## **UNIVERSITI TEKNOLOGI MARA**

# THE EFFECT OF PULPING TIME AND ALKALI CHARGE ON THE EFFICIENCY OF SODA PULPING USING BANANA STEM

## NUR SYAFIQAH BINTI JUSOH

Thesis submitted in fulfillment of the requirements for the degree of **Bachelor of Engineering (HONS)** Chemical

**Faculty of Chemical Engineering** 

June 2018

#### ACKNOWLEDGEMENT

First and foremost I would like to express the gratitude to the Most Merciful Allah s.w.t for giving me the chance to complete this research without any glitch. Then I would like to express my deepest appreciation to my supervisor Prof Madya Dr Junaidah Jai and Madam Nurul Amal Nadhirah Mohamad whose contribution in stimulating suggestions and encouragement and helped me to coordinate my research. I would also like to thank to the lab assistants for helping and guiding me in conducting the research. Not to forget, a big thanks to all of my coursemates for giving me the ideas and sharing information throughout my research. Last but not least I would like to thank my parents Tuan Haji Jusoh bin Deraman and for always being there for me whenever I'm having hard times and always give positive words for me. Words cannot express how grateful I am to both of them.

### ABSTRACT

The demand in pulp and paper industry has increased greatly as the world population using more and more papers every day. Since most papers are made from wood which makes the production hugely relies on the forest resources, huge areas of rainforest are getting destroyed every year. The main objectives of this research are to produce nonwood pulp from banana stem using soda pulping process and to analyze the efficiency of the soda pulping process by yield and also the kappa number of the resulting banana pulp. Pseudo stem are really suitable for pulping in paper industry. Banana fibers have great physical strength properties. The first step in this experiment is the preparation of the raw material. Then the soda pulping experiment is conducted with time and soda concentration as manipulated variable. The sample from the soda pulping is then dried to get the dried pulp. The dried pulp is characterized with yield, Kappa number. For cooking time, the shortest time at 60 min obtained the highest average yield at 39.47%. For the test of different concentration, the yield obtained the lowest yield at 16% concentration which is only 27.61%. The kappa number pattern for different concentration is decreasing with the increase of concentration. At 16% concentration the kappa number was 35.05 and at 20% the kappa number was 29.66%. Shorter cooking time and lower concentration of sodium hydroxide can give you higher yield, but it will also have higher bleachability and vice versa.

### **TABLE OF CONTENTS**

			PAGE
LIST OF TABLES			vii
LIST OF FIGURES			
CHAPTER 1	INTR	ODUCTION	
	1.1	Research Background	1
	1.2	Problem Statement	2
	1.3	Objectives	2
	1.4	Scopes of Research	3
	1.5	Significance	3
CHAPTER 2	LITEI	RATURE REVIEW	
	2.1	Banana plant	4
		2.1.1 The uses of banana plants	5
		2.1.2 Compositions of banana	7
		stems, woods and other sources	
	2.2	Pulp and papermaking process	9
		2.2.1 Chemical pulping	9
		2.2.2 Mechanical pulping	14
		2.2.3 Biopulping	15
	2.3	The potential of banana stem as	15
		non-wood pulp	
	2.4	Pulp characterization	19
		2.4.1 Kappa number	19
		2.4.2 Yield	20

#### **CHAPTER 1**

#### **INTRODUCTION**

#### 1.1 Research background

Banana can be found in over 130 countries making it one of the most broadly planted fruit plant and with 16% of fruit production out of world's total fruit production, banana is crown as the second major fruit produced following behind citrus (Debabandya, Sabyasachi, & Namrata, 2010). Banana plant not only can be used as food, but its other parts besides the fruit can be used for other purposes too. The stem, which has high fiber content, can be used to make a lot of products for example paper board and tissue paper. Pseudo stem contain large quantity of holocellulose (72.71%) and with relatively small content of ash (8.20%) and lignin. Carrying this characteristics, pseudo stem are really suitable for pulping in paper industry (Debabandya, Sabyasachi, & Namrata, 2010).

Since the market demands for pulp and paper are keep growing, the technology used for making and producing pulp and paper undergo constant improvement (Kurt & Ewald, 1994). There are two types of pulping in the industry, which are chemical pulping and mechanical pulping. When enzymes are used in pretreatment of the woods it will be called as biopulping (Kurt & Ewald, 1994). Chemical pulping have lots of advantages which include producing wood pulp that is of high quality that contain longer and stronger fibers with only a little impurities. The lignin waste from the process can be used as a fuel oil substitute.

There are three main methods in the chemical pulping process which are sulfate or kraft, acid sulfite and also the soda process. Different process will use different types of chemicals. For kraft process, the chemicals used for pulping are sodium hydroxide and sodium sulphite whereas for soda pulping only sodium hydroxide is used. There are also other chemical pulping processes such as formic/acetic process, urea/sodium hydroxide process and also soda anthraquenone process (Manish & Deepak, 2011).