

**EXERGY ANALYSIS FOR A PETROLEUM REFINERY :
CUMULATIVE EXERGY CONSUMPTION ANALYSIS**

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ABSTRACT

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The aim of cumulative exergy consumption (CExC) analysis is to evaluate the qualitative amount of energy required to produce the specific products of the process under consideration. Therefore, the CExC indices of the products under consideration can be compared to those evaluated from different processes. The results obtained can be implemented to the possibility of thermodynamic improvement of the process. In this work, the CExC was implemented on the Plant 2 of the Bangchak refinery in which it can be divided into nine processing units and an energy complex. The CExC for each unit was determined using the operating plant data. It is indicated that the cumulative exergy consumption of the products of the refinery is competitive in term of energy conservation. Based on the CExC analysis, the most important unit which should be considered to be improved is the energy complex. For thermodynamic improvement of the complex, one of the modifications proposed is to preheat air with effluent combustion gas.

บทคัดย่อ

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การวิเคราะห์หาปริมาณพลังงานสะสมที่ใช้ในการผลิตผลิตภัณฑ์ที่ต้องการในโรงกลั่น
น้ำมัน โดยใช้หลักการของกฎข้อที่หนึ่งและสองทางเทอร์โมไดนามิก และผลที่ได้จะนำไปเปรียบ
เทียบกับโรงกลั่นน้ำมันอื่นๆ ในการศึกษาที่ใช้ข้อมูลในการศึกษาจากโรงกลั่นน้ำมันที่สองของ
โรงกลั่นน้ำมันบางจาก ซึ่งในการศึกษานี้จำเป็นต้องแบ่งขอบเขตของการผลิตออกเป็น 9 หน่วยการ
ผลิตและ 1 หน่วยพลังงาน โดยใช้โปรแกรมProvision IIช่วยในการคำนวณ จากการศึกษาพบว่า
ปริมาณพลังงานสะสมที่ใช้ในการผลิตผลิตภัณฑ์ของโรงกลั่นน้ำมันบางจากอยู่ในเกณฑ์ที่สามารถ
แข่งขันกับโรงกลั่นน้ำมันอื่นได้เป็นอย่างดี และยังพบว่าหน่วยที่สำคัญที่ช่วยในการเพิ่มประสิทธิ
ภาพในการผลิตคือ หน่วยผลิตพลังงาน แนวทางในการปรับปรุงประสิทธิภาพได้ถูกเสนอไว้คือ
การเพิ่มอุณหภูมิของอากาศโดยใช้ความร้อนจากเตาเผา

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TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	xi
List of Figures	xiii
List of Symbols	xiv
CHAPTER	
I INTRODUCTION	1
II LITERATURE SURVEY	4
2.1 Research Related to Exergy Analysis	4
III CUMULATIVE EXERGY CONSUMPTION	10
3.1 Definition of Exergy	10
3.2 Chemical Exergy	11
3.3 Physical Exergy	12
3.4 Exergy due to Mixing	12
3.5 Cumulative Exergy Consumption	12
3.6 Process Analysis	14
3.6.1 Definition on the system	14
3.6.2 Exergy Analysis	15
3.6.3 Cumulative Exergy Consumption Balance Equation	15

CHAPTER	PAGE
3.6.3.1 Feed Streams	15
3.6.3.2 Exergy Supply Streams	16
3.6.3.3 Recycle Streams	16
3.6.3.4 Recycle and Recovered Streams	18
3.6.3.5 Product Streams	18
3.6.4 CexC Balance Equations for an Energy Section	19
IV BANGCHAK REFINERY PROCESS	22
4.1 Bangchak Refinery	22
4.2 Process Description	23
4.2.1 Topping Unit	24
4.2.2 Deethanizer Unit	26
4.2.3 LPG Treating Unit	27
4.2.4 Naphtha Pretreating Unit	28
4.2.5 Isomerization Unit	30
4.2.6 Catalytic Reforming Unit	31
4.2.7 Gas Oil Hydrosulfurization Unit	32
4.2.8 Fuel Gas Treating Unit	34
4.2.9 Sulfur Recovery Unit	35
4.2.10 Energy Section	36
V PROCEDURE	38
5.1 Experiment	38
5.2 Calculation Method for Physical Exergy	39
5.3 Calculation Method for Chemical Exergy	40
5.4 The Cumulative Exergy Consumption Equation	41

CHAPTER	PAGE
5.5 Exergetic Efficiency	42
5.6 Degree of Perfection	42
VI RESULTS	43
6.1 Cumulative Energy Consumption	44
6.2 Cumulative Exergy Consumption	55
VII DISCUSSION AND SUGGESTION	67
7.1 The Cumulative Degree of Perfection of the Bangchak Refinery's Products	67
7.2 The Production Efficiency of the Electricity and the Steam	68
7.3 Losses	69
7.4 Preheating Combustion Reactants with Effluent Combustion Gas	70
7.5 Application	74
VIII CONCLUTIONS AND RECOMMENDATIONS	78
REFERENCES	79
APPENDIX A	81
APPENDIX B	106
CURRICULUM VITAE	112

LIST OF FIGURES

FIGURE	PAGE
3.1 Representation of a process and its sub-system	14
3.2 Diagram of Section N	17
3.3 Diagram of the Energy Section	19
3.4 Representation of the “Electricity Mixing” Section	21
4.1 Process Flow Diagram of Plant no.2 of Bangchak Refinery	23
4.2 Process Flow Diagram of Topping Unit	26
4.3 Process Flow Diagram of Deethanizer Unit	27
4.4 Process Flow Diagram of LPG Treating Unit	28
4.5 Process Flow Diagram of Naphtha Pre-treating unit	29
4.6 Process Flow Diagram of Isomerization Unit	31
4.7 Process Flow Diagram of Catalytic Reforming Unit	32
4.8 Process Flow Diagram of Gas Oil Hydrodesulfurization Unit	33
4.9 Process Flow Diagram of Fuel Gas Treating Unit	35
4.10 Process Flow Diagram of Sulfur Recovery Unit	36
4.11 Process Flow Diagram of Energy Section	37
7.1 Scheme of Furnace with Recuperator	71

LIST OF SYMBOLS

B	=	Total exergy
B_p	=	Potential exergy
B_k	=	Kinetic exergy
B_{ph}	=	Physical exergy
B_{ch}	=	Chemical exergy
$\sum \Delta B_{gu}$	=	Useful exergy increase in heat reservoir
$-\sum \Delta B_{gf}$	=	Useful exergy loss of feeding heat reservoir (positive if added to system)
B_{au}	=	Exergy in useful product
B_d	=	Exergy delivered to system in feed materials
B_{df}	=	Exergy delivered in driving materials (fuel)
C_p	=	Heat Capacity
H	=	Enthalpy
H_0	=	Enthalpy at reference standard
S	=	Entropy
S_0	=	Entropy at reference standard
P	=	Partial pressure
P_0	=	Reference pressure, 1 atmosphere
T	=	Temperature
T_0	=	Reference temperature, 25°C
μ_i	=	Chemical potential of species i
X_i	=	Mole fraction of species i
R	=	Gas constant
γ_i	=	Activity coefficient of species i