SOFRASER

Inline control
Refining

Application
Visbreaker process control

Targets: Refineries

Application

Increasing conversion refineries has been the key driver of oil refining profitability. Typical vacuum residues have high metal content which poisons catalysts therefore, thermal cracking is preferred to catalytic processes for such feedstocks. Visbreaking is a mild form of thermal cracking, which is primarily aimed at lowering the viscosity of vacuum residues. Visbreaking units are now designed to maximize yield of valuable gas oil and other lighter ends used in fuel blending.

Visbreakers **reduce the viscosity of the feed stream** (bottom vacuum distillates, oils produced in the processing of tar sands, certain high viscosity crude oils and other high viscosity, low value oils); **reduce the amount of residual fuel oil refined** (low value product with decreasing demand); and **increase the proportion of middle distillates in the refinery output** (used in fuel blending or as a diluent with residual oils to bring their viscosity down to a marketable level).

By reducing the viscosity of the residual stream in the visbreaker, fuel oil can be made using less diluent and middle distillates saved can be diverted to higher value diesel or heating oil manufacturing. There are two types of visbreaking process: soaker cracking and coil cracking. Coil cracking uses higher furnace outlet temperatures (470-500°C) and few minutes reaction times, whereas soaker cracking uses lower furnace outlet temperatures (430-450°C) and longer reaction times. Both are targeted in this application.

The use of reliable viscosity measurement is critical to refineries for safe characterization and handling the products and is essential for better process control while increasing output capacity to meet ever growing demands.

Challenges

The extent of viscosity and pour point reduction is a function of the composition of the visbreaker feed. Most feeds such as bottom residues are viscous and sticky liquids handled at high temperature. Unstable residues have great fouling potential that lead to coke formation in the equipment and thus reduce the conversion ratio at which a stable fuel can be made.

The objective of visbreaking is to reduce the feed viscosity as much as possible **without significantly affecting fuel stability**. To prevent fouling cracking is controlled and limited however, if the operation is too severe, the resulting product becomes unstable and causes:

- impulse line clogging
- filter plugging
- frequent breakdowns
- high maintenance costs / process shutdowns
- sludge formation during storage

In this context, inline viscosity measurement may be used in several applications during the visbreaking process to help preventing fouling and increase yield. Viscometers may help characterize the incoming feedstock for adjustment of heating parameters. Viscometers may also monitor the visbreaker outputs to ensure that sufficient fuel oil and light ends have been removed from the bottom residues.

Solution and Installation

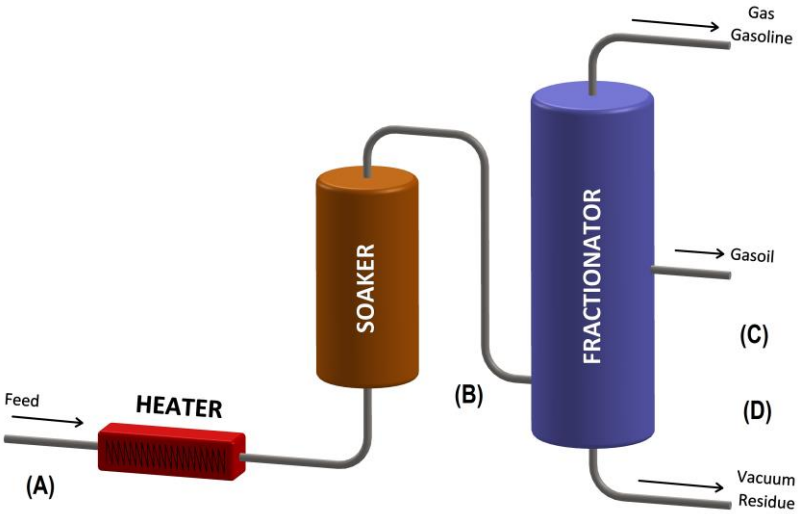
An **inline process viscometer MIVI (A)** can be installed before the heater in order to characterize the feed viscosity to adjust heating parameters.

Another inline viscometer **(B)** or **viscosity at reference temperature analyzer**, installed before the distillation column, after quench, will monitor the thermal cracking efficiency and help to optimize the distillation parameters and improve the yield of gasoline and gasoil production.

On the stripper output, online viscosity measurement **(C)** using **a viscosity analyzer at reference temperature** will help for further blending operations and conform to gasoil regulations.

Another **inline viscometer (D)** installed on the heavy fuel residue line will bring huge advantages to characterize its properties and possible re-distillation or further blending operation.

General description of Visbreaking unt

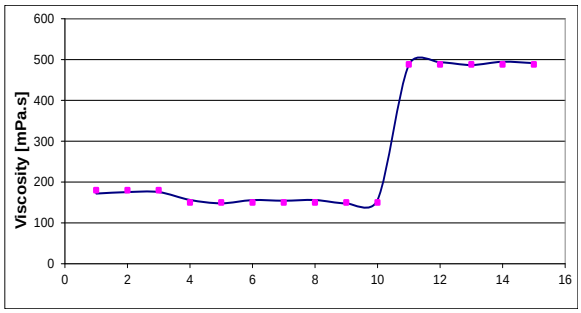


Analyzer installation & principle

Viscosity at reference temperature analyzer

CF version

Process records and comparison with sampling points.



Key product characteristics – Thermoset product range

- Available in CF, LT and KV version
- Using proofed MIVI tuning type viscometer
- Designed for handling light to heavy fluids – highly resilient to fouling and clogging phenomenon
- Very high measurement capabilities, up to 10 000 cP
- Easy to install – small footprint
- Analyzer with Ex-proof agreement
- Easy assembly / dismantling of all parts
- Low maintenance
- short response time