RESEARCH PROJECT

UTILIZATION OF NANOMATERIAL WITH CUBIC MESOSTRUCTURE TO INCREASE EFFICIENCY OF ENZYMATIC CONVERSION OF CELLULOSE INTO GLUCOSE

Submitted by:
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DEPARTMENT OF CHEMICAL ENGINEERING
FACULTY OF ENGINEERING
WIDYA MANDALA CATHOLIC UNIVERSITY
SURABAYA
2015

LETTER OF APPROVAL

The research entitled:

Utilization of Nanomaterial with Cubic Mesostructure to Increase Efficiency of Enzymatic Conversion of Cellulose into Glucose

Which was conducted and submitted by:

Name : Christian Harmoko

NRP : 5203012023

Has been approved and accepted as progress report for one of requirement for **Bachelor Engineering** degree in Chemical Engineering Department, Faculty of Engineering, Widya Mandala Surabaya Catholic University by following supervisor/s.

Surabaya, 15 June 2015

Supervisor	Co-Supervisor
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PREFACE

First of all, thanks to God for his grace and love so the writer can finish this report on time. This report is presented to fulfill one of the requirements in accomplishing the Bachelor Degree at the Department of Chemical Engineering in Widya Mandala Catholic University. The writer would like to express his sincere gratitude to the following:

1. Mr. Sandy Budi Hartono and Mrs. Ery Susiany as my supervisors who guide me in writing this thesis report and give motivation and advice in the experiments.
2. The examiners who give suggestions and critics in this reports.
3. My family and friends who give me never ending supports.
4. Anyone that can't be mentioned directly or indirectly who has helped the writer in completing this script. The writer does appreciate any opinion and suggestion for the improvement of this thesis report.

ABSTRACT

The use of conventional fuel becomes major part of life that can't be separate anymore. However, conventional fuel can't be renewable so over time the stocks are dwindling and cause fuels price has been increase. Recently, Indonesia has changed to become one of petroleum importing countries. It makes the country economic more vulnerable against rising fuel prices. Availability of alternative fuels such as bio-ethanol or bio-diesel becomes very important.

To overcome this challenges, alternative fuel researches are encouraged by so many countries. One of organic component that can be used as a raw material to produce bio-ethanol is cellulose. Cellulose is the largest organic material in earth. Cellulose can be easily founded from agricultural residue such as corn head. Cellulose can be converted to glucose which is the base material to produce bio-ethanol.

There are two processes to convert cellulose into glucose: through chemical process and enzymatic process. Cellulase enzymes convert cellulose materials into glucose. The enzymatic process have a benefit, the high cellulose conversion into glucose and zero waste process as compared to chemical process. Yet, the enzymatic process is hindered due to the high cost of enzyme production. For this reason, the increase in enzymatic process efficiency is unavoidable to cut production cost. On this study, we intend to improve efficiency from enzyme with nanoporous material for reusability from cellulose enzyme, while keeping activity and stability from enzyme.

The purpose from this research is to study the use of nanomaterial to improve enzyme stability and the use of nanomaterial to enzyme reusability. There are many factors that influence activity, stability and reusability from cellulase enzyme such as chemical character of surface, particle size from nanoporous material (micron sized: 4-8 micrometer and submicron : 100-300 nm), property of nanoporous will be examined to reduce production cost so it can increase efficiency from enzymatic process.

This research is divided into 4 stages, nanoporous silica synthesis, chemical character modification of surface, enzyme immobilization, and activity, stability and reusability of enzyme measurement. At first stage, cubic mesostucture nanoporous silica (FDU-12) will be synthesized in two different particle size: micron size and submicron size. Then, chemical character modification of surface with organosilane (VTMS: Vinyltrimetoxysilane) in different ratio. Next, enzyme immobilization and measure enzyme activity with: filter paper and CMC methods. Functionalized nanoporous silica product that filled by enzyme is used to convert cellulose into glucose. Finally the optimum condition that give best efficiency to improve activity, stability and reusability from cellulose enzyme will be determined.