovered as alkyl disulfides

Asphalt Blowing



Auxiliary Processes

- Sulfur recovery
- Wastewater treatment
- Fuel gas recovery
- Blowdown systems

Sulfur Recovery

- Sulfur compounds in petroleum fractions are converted into hydrogen sulfide by treatment processes
- Hydrogen sulfide is collected and converted to elemental sulfur, usually with a Claus process

Chapter 8: Petroleum Refining

Wastewater Treatment

- Specific design of system varies
- Systems generally include:
 - Drain systems
 - Oil-water separators
 - Air flotation units
- Additional treatment may involve secondary and tertiary processes

Fuel Gas Recovery

- Recovers hydrocarbon vapors from various refinery processes
- Collected gases are compressed, condensed and separated into constant vapor pressure mixtures
- Recovered mixtures used as refinery fuel or feedstock or sold

Blowdown Systems

- Provides for safe disposal of liquid and gaseous hydrocarbons from pressure-relief devices
- Blowdown is separated into liquid and vapor fractions and recycled or flared

Emission Control Techniques

- Flares
- Incinerators
- Process heaters
- Covers
- Fugitive emission control

Emission Regulation

Process Inspection
