

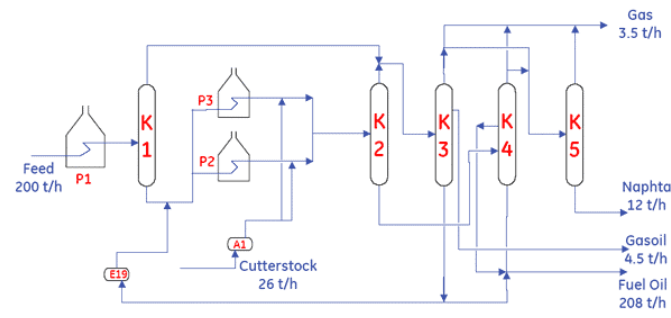
GE Achieves Record Results in a Visbreaking Unit at Russian Refinery

Challenge

Visbreaking units play a very important role in refining process, by decreasing the yield of low value fuel oil and increasing lighter and more valuable product yields.

Fouling seriously limits visbreaker operation and therefore it affects significantly the profitability of the operation.

A Russian refinery has worked to progressively improve the operation of its visbreaker unit in order to minimize the total fuel oil production of the refinery, thus increasing the overall profitability by making higher value products.



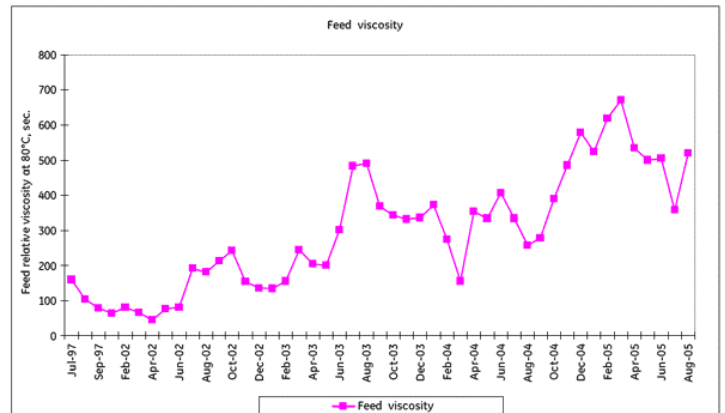
The double cracking furnace configuration (P2 and P3) allows the unit to be operated with a charge rate that can be as low as 100 t/h and as high as 210 t/h (average is 150 t/h).

Over the years a progressively heavier feedstock has been processed.

Feed is composed of vacuum residue from West Siberian and Arlan - Chekmagush crude oils.

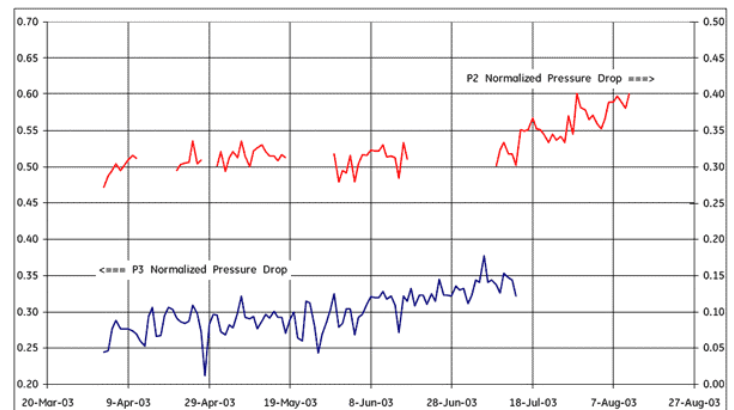
To further improve profitability of the unit, the asphalt from the propane and propane-butane deasphalting of the West Siberian vacuum bottom has become part of the visbreaking feedstock.

The following figure shows the viscosity of the visbreaker feed over the years.



To take full advantage from the heavier feedstock, the refinery needed to operate at a progressively higher reaction temperature, increasing it from the previous typical range of 460 - 470 °C up to 480 °C. The heavier feedstock, however, generated a massive coke deposition, mostly in the cracking furnaces, requiring decoking as frequently as every 3-4 months.

Coke deposition typically produced increased pressure drops in the cracking furnaces.



When the inlet pressure reached approximately 33 - 35kg/cm², decoking was necessary. The previous



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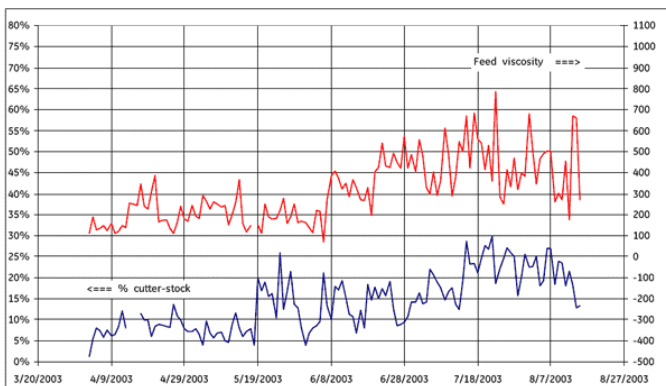
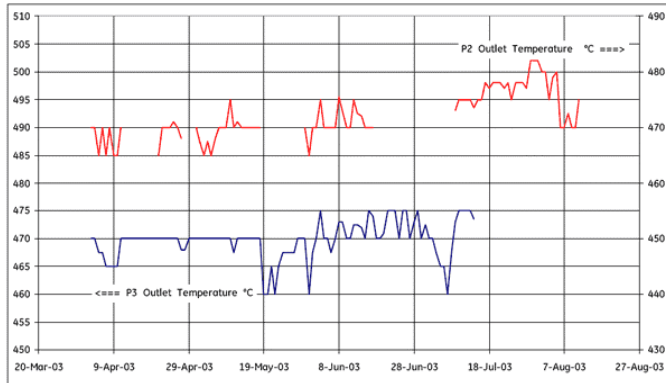
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figure shows the normalized pressure drop in relative units for the untreated run (upper limit in this scale is 0.4 - 0.45).

The next figures show the heater outlet temperature, the feedstock viscosity and the amount of cutterstock required for the fuel oil blending to meet the viscosity specification for the untreated run.



Solution

It became clear to the refinery that a coke deposition reduction program was the most suitable way to accomplish its targets.

GE Water & Process Technologies was selected from among other suppliers based on its long experience in visbreaking units since 1981, and its specialized service program on these types of units.

An antifouling program, using Thermoflo* 7R630, was proposed and implemented.

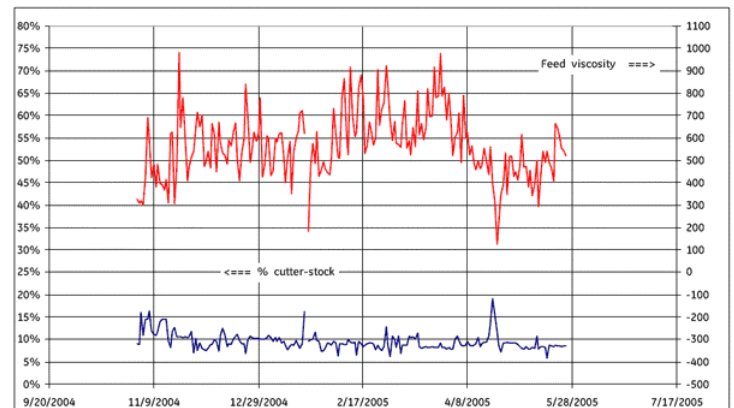
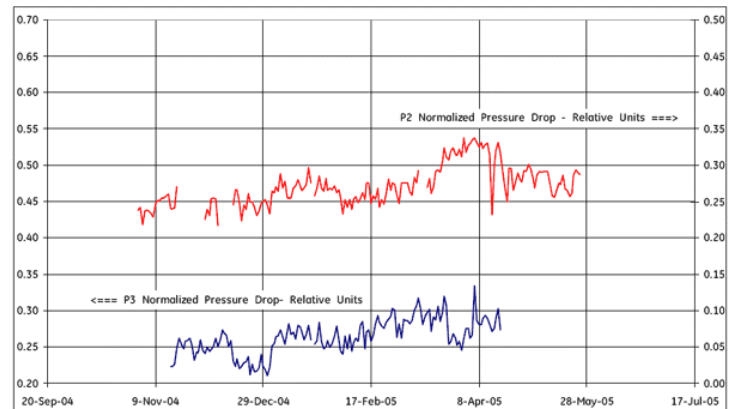
The chemical treatment program was implemented at the end of summer 2003. Before the implementation, a change in feedstock quality occurred due to a different operation of the crude vacuum column. A significant increase of the feedstock viscosity was observed, requiring readjusting the treatment program after its start-up.

After readjustments, the unit operated without unplanned decoking during the application of the treatment up to the late spring 2004.

Results

After the general turnaround (Q3 2004) the program was re-started and the unit operated without any problem related to coke deposition until July 2005 when it was stopped for the scheduled turnaround. The unit would still have been able to run an additional two months before requiring decoking.

Next figures show the normalized pressure drop, the heater outlet temperature and the viscosity of feedstock and the amount of required cutterstock in the treated run (data available up to May 2005).



Results of the GE treatment can be summarized as follows:

- Feedstock was typically heavier as illustrated by the viscosity (average 585 sec. vs. 313 sec.)
- Average heater outlet temperature was 6 °C higher in P2 (478 °C vs. 472°C) and 10 °C higher in P3 (479°C vs. 469 °C)

- Cutter-stock requirement, as a consequence of the higher heater outlet temperature, was significantly lower (9.5 % vs. 14.2% of feed) leading to a significant benefit for the reduced fuel oil production, i.e. approximately 10 t/h

The increased conversion and increased run length have resulted in several million dollars of economic benefits to the refinery.

Although an estimation is not easy, due to the very wide fluctuation of the market, a reasonable value is in excess of \$5,000,000.

An additional advantage observed was the reduced maintenance work. Prior to implementing the treatment program, decoking would produce several truckloads of coke for disposal. During the shut-down of July 2005 only five drums of coke needed to be disposed.

Same or even better results have been observed in the run from the mid 2005 till mid 2006.