REFINING INDUSTRY

OPTIMIZATION OF REFINERY THROUGHPUT AND BLENDING WITH MICRO MOTION VISCOSITY METER

RESULTS

Improved operational agility with an online viscosity measurement

Provided a better understanding of effects of crude changes upstream and downstream of the crude unit

Enabled optimization of refinery operations with a better understanding of the tradeoffs between throughput, product yields and margin

Allowed the refiner to blend a crude which optimized the profitability for the refinery

Application

Refiners throughout most parts of the world are trying to increase their flexibility to process various crude slates. The crude oil that is being processed in refineries today is quite different in nature from the crudes processed in the past due to high variability in the quality. Refiners want to take advantage of the less costly crudes, whether they are in the form of heavier opportunity crudes, or light shale oil. They need to understand the full impact of running those crudes in terms of the planned throughput and the final product distribution in order to maximize their margins.

Challenge

One refiner in Texas came up with an innovative way to help them to quickly and efficiently characterize the crude feeding the crude distillation unit by measuring the viscosity and density of the crude online, continuously. This refiner wished to process a wide variety of crude oils, and found that by blending a heavy crude with the shale crude often resulted in a “dumbbell blend”. In other words there were a lot of very heavy components and a lot of very light components, and very little in the mid-boiling range. Because of this variability, they found that they could process two crude oils with the same API gravity, of 25 for example, and the viscosity of the crude could vary by 50%. This would have a significant impact on the hydraulics through the heat exchangers in the crude preheat train, and would therefore affect throughput.

Solution

Using the viscosity and density measurements to characterize the crude then allowed them to more effectively optimize the refinery operations. They were able to better understand and act on the tradeoffs between throughput, product yields and margin to run the refinery most profitably. They also found that characterizing the crude helped to understand the operational effects upstream and downstream of the crude unit including the following:

- Adjustments of exchanger duties of the preheat train

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- Feed rates to downstream units including vacuum unit, coker, reformers, gas processing plant
- Distribution of yield and product blending

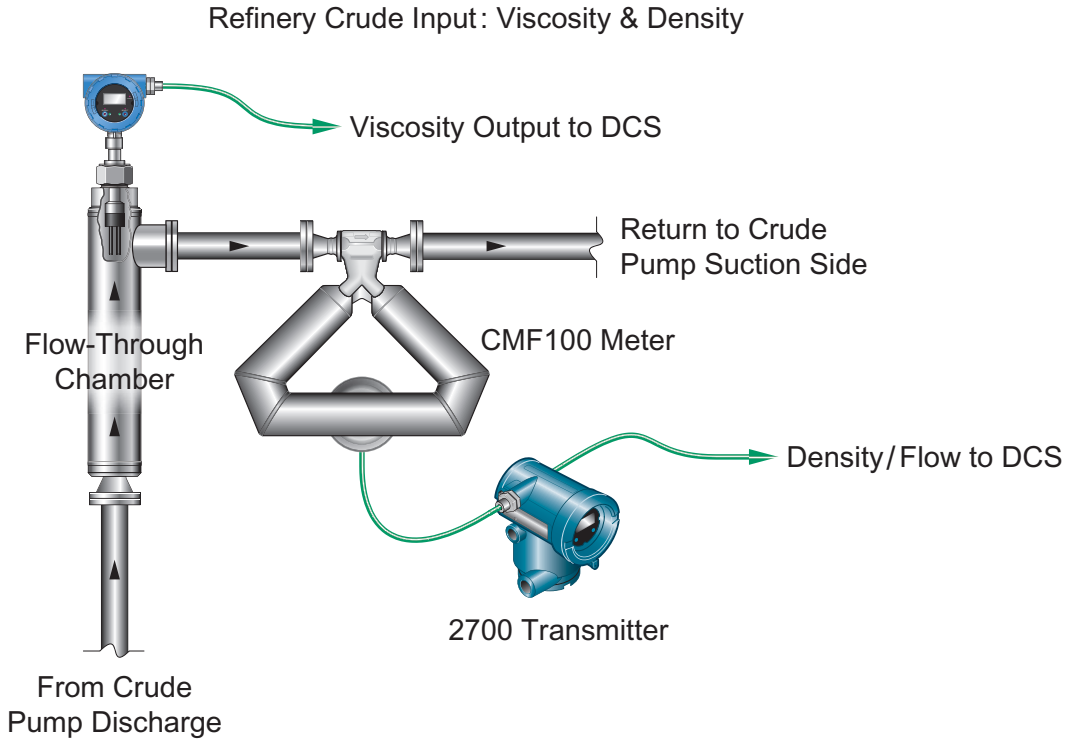
The refiner found that taking samples to a laboratory once a day was not sufficient. For one, the refiner wanted to operate in a more dynamic environment taking advantage of market conditions. It was also found that there was enough stratification in the tanks that the viscosity and density could change significantly within a few hours, so an online measurement had the greatest benefit.

Another benefit to the online viscosity measurement is the ability to verify that the crude they are being sent by their supplier is indeed within the specified range. In the event that the crude appears to be outside of the range, they are able to go back to their supplier with data to support the discrepancy and rectify the situation.

The measurements were taken using a slip stream around the crude charge pump, as shown in the diagram below.

The viscosity measurement was made with a Micro Motion Fork Viscosity Meter (FVM), and the density and flow though the Micro Motion CMF100 Coriolis meter. Although the FVM can measure both viscosity and density, the Coriolis meter measures the flow rate as well to insure that a representative sample is being measured.

The value of these measurements in optimizing the refinery operations has been tremendous. There are plans in the future of receiving even further benefit by incorporating the measurements into the crude unit's advanced process control system.



Flow diagram of the installation

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