**OPTIMAL DESIGN OF INDUSTRIAL REACTOR FOR NAPHTHA THERMAL CRACKING PROCESS**

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**ABSTRACT:** The ethylene production is regarded one of the most significant issues for chemical industries and improving its production operation can bring several benefits. Thus, the market demand for ethylene production has accelerated the improvement of a more rigorous and reliable thermal cracking model of such process. In the present study, developing a rigorous mathematical model for an industrial naphtha cracker is investigated based on experimental data combining with a kinetic model describes the coke formation on the internal reactor tubes.

The best kinetic model obtained is applied for predicting the products yield, the gas temperature and the optimal temperature profiles along the reactor to maximize the profit of the process. The influence of process factors on the optimal solutions (mainly, coil outlet temperature (COT), steam to naphtha ratio (S/N) and feed flow rate on the product yields have also been discussed here, and new results of the reactor with the optimal cost and temperature profile are obtained.

Modeling, simulation and optimal design via optimization of the industrial thermal cracking reactor has been carried out by gPROMS software. The optimization problems are solved employing a Successive Quadratic Programming (SQP) method formulated as a Non-Linear Programming (NLP) problem.

***Keywords:*** Thermal cracking, Ethylene production, Naphtha pyrolysis, Ethylene furnace.