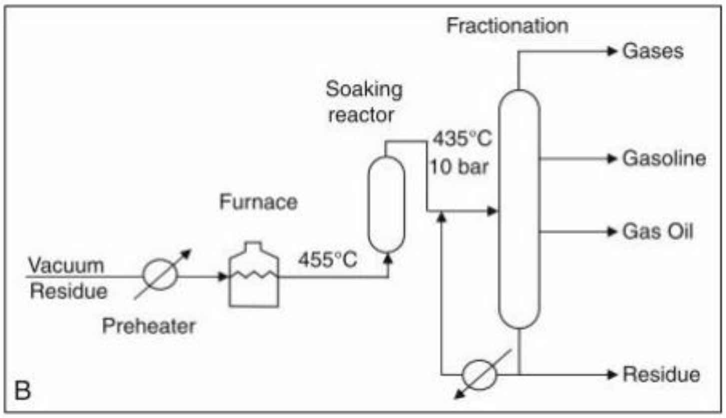
Republic of Iraq
Ministry of Higher Education
and Scientific Research
Al-Mustaqbal University College
Chemical Engineering and Petroleum Industries Department

Subject: Oil and Gas Field Processing
3rd Class
Lecture 8

Soaker Visbreaker

The process scheme described above is usually referred to as furnace or coil cracking. Some visbreakers employ a soaker between the visbreaker furnace and the quenching step, similar to the conventional thermal cracking processes. This type of operation is termed soaker cracking as shown in Figure B.



Both process configurations have their advantages and applications. Coil cracking yields a slightly more stable visbreaker product, which are important for some feedstocks and applications. It is generally more flexible and allows the production of heavy cuts, boiling in the vacuum gas oil range. Soaker cracking usually requires less capital investment, consumes less fuel and has longer on-stream times.

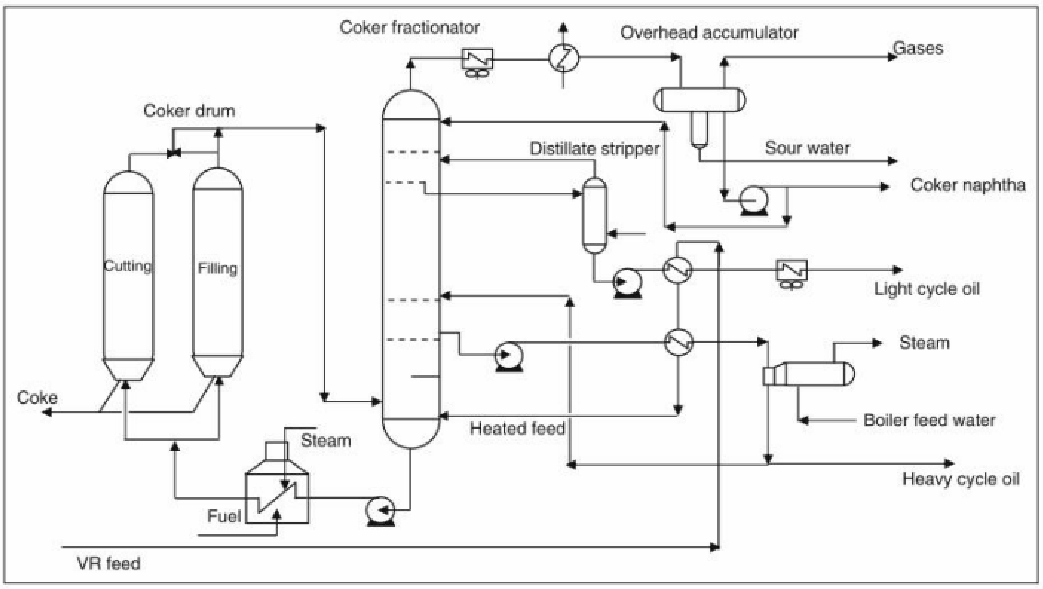
Delayed Coking

Delayed coking is a type of thermal cracking in which the heat required to complete the coking reactions is supplied by a furnace, while coking itself takes place in drums operating continuously on a 24 h filling and 24 h emptying cycles.

The feed to coker is usually vacuum residue which is high on asphaltenes, resins, aromatics, sulphur and metals. The deposited coke contains most of the asphaltenes, sulphur, and metals present in the feed, and the products are unsaturated gases (olefins) and highly aromatic liquids.

Process Description

A schematic flow diagram of the delayed coking is shown in Figure below. The process includes a furnace, two coke drums, fractionator and stripping section. Vacuum residue enters the bottom of the flash zone in the distillation column or just below the gas oil tray. Fractions lighter than heavy gas oil are flashed off and the remaining oil are fed to the coking furnace.



Steam is injected in the furnace to prevent premature coking. The feed to the coker drums is heated to just above 482 °C (900 F). The liquid–vapour mixture leaving the furnace passes to one of the coking drum. Coke is deposited in this drum for 24 h period while the other drum is being decoked and cleaned. Hot vapors from the coke drum are quenched by the liquid feed. Vapors from the top of the coke drum are returned to the bottom of the fractionator.

These vapors consist of steam and the products of the thermal cracking reaction (gas, naphtha and gas oils). The vapors flow up through the quench trays of the fractionator. Steam and vaporized light ends are returned from the top of the gas oil stripper to the fractionator. Eight to ten trays are generally used between the gas oil draw and the naphtha draw or column top.

Delayed Coking Variables

There are three classes of variables affecting coking. They are related to process operating variables, feedstock characterization and engineering variables as shown in Table below.

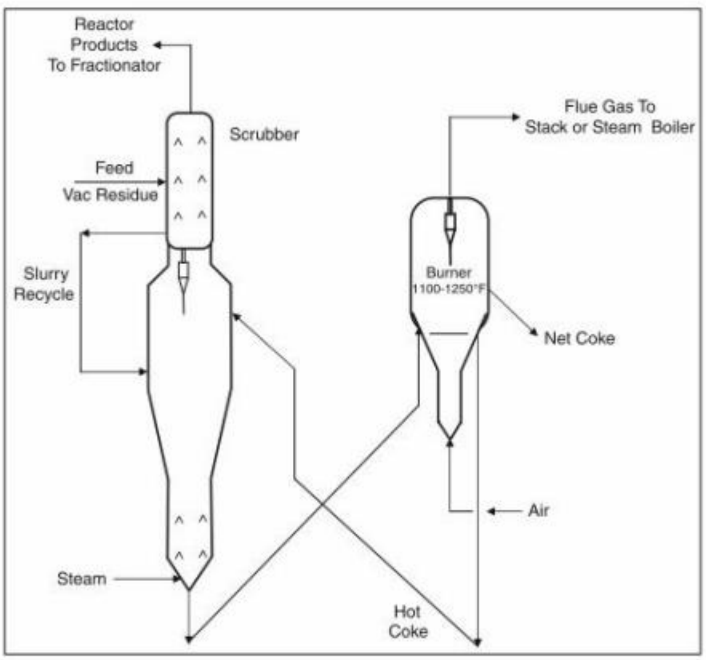
Delayed coking variables

Process variables	Feedstock variables	Engineering variables
Cycle time	Characterization factor	Mode of operation
Temperature	Conradson carbon	
Pressure	Sulphur content	Capacity
Recycle ratio	Metal content, characterization	Equipment used for coke removal and handling

Temperature is used to control the severity of coking. In delayed coking, the temperature controls the quality of the coke produced. High temperature will remove more volatile materials. Coke yield decreases as temperature increases. If the furnace temperature is high this might lead to coke formation in the furnace. A low inlet furnace temperature will lead to incomplete coking. Short cycle time will increase capacity but will give lower amounts of liquid products and will shorten drum lifetime. Increasing pressure will increase coke formation and slightly increase gas yield. Recycle ratio is used to control the endpoint of the coker gas oil. It has the same effect as pressure. Feedstock variables are the characterization factor and the Conradson carbon which affect yield production. Sulphur and metal content are usually retained in the coke produced. Engineering variables also affect the process performance. These include mode of operation, capacity, coke removal and handling equipment.

Fluid Coking

Fluid coking is a thermal cracking process consisting of a fluidized bed reactor and a fluidized bed burner as shown in Figure below. Vacuum residue is heated to 260 °C (500 F) and is fed into the scrubber which is located above the reactor for coke fine particle recovery, and it operates at 370 °C (700 F). The heavy hydrocarbons in the feed are recycled with the fine particles to the reactor as slurry recycle. The reactor operating temperature is 510–566 °C (950–1050 F). The heavy vacuum residue feed is injected through nozzles to a fluidized bed of coke particles. The feed is cracked to vapor and lighter gases which pass through the scrubber to the distillation column.



Fluid coking process