INVESTIGATE TO IMPROVE THE PERFORMANCES OF THE PLATINUM–RHENIUM BIMETALLIC CATALYST SYSTEM FOR THE SEMI REGENERATIVE PLATFORMER UNIT IN THE REFINERY OF CEYLON PETROLEUM CORPORATION

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Degree of Master of Science in Sustainable Process Engineering

Department of Chemical and Process Engineering

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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The above candidate has researched the Master's Dissertation under my supervision.

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Signature of the supervisor Date

Dr. Thushara Subasinghe

Senior Lecture Grade II

Abbreviations

BPSD	-	Barrels per day
mt/d	-	Metric tons per day
wt	-	Weight
%	-	Percentage
Kg	-	Kilo grams
°C	-	Celsius
Ppm	-	Parts per million
m^3	-	Cubic meters
hrs	-	Hours
m^3 / kg	-	Cubic meters per kilograms
MPa	-	Mega Pascals
°F	-	Faranhite
ft^3	-	Cubic feets
V%	-	Volume percentage

Abstract

This report presents a comprehensive investigation into the cycle length shortening of platinum-rhenium bimetallic catalysts in the semi-regenerative catalytic reforming unit of Ceylon Petroleum Corporation's Sapugaskanda refinery. Addressing the challenge of catalyst deactivation, particularly in the unit's second cycle, the study meticulously analyses operational data spanning from March/June 2018 to March 2020 to elucidate the underlying factors impacting catalyst longevity.

A critical review of the catalyst regeneration procedure identified key areas affecting catalyst life, including the essential oxidation and reduction steps that ensure effective metal redistribution and conversion. The increased hydrogen consumption in the regeneration process is examined, emphasizing the importance of maintaining an ample and reliable hydrogen supply.

Operational parameters such as feed endpoint, hydrogen purity, H_2/HC ratio, water-chlorine equilibrium, and reactor inlet temperature (RIT) variation are scrutinized. The report discusses the implementation of new monitoring practices, such as the introduction of plant data sheets and panel sheets, which have significantly enhanced the precision of process control.

Instrumentation and power supply issues, predominantly stemming from boiler and tubing failures, are highlighted as critical factors that adversely affect catalyst performance. Operational responses to these failures, including temperature control measures and the strategic replacement of central charge heater cells, are analyzed.

The report acknowledges the persisting use of outdated equipment due to delays in project approvals and policy changes, underscoring the associated energy inefficiencies and financial implications. Innovative approaches to maintenance, such as the adoption of a chemical cleaning procedure for heat exchangers, are discussed as a viable alternative to traditional, more hazardous methods.

Furthermore, the report delves into the process risks introduced by sulfur ingress during reactor startup procedures, weighing the pros and cons of hot and cold feed cut-in methods in maintaining optimal catalyst activity and ensuring product quality.

In conclusion, the study reveals critical insights into the selection and management of reforming catalysts, the influence of process variables on catalyst cycle life, and the broader implications on reactor operation and product quality. The findings underscore the necessity of strategic operational adjustments and proactive supply chain management to mitigate the challenges associated with catalyst deactivation.

Keywords: Refinery optimization, catalytic reforming technology, reformer catalysts, catalyst deactivation, catalyst regeneration, bimetallic catalyst

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