Tüpraş

Control Column Performance with a Plant Digital Twin Using Aspen HYSYS®

40%
increase in column capacity

CHALLENGE

The refinery's naphtha splitter column was failing to meet the required product specification

SOLUTION

The problem was diagnosed and fixed using a plant digital twin of the column built using the column analysis capability in Aspen HYSYS® and its integration with Aspen Exchanger Design & Rating

BENEFITS

Troubleshot and revamped the naphtha splitter column unit resulting in an expected

- 40% increase in column capacity

- 15% reduction in utility consumption; a savings of ~$500,000 USD per year

- Improvement in on-spec products

- Full recovery of costs in less than one year

"The column analysis capability in Aspen HYSYS showed us exactly where the problem was with the column. The tool showed us the exact location and reason for the problem."

Asli Reyhan, Superintendent – Simulation, Tupras Refineries

Tüpraş is Turkey's largest refining company, operating 4 refineries across the country with a total capacity to handle 560,000 barrels per day of crude oil.

The column analysis capability in Aspen HYSYS, using the detailed geometric data of the column, revealed the reason behind low column tray efficiencies.

Using column analysis to improve product quality

Products from the naphtha splitter column were failing to meet the required specifications. The naphtha splitter column produced light straight-run naphtha (LSRN) and heavy straight-run naphtha (HSRN) used by the isomerization and continuous catalytic reforming (CCR) units downstream of the column.

Refinery engineers conducted analysis by simulating the unit rigorously in Aspen HYSYS. They wanted to figure out how to get the unit to deliver on-spec products while maximizing the unit's capacity and improving its energy recovery.

Engineers used Aspen HYSYS to develop a plant digital twin of the naphtha splitter column, which allowed them to investigate column tray hydraulics. By calibrating the column model to simulate its operating conditions, engineers found low tray column efficiencies.

Analysis in Aspen HYSYS, using detailed geometric data of the column, revealed the reason behind low column tray efficiencies. Engineers then remodeled the column in Aspen HYSYS to increase its capacity as well as consistently meet product specifications.

Preparing heat exchangers and checking hydraulics for new operating conditions

Refinery engineers used other capabilities with Aspen HYSYS to analyze whether heat exchanger units and piping hydraulics could withstand changed operation conditions.

The Tupras team used Aspen Exchanger Design & Rating (EDR) and its seamless integration with Aspen HYSYS to rigorously simulate different types of heat exchangers (HX), including the feed HX and reboiler (shell & tube HX) and the condenser (air-cooled HX).

The rigorous HX models helped check for the following potential operational problems:

- Vibration

- Rho*V^2 (Erosion)

- Pressure drop

The feed HX model projected potential erosional issues. Refinery engineers followed the program's recommendation and added an impingement plate to the HX to avoid this issue.

To check piping hydraulics, the refinery engineers also modeled pipe segments in Aspen HYSYS to ensure that the velocity and pressure drops are within desirable levels for the new operating conditions.

Conclusion

The refinery management decided to revamp and replace the naphtha splitter column trays based on the recommendations from Aspen HYSYS.

With this project the engineers expect to increase the column capacity by 40 percent and meet the required product specifications. Tupras also anticipates a 15 percent reduction in utility consumption, providing a cost savings of $500,000 USD per year. With the additional profit from the added capacity and product quality improvements, the revamp project is expected to pay off in less than a year.

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About Aspen Technology

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