

FINAL DESIGN PROJECT REPORT
PRELIMINARY DESIGN OF TITANIUM DIOXIDE PLANT FROM
ILMENITE
CAPACITY OF 55,000 TONS/ YEAR



Submitted to Fulfillment the Bachelor's Degree in Chemical Engineering

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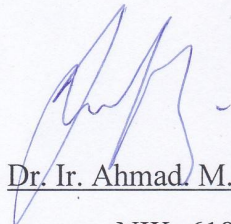
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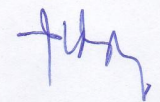
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Starting the fact that the result of final project that I make and submit is the result of my own work, except for quotations and summaries that I have explained the sources. If the final project is plagiarism and other scientific or research work, then I am ready to accept the punishment both academic and law.

Surakarta, March 2017

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ABSTRACT

Titanium dioxide is an inorganic compound with chemical formula TiO_2 . Titanium dioxide plant is designed with capacity of 55,000 tons per year. The plant is planned to operate for 330 days per year. Titanium dioxide will be built in 2020 on East Belitung, Bangka Belitung. Titanium dioxide is used as a white pigment (in paints, plastics, rubber, and paper), industry of ceramics, fiber, and cosmetics, also used as catalysts and photocatalysts. The product of titanium dioxide is planned to be distributed for domestic needs.

Titanium dioxide-making process is done by reacting ilmenite with chlorine gas that produce TiCl_4 using coke as reducing agent in a first fluidized bed reactor solid-gas phase. The process takes place at a temperature of 900°C and a pressure of 1 atm. The output of first Reactor is purified and fed to second Fluidized Bed Reactor that continuously operates at a temperature 1000°C and a pressure of 1 atm. The processes are irreversible reaction and exothermic. This plant is classified as high risk plant. The need for raw materials ilmenite is 18,314.8573 kg/h, chlorine is 4,578.7143 kg/h, and coke is 16,255.0694 kg/h. Utilities include water supply process support for 49,795.3701 kg/hour is obtained from river water. Diesel fuel is 2.3222 m^3 /hour. Compressed air requirement is 122 m^3 /h. Electricity demand is obtained from the PLN and generator for backup power is 986.4136 kW, fuel is 9.2860 m^3 /h. Total land area is 19,770 m^2 . The availability of raw material of ilmenite is obtained from PT. Timah Tbk. and chlorine gas is imported from abroad. The number of employees is 201 people.

The titanium dioxide plant needs 588,594,482,703 IDR of fixed capital. Titanium dioxide needs 320,860,312,440 IDR of working capital. Based on the economic analysis, the plant will get 400,433,669,735 IDR of profit before tax. The plant will get 120,130,100,920 IDR of profit after 30% of tax per year. Number of percent Return of Investment (ROI) before tax and after tax is 68% and 47%, respectively. Pay out Time (POT) before tax and after tax is about 1.28 years and 1.74 years, respectively. Break Even Point (BEP) is 46% and shut down point is 35%. Discounted cash flow (DCF) is 56%. Based on the economic feasibility, it can be concluded that the titanium dioxide plant is considered feasible to be built.

Keyword: Titanium dioxide, Ilmenite, Fluidized Bed Reactor

MOTTO

‘WE BECOME WHAT WE THINK ABOUT’

DEDICATION

*There is never just one thing that leads to success for anyone.
It always a combination of dedication, hard work, and also
prays, affection and love for those who were very close to our
heart.*

My sincere effort I dedicate to my dear and beloved,

Father & Mother,

*Who's giving love, encouragement and guide untill the end
that made me able to get success and honor.*

Along with all hard working and respected,

Lecturer,

*Walking with friends in the dark is better than walking
alone in the night.*

For my dearest friends,

Hani, Anggi, Rendra, Delta, Listi, Nanik, Diah, and Salam,

And,

*For someone special that always support me in any
conditions.*

Thank to him very sincerely.

PREFACE



Assalamu'alaikum Wr. Wb.

Alhamdulillah, the author would like to acknowledge her countless thanks to the Most Gracious and the Most Merciful, Allah SWT who always gives her all the best of this life and there is no doubt about it to finish this final project.

In arrangement of this project, the author is willing to present her thanks for everyone who has helped and guide in completing this report. Therefore, the author would like to express her sincere thanks to:

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3. Dr. Ir. Ahmad M. Fuadi, M.T. as first supervisor of final project
4. Ir. Nur Hidayati, M.T., Ph.D. as second supervisor of final project
5. Mr. Rois Fatoni, S.T., M.Sc., Ph.D. as Head of Chemical Engineering Department, Faculty of Engineering, Universitas Muhammadiyah Surakarta
6. Father, mother, and brother, who has given support, and a lot of love to the author.
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The author realizes of limitations and capabilities in the writing of this project. Therefore, advice and suggestion are welcome. Author wish this project to be beneficial to those may concern.

Wasalamu'alaikum Wr. Wb.

Surakarta, March 2017

Author

TABLE OF CONTENTS

TITLE PAGE.....	i
VALIDATION.....	ii
STATEMENT OF AUTHENTICITY.....	iii
ABSTRACT.....	iv
MOTTO.....	v
DEDICATION.....	vi
PREFACE.....	vii
TABLE OF CONTENTS.....	viii
LIST OF TABLE.....	xiii
LIST OF FIGURE.....	xv
CHAPTER I INTRODUCTION.....	1
1.1. Background.....	1
1.2. Design Capacity.....	3
1.2.1. Titanium Dioxide Consumption.....	3
1.2.2. Raw Materials Consumption.....	4
1.2.3. Minimum Capacity.....	4
1.3. Plant Location.....	6
1.3.1. Raw Materials.....	6
1.3.2. Marketing.....	6
1.3.3. Utility.....	6
1.3.4. Labor.....	6
1.3.5. Transportation and Telecommunication.....	7
1.4. Literature Review.....	7
1.4.1. Production Process Description.....	7
1.4.2. Uses of Titanium Dioxide.....	8
1.4.3. Physical and Chemical Properties of Raw Materials and Products.....	9
1.4.4. Process Description.....	13
CHAPTER II PROCESS DESCRIPTION.....	14
2.1. Raw Material and Product Specifications.....	14
2.1.1. Raw Material Specification.....	14



2.1.2. Product Specification	15
2.2. The Concept of Process	15
2.2.1. Mechanism of the Reaction	16
2.2.2. Kinetics Review	16
2.2.3. Thermodynamics Review	18
2.3. The Steps of the Process	22
2.3.1. Steps of the Process	22
2.3.2. Flow Diagram of Process	24
2.4. Mass and Heat Balance	27
2.4.1. Mass Balance	27
2.4.2. Heat Balance	31
2.5. Layout of Plant and Equipment	36
2.5.1. Plant Layout	36
2.5.2. Equipment Plant Layout	40
CHAPTER III EQUIPMENTS SPECIFICATION	42
3.1. Reactor – 01	42
3.2. Reactor – 02	43
3.3. Absorber	44
3.4. Ball Mill	45
3.5. Belt Conveyor	45
3.5.1. Belt Conveyor – 01	45
3.5.2. Belt Conveyor – 02	46
3.5.3. Belt Conveyor – 03	46
3.6. Blower	47
3.6.1. Blower – 01	47
3.6.2. Blower – 02	47
3.7. Partial Condenser	48
3.7.1. Partial Condenser – 01	48
3.7.2. Partial Condenser – 02	49
3.8. Expander Valve	50
3.8.1. Expander Valve – 01	50
3.8.2. Expander Valve – 02	50



3.8.3. Expander Valve – 03	51
3.9. Grate Cooler.....	52
3.9.1. Grate Cooler – 01	52
3.9.2. Grate Cooler – 02	52
3.9.3. Grate Cooler – 03	53
3.10. Heat Exchanger.....	54
3.10.1. Heat Exchanger – 01.....	54
3.10.2. Heat Exchanger – 02.....	55
3.10.3. Heat Exchanger – 03.....	56
3.10.4. Heat Exchanger – 04.....	57
3.10.5. Heat Exchanger – 05.....	58
3.10.6. Heat Exchanger – 06.....	59
3.10.7. Heat Exchanger – 07.....	60
3.10.8. Heat Exchanger – 08.....	62
3.11. Compressor	63
3.11.1. Compressor – 01	63
3.11.2. Compressor – 02.....	63
3.12. Mixer.....	64
3.13. Pump.....	64
3.13.1. Pump – 01	64
3.13.2. Pump – 02.....	65
3.14. Screw Conveyor.....	66
3.14.1. Screw Conveyor – 01.....	66
3.14.2. Screw Conveyor – 02.....	66
3.15. Separator	67
3.15.1. Separator – 01	67
3.15.2. Separator – 02.....	67
3.16. Silo.....	68
3.16.1. Silo – 01	68
3.16.2. Silo – 02.....	69
3.17. Tank.....	69
3.17.1. Tank – 01	69



3.17.2. Tank – 02	70
3.18. Vaporizer	71
3.19. Cyclones	72
3.19.1. Cyclones – 01	72
3.19.2. Cyclones – 02	73
CHAPTER IV PROCESS SUPPORTING UNIT AND LABORATORY	75
4.1. Process Supporting Unit	73
4.1.1. Water Supply Unit.....	75
4.1.2. Dowtherm Supply Unit	78
4.1.3. Electricity Supply Unit.....	79
4.1.4. Fuel Supply Unit	84
4.1.5. Compressed Air Supply Unit	85
4.1.6. Waste Treatment Unit	85
4.2. Laboratory.....	87
4.3. Spesification of Utility Equipment	90
CHAPTER V PLANT MANAGEMENT	99
5.1. Form of Enterprise	99
5.2. Organizational Structure	100
5.3. Duties and Authorities	102
5.3.1. Share holder.....	102
5.3.2. The Board of Commissioners.....	102
5.3.3. President Director.....	102
5.3.4. Expert Staff	103
5.3.5. Director of Engineering and Production	103
5.3.6. Director of Finance and Public.....	103
5.3.7. Department Head.....	103
5.3.8. Section Head	106
5.4. Departments of Employee Work Hours	106
5.4.1. Non-shift Employees.....	106
5.4.2. Shift Employees	107
5.5. Status of Employees and Wage System	108
5.6. Classification of Occupation, Number of Employees and Salaries	109



5.6.1. Classification of Occupation	109
5.6.2. Number of Employees and Salaries	109
5.7. Social Welfare Employees.....	111
5.8. Production Management.....	112
CHAPTER VI ECONOMIC ANALYSIS	113
6.1. Fixed Capital Investment.....	119
6.2. Working Capital.....	119
6.3. Total Product Cost.....	120
6.4. Production Profit.....	121
6.5. Feasibility Analysis	121
CONCLUSION.....	126
REFERENCE.....	127
ATTACHMENT	131

LIST OF TABLE

Table 1.1 Comparison the Characteristic of Rutile and Anatase	2
Table 1.2 Data of Titanium Dioxide Import in 2011-2014.....	3
Table 1.3 Titanium Dioxide Companies in the World and Its Production Capacity.....	5
Table 1.4 Comparison of Titanium Dioxide Manufacture Process.....	8
Table 2.1 Mass Balance Around of Reactor 1 (R-100).....	27
Table 2.2 Mass Balance Around of Reactor 2 (R-200).....	27
Table 2.3 Mass Balance Around of Absorber (D-300).....	28
Table 2.4 Mass Balance Around of Separator 1 (H-217).....	28
Table 2.5 Mass Balance Around of Separator 2 (H-316).....	29
Table 2.6 Mass Balance Around of Vaporizer (V-313).....	29
Table 2.7 Overall Mass Balance	30
Table 2.8 Heat Enthalpy Around of Reactor 2 (R-200).....	31
Table 2.9 Heat Balance Around of Reactor 2 (R-200).....	32
Table 2.10 Heat Balance Around of Vaporizer (V-313).....	32
Table 2.11 Heat Balance Around of Absorber (D-300).....	33
Table 2.12 Heat Balance Around of Condenser Partial 1 (E-216).....	33
Table 2.13 Heat Balance Around of Condenser Partial 2 (E-315).....	34
Table 2.14 Heat Balance Around of Reactor 1 (R-100).....	35
Table 2.15 Total Area of Titanium Dioxide Plant with Capacity of 55,000 tons/year	38
Table 4.1 Sanitation Water Consumption	76
Table 4.2 Total of Water Consumption.....	77
Table 4.3 Electricity Needs for Process Equipment.....	80
Table 4.4 Electricity Needs for Utilities Equipment.....	80
Table 4.5 Electricity Needs for Lighting of Titanium Dioxide Plant	82
Table 5.1 Shift Employee's Distribution of Working Time	108
Table 5.2 Classification of Occupation.....	109
Table 5.3 Number of Employees	109



Table 5.4 Details of the Group and Employee Salaries	111
Table 5.5 Details Non-Classified Employee Salaries	111
Table 6.1 Cost Index Chemical Plant Data	115
Table 6.2 Fixed Capital Investment	119
Table 6.3 Working Capital	119
Table 6.4 Manufacturing Cost.....	120
Table 6.5 General Expenses	120
Table 6.6 Total Product Cost	120
Table 6.7 Fixed Cost	122
Table 6.8 Variable Cost.....	123
Table 6.9 Regulated Cost	123

LIST OF FIGURE

Figure 1.1 Composite Phase Diagram for Titanium Dioxide	2
Figure 1.2 Graph of Titanium Dioxide Import in Indonesia in 2011-2014	4
Figure 2.1 Flow Diagram of Qualitative	25
Figure 2.2 Flow Diagram of Quantitative	26
Figure 2.3 Layout of Titanium Dioxide Plant	39
Figure 4.1 Water Treatment Unit	98
Figure 5.1 Organizational Structure	101
Figure 6.1 Relationship between Years and Cost Index	115
Figure 6.2 Economic Analysis	125