FINAL PROJECT

PRELIMINARY DESIGN OF LINEAR LOW DENSITY POLYETHYLENE (LLDPE) USING UNIPOL PROCESS CAPACITY OF 400,000 TONS/YEAR

Achmad Amiruddin Hasan
D 500 112 003

Supervisors :
1. Tri Widayatno, S.T., M.Sc., Ph.D.
2. Ir. H. Haryanto AR., M.S.

DEPARTMENT OF CHEMICAL ENGINEERING
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THE APPROVAL PAGE
UNIVERSITAS MUHAMMADIYAH SURAKARTA
FACULTY OF ENGINEERING
DEPARTMENT OF CHEMICAL ENGINEERING

Name: Achmad Amiruddin Hasan
NIM: D 500 112 003
Title: Preliminary design of linear low density polyethylene (LLDPE) using unipol process Capacity of 400,000 tons/year
Supervisors: 1. Tri Widayatno, S.T., M.Sc., Ph.D.
2. Ir. H. Haryanto AR., M.S.

Surakarta, June 2015

Approved by,
Supervisor I

Tri Widayatno, S.T., M.Sc., Ph.D.
NIK. 960

Supervisor II

Ir. H. Haryanto AR., M.S.
NIP. 196307051990031002

Dean of Engineering

Ir. Sri Sunarjono, M.T., Ph.D.
NIK. 682

Chairman of The Department of Chemical Engineering

Rois Fatomi, S.T., M.Sc., Ph.D.
NIK. 892
STATEMENT OF AUTHENTICITY

I, the undersigned below:

Name: Achmad Amiruddin Hasan
NIM: D 500 112 003
Study Program: Chemical Engineering
Final Project Title: Preliminary design of linear low density polyethylene (LLDPE) using unipol process Capacity of 400,000 tons/year

State that this design project report is my original work. All material presented in this report is my own work. Information derived from the published and unpublished work of other has been acknowledged in the text and references are given in the list of sources.

I declare that this is a true copy of my report including my final revision as approved by my project supervisors.

I understand that if at any time it is shown that I have significantly misinterpreted any materials and shown any plagiarism, the degree awarded to me may be revoked.

Surakarta, June 2015

Author,

Achmad Amiruddin Hasan
ABSTRACT

Linear Low Density Polyethylene (LLDPE) factory with a capacity of 400,000 tons/year is planned to operate for 330 days per year. The manufacturing process of LLDPE utilise solid catalyst TiCl₄-MgCl₂. The reaction takes place in a fluidized bed reactor in the gas-solid phase. It is exothermic, adiabatic and non-isothermal at inlet and outlet temperature of 75 °C and 80 °C and pressure of 25 atm. Products exit the reactor in the form of a solid resin with a conversion per pass of 5%. Factory is classified as a high risk due to plant operating conditions with high pressure.

Polymerization formation reaction of LLDPE of ethylene takes place through three stages, namely the initiation stage in which the reaction occurs between ethylene gas with free radicals from the activation of the catalyst with a co-catalyst. The second stage is the propagation reaction and the last is the termination stage. Raw material of ethylene required for the plant is 50,596.785 kg per hour, butene-1 is 3.400 kg per hour, hydrogen is 0.8162 kg per hour, catalyst TiCl₄-MgCl₂ as much as 2.5252 kg per hour and co-catalyst TEAL (Al(C₂H₅)₃) totals is 37.9959 kg per hour. The products of LLDPE is 50505.0505 kg per hour. Supporting utilities include water supply of 367,003.12 kg per hour were obtained from Grogol river water, the provision is 5,255.325 kg per hour of saturated steam were obtained from the fuel boiler with fuel oil amounted to 621.371 liters per hour, the need for compressed air of 100 m³ per hour, the demand for electricity is obtained from the PLN and a generator set of 500 kW in reserve. The factory was established in Cilegon, Banten with a land area of 15,779 m² and the number of employees 202 people.

LLDPE factory requires a fixed capital of IDR 598,874,667,292 and working capital of IDR 478,453,884,401. The economic analysis of this plant show a profit before tax of IDR 429,859,745,392 per year after taxes 30%, The profit reached IDR 300,901,828,074 per year. Percent Return On Investment (ROI) before tax and after tax are 71.81% and 50.27%. Respectably Pay Out Time (POT) before tax and after tax for 5 years are 1.25 and 1.72. Respectably Break Even Point (BEP) is 49.35%, and Shut Down Point (SDP) amounted to 41.34%. Discounted Cash Flow (DCF) accounted for 31.01%. From the above data of feasibility analysis, it can be concluded that the plant is profitable and feasible to be established.

Keywords: Linear Low Density Polyethylene, fluidized bed reactor, TiCl₄-MgCl₂ catalyst.
MOTTO

There shall be no compulsion in [acceptance of] the religion. The right course has become clear from the wrong. So whoever disbelieves in Taghut and believes in Allah has grasped the most trustworthy handhold with no break in it. And Allah is Hearing and Knowing. Allah is the ally of those who believe. He brings them out from darkneses into the light. And those who disbelieve - their allies are Taghut. They take them out of the light into darkneses. Those are the companions of the Fire; they will abide eternally therein.

Qs 2:256-257

[To the righteous it will be said], “O reassured soul, Return to your Lord, well-pleased and pleasing [to Him], And enter among My [righteous] servants And enter My Paradise.”

Qs 89:27-30

Keep soul
Keep spirit
Keep smile
Keep silent
and preparing hereafter
DEDICATION

Ya Allah, because of Al Quran, gives us Your Blessing for us. Being Al quran as our faith, light, guidance, and source of God’s mercy for us.

Ya Allah, remind us if there are verse that is forgot by us. Teaching us, which are verse that is hard to understand. giving us pleasure to read it, as long time, in the midnight or in the day. Being Al quran. Being Al quran for us as hujjah, ya robbal alamiin

Ya Allah, giving us Your goodness for us in our dien which is the key of price tag for us. Giving goodness for us in the world that is the place for us to survive our life. Giving us Your goodness in here after for us, that is the place for to back. Being our life always be better, and being our death as freedom of us from the badness.

Ya Allah, being end of our ages is the best, being the best reward for us in the end, being the best days of us when we meet You.

Ya Allah, we hope to You, give us the best life, the death is normal and the place to back is not patethic and avoid from the problem.

Ya Allah, we hope to You the best request, the best pray, the best success, the best knowledge, the best charity, the best reward, the best life, the death life, strength us, weighting our goodness, applying our faith, high our ranking, accept our prayer, forgive our sins, and we hope the highest paradise.

Ya Allah, we hope giving us that is obligate You gave, forgiveness that is You should gave, safety from the sins, ghanimah from goodness and win to get paradise, and safe from the fire of hell.

Ya Allah, giving us goodness for us in everything, giving us the best rewards for us from all of hurt sins the world and mistreatment here after.

Ya Allah, giving us the scary to You, that is limited between us with our badness to You and giving obey to You that is take us into Your paradise, giving also the belief that is caused us for everything disaster in this world
Ya 以外, giving us Your pleasure for us through our ears, eyes, and in the strength for us as long as our life and being it is inheritance from us. Being it is replied us for people that bad attitude to us and helping us from people that hate us. Don’t You are being disaster for our dien. Don’t be You being this world is the big goal for us and the summit of knowledge for us. don’t You are being power on us, people are not like us.

Ya 以外, don’t ever You leave the sins, except You forgive us. there is no doubt except You give us the way, there is no credit except You fulfill, oh, the God of unverse.

Ya 以外, giving us goodness in the world and goodness in here after, also keeping us from the hellfire, hope peace and salutation always be given to our prophet Muhammad, his family, and also all of his friends and blessing our parents like they love us.
FOREWORDS

All praises due to Allah SWT and his prophets, because of his mercy and blessing this final project has completed. This report is one of requirements to pass the chemical engineering study.

The author realizes that report is not perfect due to our limited knowledge and experience, therefore advice and suggestion are welcome.

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Author wish this report to be benefical to those my concern.

Surakarta, June 2015

Author
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