

**UNIVERSITI TEKNOLOGI MARA**

**RHEOLOGICAL STUDY OF OIL PALM TRUNK  
WASTE AS VISCOSIFIER AGENT ON WATER-  
BASED MUD**

**MOHD FIRDAUS BIN SARIMAN**

Thesis submitted in fulfillment  
of the requirements for the degree of  
**Bachelor of Engineering (Hons) Oil and Gas**

**Faculty of Chemical Engineering**

**July 2018**

## ABSTRACT

The Oil Palm Trunk (OPT) is one of the biggest agro-waste in Malaysia. In OPT, contains rich with cellulose which is has potential become as viscosifier agent in designing Water- Based Mud (WBM) by improving the rheological properties of WBM. The cellulose was extracted by using two methods which are Method 1 (Chlorination-Bleaching Process and Mercerization Method) and Method 2 (Dewaxed-Alkaline-Delignification method). The characterization of OPT cellulose is defined by FTIR analysis while the content of cellulose product is defined by using Weighting method. In this experiment, the mud samples were formulated by presence of different weight of cellulose applied. The production method and determination of rheological (Viscosity, Gel Strength, Yield Point and Filtration test) properties were carried out based on API mud production standards. From the analysis of the experiment results, the Soxhlet method yield more percentage of cellulose by 43.05% and for the Direct method only yield percentage of cellulose by 37.63%. Based on FT-IR Spectrometry results, it shows the Method 2 mimicking the behaviour of HEC cellulose which is the best cellulose as viscosifier agent to the WBM. This is proven by the spectral peaks of cellulose of Method 2 which is has the same cellulose spectral peaks due as the HEC to detection of functional group in the FT-IR analysis. In conclusion, Method 2 cellulose shows the best and almost following with range API standard for WBM on rheological properties.

## **ACKNOWLEDGEMENT**

Firstly, I wish to thank Allah Almighty for giving me the opportunity to embark on my B.Eng and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Madam Husna Hayati Binti Jarni.

My appreciation goes to the Faculty of Chemical Engineering, UiTM Shah Alam by provided the facilities to complete my research. Special thanks to my colleagues and friends for helping me with this project.

Finally, this thesis is dedicated to the loving father and mother for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulillah.

# TABLE OF CONTENTS

	Page
<b>AUTHOR’S DECLARATION</b>	<b>i</b>
<b>PLAGIARISM FORM</b>	<b>ii</b>
<b>SUPERVISOR'S CERTIFICATION</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>ACKNOWLEDGEMENT</b>	<b>v</b>
<b>TABLE OF CONTENTS</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>viii</b>
<b>LIST OF ABBREVIATIONS</b>	<b>ix</b>
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Research Objectives	4
1.4 Scope of Works	4
<b>CHAPTER TWO: LITERATURE REVIEW</b>	<b>6</b>
2.1 Drilling Fluid	6
2.2 Water-Based Mud (WBM)	7
2.3 Oil-Based Mud (OBM)	9
2.4 The Oil Palms	10
2.4.1 Oil Palm and Its Availability in Malaysia	10
2.5 Oil Palm Biomass	12
2.5.1 Properties of Oil Palm Trunk	14
2.6 Rheological Study	17
2.6.1 Rheology	17
2.6.2 Rheological Models	19
2.7 Mud Additive	22

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 BACKGROUND OF RESEARCH**

By referring to the American Petroleum Institute (API), drilling fluid is defined as a circulating fluid used in the drilling operation. The functions of drilling fluid are to bring the drill cuttings from beneath of drill-bit to surface; clean the wellbore from drilling cuttings (Werner B, Myrseth V,& Lund B, 2016), acts as cooling and lubricate the drill string and drill bit from damage, assists in cementing and completion of well, minimize the reservoir damage and also manages formation pressure to maintain well-bore stability until the section of borehole has been cased and cemented. The selection of drilling fluids is depending on the types of the formation to be drilled, the range of temperature and strength, permeability and pore fluids pressure exhibited by the formation. Besides, the costs, technical performance, and environmental impact also needed to be considered when the selection of drilling fluids. Drilling fluids had been important which lead either the drilling program successfully or not and deserve careful study. The rheological properties are crucial to control and maintain and if the failure happens, the cost and loss of time and worst-case scenario, the well will be closed and abandoned (Dhiman & Scotia, 2012).

The study of drilling fluid rheological behaviour is important whether the drilling fluids are ready to be used or not which are included a series of tests that included such as the determination of mud density, viscosity, gel strength and yield point of the drilling fluids. Furthermore, the other of rheological tests such as chemical analysis, pH, filtration tests, sand content (solids, water and oil content and chemical properties).

There are three types drilling fluids commonly used in drilling operation which is Water-Based Mud (WBM), Oil-Based Mud (OBM) and Synthetic-Based Mud (SBM).