441e Integrated Optimization of Refinery and Chemical Plant in Petrochemical Industry

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Integrated optimization of refinery and chemical plant has been concerned widely in the word. Some famous petrochemical companies have studied this subject for some years, and they gained some experiences and huge profit. In the integrated optimization of refinery and chemical plant, it is very important to realize providing raw materials each other between refinery and chemical plant. The optimization of raw materials of ethylene cracking unit is a key step especially for integrated optimization.

In this paper the study on the integrated optimization of refinery and chemical plant is based on GIOPIMS (Graphic I/O Petro-chemical Industry Modeling System) developed by Department of Chemical Engineering of Tsinghua University. GIOPIMS is a modeling system of production planning for petrochemical company. It can automatically generate linear model of production planning through flowsheet and related data. It provides an effective means for accessing techniques without necessarily being experts in mathematical programming and a decision support tools in the form of advanced computer programs for easy modeling of production planning. The functions of graphic editor are same as Microsoft Office. And it is rather strong in diagnosis of infeasible model and unreasonable solution.

The raw materials of ethylene cracking unit are naphtha, topped oil, light diesel oil and propane. At the same time, naphtha is also the raw material of continuous reformer to produce benzene, toluene and xylene. In petroleum processing processes, different kinds of crude oil produces different naphtha, and different naphtha has a different production rate of ethylene in ethylene cracking unit and a different production rate of benzene, toluene and xylene in continuous reformer. Therefore, the amount of naphtha fed to the ethylene cracking unit or continuous reformer should be optimized.

In the application case study, there are 6 kinds of crude oil in petroleum processing process, so there are 6 kinds of naphtha fed to the ethylene cracking unit or continuous reformer. The optimization results obtained by using GIOPIMS show that Nanjiang naphtha is most suitable for ethylene cracking, and another 5 naphtha for continuous reformer. It is in accordance with experiment data because Nanjiang naphtha has the highest production rate of ethylene, propylene and butadiene. The profit has a $100.0 million increase per month than the case without naphtha optimization. After optimization of naphtha in chemical processes, the output of benzene and butadiene have a 305t and 221t increase, thus, the purchased amount of benzene and butadiene have a same decrease, which results in a big decrease of the cost of raw materials in the petro-chemical company.

It can be concluded that the optimization of naphtha is a key step for integrated optimization of refinery and chemical plant in petrochemical industry. The integrated optimization of refinery and chemical company is the developing trend and should be greatly concerned in the future.