DEVELOPMENT OF A MATHEMATICAL MODEL FOR A HYDROCRACKING UNIT

A Thesis

Submitted to the Chemical Engineering Department in

Partial fulfillment of the Requirements for the Degree

of Doctor of Philosophy

in

Chemical Engineering

By

Eng. Rania Farouq Abdou Salama

2013

Acknowledgment

Thanks to ALLAH. I could finish this thesis only by HIS guidance and will.

I would like to express my sincere appreciation for the guidance, advice and encouragement provided by Prof .Dr. Ramadan Abo Ela

And to my thesis advisor Prof .Dr. Hassan Farag

I would like to thank Pharos University for their support

Also, I would like to thank my family, and my friends for their continuous support and encouragement.

ABSTRACT

A hydrocracking unit is used to produce lighter products from heavier refinery feed oil. The reactor is a fixed bed tubular catalytic reactor, and the reaction that takes place in the reactor is exothermic. A two-dimensional catalytic packed bed model, incorporating all transport parameters and resistances, along with boundary conditions has been developed. Thermal conduction through the solid phase is included in the model. Kinetic parameters have been estimated, the dynamic behavior in feed temperature change is also examined. Partial differential equations describing conservation laws for mass and energy are solved, and compared to actual values from an operating unit. The main objective of the present research is to model and simulate the hydrocracking unit to optimize its operating conditions, improve its overall performance and to evaluate correlations for the pellet heat transfer coefficient, effective radial diffusivity, effective radial thermal coefficient and wall heat transfer coefficient suitable for hydrocracking process. Its significance rises up from development of a powerful computational tool for simulating the unit.