VISBREAKING

Visbreaking

- Visbreaking ,an abbreviated term for viscosity breaking or viscosity lowering ,is a mild ,liquid phase thermal conversion process to reduce the viscosity of atmospheric and vacuum residues to produce specification fuel oil.
- small quantity of LPG and fair amount of naphtha are also produced.
- Visbreaker gas oils can be produced if necessary . if produced ,light gas oil can be use as a component of diesel oil ,and heavy gas oil can be used as a feedstock for fluid catalytic cracking or hydrocracking process.
- Visbroken vacuum residue is utilized in refineries as fuel for furnaces and boilers.

- The fuel consumption in the visbreaking operation varies in the range of net 1-1.5 wt% on feed which forms the major portion of the operating cost .

- But the visbreaking operation leads to a reduction of cutterstock requirement of the order of 20-30wt% on feed ,depending on the type of feedstock.

- In addition some light distillate (LPG,naphtha) are produced ,so that altogether a fuel oil reduction of 25-30wt.% on feed to the visbreaker is achieved.

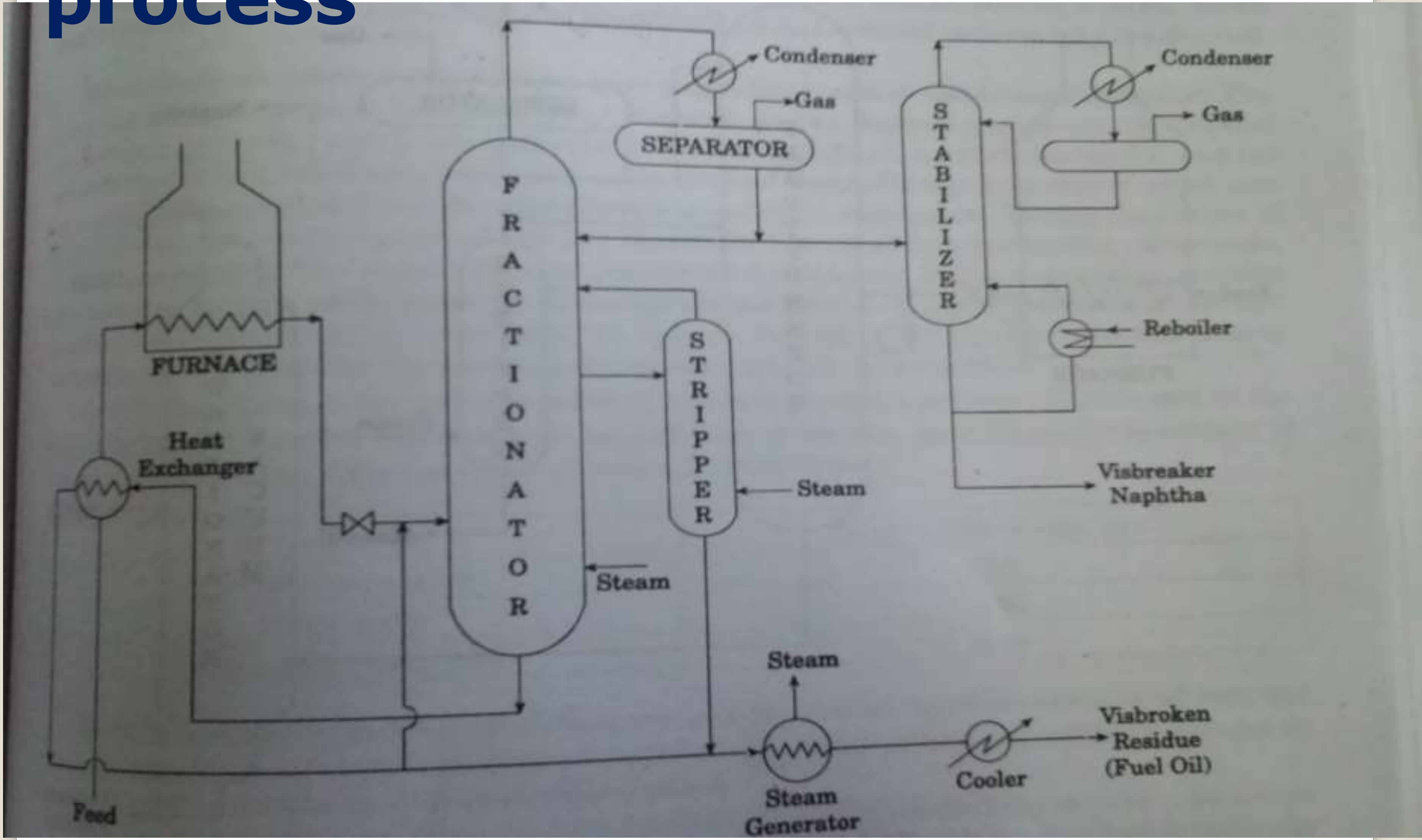
With present technology ,two options are available for visbreaking .these are:

- Conventional visbreaking
- Soaker visbreaking

Conventional visbreaking :

This process produces a minimum of naphtha and a maximum of fuel oil of suitable viscosity and pour point from atmospheric residue ,vacuum residue and other heavy feedstocks.

Conventional visbreaking process



Process Variables

The process variables which affect visbreaking operations are:

•Furnace outlet temperature
•Furnace outlet pressure
•Feed rate
•Feedstock characteristics

Furnace outlet temperature

At constant feed rate ,the extent of cracking increases with increase in the furnace outlet temperature resulting in viscosity reduction of the visbroken residue along with increased production of gas ,naphtha and gas oil.

Furnace outlet pressure

- A high pressure suppresses vaporization and tends to produce a liquid phase.
- So at low pressure there is higher yield of gas and naphtha.at higher pressure the yield of gas oil is more.

Feed rate

- Severity of the visbreaking operation decreases with increase in feed rate for the same furnace outlet temperature.
- Hence, for maintaining the same viscosity of visbroken residue,furnace outlet temperature should be with feed rate and vice versa.

Feedstock characteristics

The compounds in visbreaker feed may be considered as two distinct groups viz.

- Colloidal asphaltene particles, which are non-volatile and very difficult to crack thermally, and
- Volatile heavy hydrocarbons,which are easily cracked thermally and a portion of which acts as a peptizing agent to hold the asphaltenes in colloidal suspension.

- During the course of visbreaking,the heavy hydrocarbons are thermally converted into low-boiling compounds,thus concentrating the asphaltenes in unconverted residuum.
- If the visbreaking reaction proceeds too far,the asphaltenes precipitate from the oil to form deposits in the furnace and produce visbroken residue unsuitable for sale as fuel oil.
- The viscosity reduction during visbreakingis effected by the cracking of the non-asphaltic hydrocarbons.

•In refining industry the determination of asphaltenes uses n-pentane(NC_5)to extract the hydrocarbon oils leaving the asphaltenes as residue.

An NC_5 insoluble content of vacum residue from different types of crudes is given below:

Type of crude	**NC5 insoluble content,wt%**
Paraffin-base crude	2-12
Mixed crude	10-20
Naphthenic-base crude	18-28

•With the increase in NC5 insolubles content of vacuum residue ,viscosity of feed and viscosity and yield of visbroken residue increase.

•The yields of dry gas , naphtha and gas oil decrease with increase in NC_5 insolubles content.

•The feedstock having higher asphaltene content and higher viscosity require more severe operation for obtaining the same viscosity of finished fuel oil.

•As visbreaker feed is generally a blend of several components like vacuum residue,heavy vacuum gas oil ,and surplus atmospheric residue ,close monitoring is necessary over the proportion of various components to ensure that the feed viscosity does not exceed 900-1000cSt at 50C

Typical operating conditions

Furnace

Furnace inlet temperature,°c	340
Furnace outlet temperature,°c	470-490
Furnace inlet pressure,kgf/cm²	22
Furnace outlet pressure,kgf/cm²	15
Pressure drop across furnace,kgf/cm²	7
Residence time,s	600
Quench temperature,°c	260

Thank you