RESEARCH PROJECT REPORT

CONVERSION OF OIL WITH HIGH FREE FATTY ACID CONTENT INTO BIODIESEL USING SUB-CRITICAL METHANOL

Submitted by:

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WIDYA MANDALA CATHOLIC UNIVERSITY
SURABAYA

2016

LETTER OF APPROVAL

The research entitled:

Conversion Oil with High Free Fatty Acid Content into Biodiesel Using Sub-Critical Methanol

which was conducted and submitted by:

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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 supervisors.

Surabaya, 26th of May 2016

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I declare that this research was my own work and does not contain any material that belongs to the others, unless it was stated in the references. Should it is known that this research belongs to others. I aware and accept the consequences that this research cannot be used as a requirement to achieve a Bachelor of Engineering degree.

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Surabaya, 11th May 2016

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PREFACE

The authors would like to thank God for His blessing so our research project has been accomplished. This report is one of the prerequisites in achieving Bachelor of Engineering degree in Chemical Engineering. The authors realize that the completion of this report is achieved by the support of many people. Therefore, the authors would like to thank to:

1 Ir. Suryadi Ismadji, Ph.D., as Principal Supervisor and Felycia Edi S., Ph.D. as Co Supervisor
2 Wenny Irawaty, Ph.D. as Head of the Committees, Aning Ayucitra, ST., M.EngSc, and Ir. Yohanes Sudaryanto, MT., as members of committees
3 Ir. Suryadi Ismadji, Ph.D and Dra. Adriana Anteng Anggorowati, M.Si. as the Head of Process and Chemical Analysis Laboratory, respectively.
4 Mr. Novi and Mr. Pudjo as the technicians in Process and Unit Operation Laboratories, respectively.
5 Our parents and family who have given a lot of help and support, both materially and morally.
6 Our lecturers, friends and also those who are too many to be listed by name that had contributed their kind assistance

The authors realize that this report is far from perfect, therefore any critics and comments which will better improve the research is gladly accepted. Lastly, the authors hope that the report will be useful to all readers who need information regarding the research of the report.

Surabaya, 11th May 2016

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ABSTRACT

The consumption of palm cooking oil in Indonesia is very high, and as a result, the used cooking oil (UCO) which is mostly end up as the waste is also high. Direct discharge of UCO into environment causes serious environmental pollution problems. UCO contains triglyceride and free fatty acid, which can be converted into biodiesel. In this study, the conversion of UCO into biodiesel was conducted using subcritical methanol method. The effect of the process parameters such as the ratio of UCO to methanol, temperature, and pressure on the yield of biodiesel was investigated. Based on the Response Surface Method; temperature, pressure, and UCO to methanol ratio gave significant effect on the FAME yield. From the experimental result, the maximum FAME yield obtained was 88.43% with the purity up to 97% (180°C, 45 bar, 3:10), while the maximum yield calculated by RSM was 88.8115% with the optimum condition: 174.7°C, 45 bar for UCO to methanol ratio 3.263:10. The components in the FAMEs product are Undecanoic Acid Methyl Ester (C11:0), Myristoleic Acid Methyl Ester (C14:1), cis-10-Pentadecenoic Acid Methyl Ester (C15:1), Stearic Acid Methyl Ester (C18:0), Oleic Acid Methyl Ester (C18:1n9c), Elaidic Acid Methyl Ester (C18:1n9t), cis-8,11,14-Eicosatrienoic Acid Methyl Ester (C20:3n6), Heneicosanoic Acid Methyl Ester (C21:0), Arachidonic Acid Methyl Ester (C20:4n6), cis-5,8,11,14,17-Eicosapentaenoic Acid Methyl Ester (C20:5n3), Erucic Acid Methyl Ester (C22:1n9) cis-13,16-Docosadienoic Acid Methyl Ester (C22:2) Tricosanoic Acid Methyl Ester (C23:0).