RESEARCH PROJECT

SYNTHESIS AND FUNCTIONALIZATION OF CHANNEL-LIKE MESOPOROUS SILICA MATERIALS TO IMPROVE ENZYMATIC CONVERSION OF CELLULOSE TO GLUCOSE



Submitted by: Robby Wijaya NRP: 5203012009 Luciana Trisna NRP: 5203012027

DEPARTMENT OF CHEMICAL ENGINEERING FACULTY OF ENGINEERING WIDYA MANDALA CATHOLIC UNIVERSITY SURABAYA

2015

The research entitled:

Synthesis and Functionalization of Channel-like Mesoporous Silica Materialsto Improve Enzymatic Conversion of Cellulose to Glucose Which was conducted and submitted by:

Name : Robby Wijaya NRP : 5203012009

has been approved and accepted as one of requirement for Bachelor of Engineering degree in Chemical Engineering Department, Faculty of Engineering, Widya Mandala Surabaya Catholic University by following supervisor/s and has been examined by the committees on 26th of May 2015 Surabaya, 12th of June 2015

Supervisor

Sandy Budi Hartono, Ph.D. 521,99,0401

Ery Susiany R, ST., MT. 521.98.0348

Co-Supervise

The Committees

Chairman

Anvaresti, ST, M.Eng. Sc. 521,99,0396

Member

Dean

525950198

ngineering Paculty

NIVERSIT

Sandy Budi Hartono, Ph.D. 521,99,0401

Member

Secretary

UKIN Surgadi Ismadii, MT, Ph.D. Ery Susiany R, ST., MT. Authorized by 521.93.0198

Ismadji, MT, Ph.P.

Head of Chemical Engineering Department

awati, ST. MT

ii

The research entitled:

Synthesis and Functionalization of Channel-like Mesoporous Silica Materialsto Improve Enzymatic Conversion of Cellulose to Glucose Which was conducted and submitted by:

Name : Luciana Trisna NRP : 5203012027

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Secretary

The Committees

Chairman

Antaresti, ST, M.Eng. Sc. 521.99.0396

Member

Ir. Survadi Ismadii, MT, Ph.D. 521093.0198

Sandy Budi Hartono, Ph.D. 521,99,0401

Member

Ery Susiany R, ST., MT. 521.98.0348

Authorized by

Dean of Snameening Vaculty MIVERSI' madji, MT, Ph.D.

Head of Chemical Engineering Department POWZAN Wenny Irawad, ST, MT 521-01-0284

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Surabaya, 12th of June 2015 Student, 05903ADE 75137226 Luciana Trisna

5203012027

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PREFACE

The purpose of this research report is to present the research result that titled Synthesis and Functionalization of Channel-like Mesoporous Silica Materials to Improve Enzymatic Conversion of Cellulose to Glucose. The study of mesoporous material has been reported in a few years, but we focused on SBA-15 functionalization.

In doing this research, we have taught the new experiment about SBA-15 material, which is functionalized it with VTMS and modified to micron and nano-sized. We made a new idea by compared between micron and nano-sized to measure the activity, stability, and reusability.

We gratefully thank to Mr. Sandy Budi Hartono and Mrs. Ery Susiany, whose efforts helped our research and gave some advice about our experiment.

Surabaya, 12th June 2015

Author

ABSTRACT

Nowadays, the demand for energy is rising faster than anything, accelerating the exhaustion of fossil fuel, which is the most common form of energy source. Meanwhile, the amount of fossil fuels in nature are limited and will be used up at some point in the future, which is why we need another fuel source that is sustainable. Bio-ethanol is an alternate fuel, which can be made from thing that contains glucose. Glucose mostly contained in organic compounds, such as starches, and cellulose is the main compound of grains and edible roots.

Using edible material as the main source for bio-ethanol will worsen the food supply of the world. As an alternative source of bio-ethanol, waste product that is high in cellulose, such as by products from the processing of sugar cane, wood chips, and corn cobs. The conversion of cellulose to glucose will be needing an enzyme called cellulase. Despite its high potent, enzymatic reaction is less prefer compared to other processes. This is mainly due to the high production cost of enzymes. That is why every efforts to improve enzyme stability and reusability is important.

Nanoporous material, such as mesoporous silica, has the potential for making the enzyme reusable, but research about nanoporous material is still considered little despite of its capabilities. In this research, at first we focus on the synthesis a channel-like mesoporous silica materials with micron size (SBA-15) and nano size (IBN-4). The synthesized materials are functionalized with VTMS (vinyltrimethoxysilane). We will be using the mesoporous silica material to increase the interaction between the enzyme and the nanoporous silica. The synthesis of nanoporous silica will be using P123 as surfactants and TEOS as the source of silica, HCl will be used as solvent. VTMS will be used as organosilane source for silica surface modification. The effect of VTMS concentration on the affinity against enzyme will be studied.