

Two examples of Steady State Simulation with HYSYS at GALPenergia Sines Refinery

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Abstract

Resulting from the cooperation between the University (IST) and GALPenergia (Sines Refinery), in 2003 there was a trainee program with the objective of modeling and simulating some industrial processes with the software HYSYS from Aspentech. The main goal was to tune a model of the Crude Distillation Unit (CDU) with the main fractionator and all the other secondary separation columns.

The unit is feeded with a crude mix, which is separated in several fractions (gases, naphtha, kerosene, diesel and atmospheric residue). Before being feeded to the main fractionator (CCV1) the crude is heated through a preheat train where receives heat from several products streams. At a certain point the crude is feeded to a preflash drum where some lighter material is separated. This avoids a higher heat input from the crude fired heaters before the fractionator CCV1. The overhead stream of CCV1 is feeded to the fractionation section to promote a further separation. This stream is treated in 4 columns and after we obtain, as products, fuel gas, LPG, isopentane, light gasoline, chemical naphtha and medium and heavy naphtha that will feed other units.

We need several steps to build a correct simulation model: a good knowledge of the chemical components and respective composition, a correct thermodynamic method, definition of the process scheme with all the unit operations and operating conditions. We consider that a good simulation is done if after all this steps we don't have more degrees of freedom to play with. If this is the case the simulation converges for a solution where all the obtained properties and operating conditions are calculated with values near the real ones.

A well tuned model, can be used to optimize the operating variables. Without the help of this type of softwares, this type of optimization can only be done, playing with the operating conditions by real testing the unit. The model allows to play with the operating conditions without losses in production and/or products quality helping to find the optimal operating conditions. After the simulations the results can be then tested in real conditions to test the model validity.

These type of models are good also to check the validity of certain revamp options, which in other way only can be checked by detailed engineering companies or process licensors.

Besides the CDU unit simulation we have built a simulation of the sour water stripper (ABV10). The treated water was contaminated with a lot of ammonia that needed to be stripped off by environmental reasons. The simulation allowed us to optimize the column operation through the simulation of the behavior of the several operating variables involved. After implementing the simulation results in the real column, the ammonia content in the stripped water decreased significantly until values lower than the specified limit value.

Keywords: simulation software, oil refining, crude distillation, sour water stripping