**Optimization Study to Maximizing Heavy Naphtha Draw from a Condensate Distillation Unit**

Mohammad Shamsuzzoha\*, Mohammad Abdur Rakib, Mohamed Al-Musharfy

*Research Centre Division, ADNOC Refining, Post Box: 3593, Abu Dhabi, UAE*

*\*Corresponding author:* [mshamsuzzoha@adnoc.ae](mailto:mshamsuzzoha@adnoc.ae)

**Highlights**

* A rigorous simulation model has been developed in rating mode for an existing condensate distillation column to obtain the optimal condition.
* The calibrated model has been run for different cases to obtain the optimal seniors to maximize the deep cut naphtha.

**1. Introduction**

Steady-state process simulations provide powerful insights into the plant behaviour which can be used to enhance designs, safety and operations of oil refinery units. The process simulation model can be utilized in several ways from design stage to operation in oil refinery i.e., efficient and profitable designs, achieve consistent product quality, analyse plant operations, monitor & optimize operations and real-time optimization etc.

In order to explore sources of increased demand of heavy naphtha for increasing the throughput of heavy naphtha reformer for an additional heavy naphtha reformer, a rigorous simulation model was developed in process simulation software for an existing condensate distillation column. The model was tuned using test run data. Assays information for various sources of the condensate feed mix were studied, and implemented in the feed definitions to see the impact of different feed mix ratios. Since monitoring the benzene precursors for the downstream section is an important requirement, special attention was given to include detailed naphtha component analysis while defining the assays for the different condensates. A Peng-Robinson (PR) Equation of State was utilized while developing the rigorous tray-to-tray model. The model captures detailed heat exchanger networks with heat recovery from the column pump arounds. Hence the model was capable of evaluating different scenarios and studying the equipment limitations, especially the heat exchangers. An optimum scenario was thereby proposed to maximize heavy naphtha yield with details of benzene precursors for the downstream heavy naphtha reformer.

**2. Methods**

The calibrated model has been run for different cases to obtain the optimal seniors to maximize the deep cut naphtha. The heat duty of the overhead section of the main fractionation column has been main constraint in the column. The column overhead section constitutes both the air and trim cooler to achieve required reflux temperature.

**3. Results and discussion**

Therefore, in last three cases, the limiting overhead duty of 40 Gcal/hr has been restraint to keep draw adequacy and limitation of the unit overhead section.

**Case 1:** Calibrated model with plant data.

**Case 2:** Deep cut heavy naphtha 100-180°C EP.

**Case 3:** Heavy naphtha flow rate of 175 m3/hr.

**Case 4:** Heavy naphtha flow rate of 155 m3/hr, limiting overhead duty of 40 Gcal/hr.

**Case 5:** Heavy naphtha flow rate of 165 m3/hr, limiting overhead duty of 40 Gcal/hr.

**Case 6:** Heavy naphtha flow rate of 175 m3/hr limiting overhead duty of 40 Gcal/hr.

**4. Conclusions**

One the basis of the equipment adequacy and limitations, Case 5 has been selected for the design purposes. This case has heavy naphtha draw rate of 165 m3/hr and limiting overhead duty of 40 Gcal/hr. The predicted results have been compared with the plant data, for yields and different other properties e.g, SG, flash point, freezing point and pour point. The products qualities show that the results are in line with expectation as.

**References**

1. A.-F. Chang, K. Pashikanti and Y. A. Liu, Refinery Engineering: Integrated Process Modeling and Optimization, Wiley-VCH Verlag GmbH & Co. KGaA, 2012.
2. K. Anitha, T. Shuwana and V. R. Kumar, "Simulation of Atmospheric and Vacuum Crude Units Using Aspen Plus," *Petroleum Science and Technology,* vol. 29, p. 1885–1894, 2011.
3. R. K. More, V. K. Bulasara, R. Uppaluri and V. R. Banjara, "Optimization of crude distillation system using aspen plus: Effect of binary feed selection on grass-root design," *Chemical Engineering Research and Design,* vol. 88, no. 2, pp. 121-134, 2010.
4. M. Shamsuzzoha, H. Kelani, A. M. Rakib and M. Al Musharfy, "Systematic Procedure for Simulation of a Crude Distillation Unit," in *6th TRC-JCCP/Idemitsu International Symposium, 10th - 11th February 2016, TRC,*, Sas Al Nakhl, Abu Dhabi, 2016.