UNIVERSITI TEKNOLOGI MARA

# DELIGNIFICATION OF UNTREATED ELEPHANT GRASS USING MICROWAVE ASSISTED BLEACHING PROCESS PRIOR TO NANOCRYSTAL CELLULOSE ISOLATION:

## EFFECT OF CONCENTRATION OF HYDROGEN PEROXIDE ON LIGNIN DEGRADATION

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## ABSTRACT

Nanocrystal cellulose isolation involved pretreatment stages which are alkali pretreatment and bleaching. Nevertheless, those pretreatment are using conventional method and do not give a significant results in lignin degradation. Microwave assisted process for nanocrystal cellulose isolation expected to be efficient in the lignin degradation. The objectives are to extract cellulose from untreated elephant grass using microwave assisted bleaching process and determine lignin degradation using different concentration of hydrogen peroxide ($H_2O_2$) as bleaching agent. Untreated elephant grass will be bleached using different concentration of hydrogen peroxide in different time. The percentage of total lignin degradation can be determined from the summation of acid soluble lignin (ASL) and acid insoluble lignin (AIL). The result showed that the highest weight of biomass after bleaching process is 1.6301g meanwhile for percentage of total lignin degradation is 49.93% at 120 minutes, 30% concentration of $H_2O_2$ with 180W. This can be conclude that microwave assisted bleaching process can be an effective pretreatment method for nanocrystal cellulose isolation.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Research Background

In recent years, attention towards Green Chemistry principles have attracted a plethora scientists to do research on nanocrystalline cellulose (NCC) production using lignocellulosic biomass [1]. The most promising feedstock is lignocellulosic material as natural and renewable sources with huge amount and can be converted into different high value products. Typically, there are about 40-50% cellulose, 20-30% hemicellulose and 10-25% lignin comprised in agricultural lignocellulosic biomass [2]. Cellulose is the main lignocellulosic component of cell wall in plant with a sequential polymer of 1-4 β-glycosidic linkages [3]. Meanwhile, hemicellulose is a polysaccharide which is a combination of carbohydrates contains 3- 6 associated units and a second plentiful heterogeneous polymers [4]. With non-covalent attractions, cellulose and hemicellulose are binds tightly to the surface of each micro-fibril [2, 5]. Lignin, on the other hands, as an aromatic biopolymer and amorphous bio-macromolecule with a long-chain and linked by ether bonds [6]. The structure of cellulose and hemicellulose is heavily packed with layers of lignin which acts like glue by filling the gaps to protect them against enzymatic hydrolysis, mechanical process and acid hydrolysis [2, 7, 8]. Usually from these three lignocellulosic components, lignin are the most usable in some products such as isocyanate binders, biodispersants and fuel additive [9]. However, the attraction is now focusing more to the cellulose component because of its sustainability, environmental-friendly benign and cost effective [10].

Present effort had remodel cellulose to specific forms such as cellulose nanocrystal because their various peculiar properties make them potentially relevant in a different field of scientific and technological developments [11]. Nanocellulose is a particle with nano-sized dimension which displays structural characteristic of low density, biocompatible and high surface area connected with modified hydroxyl group. Recently, the nanocrystalline cellulose (NCC) is greatly applied as emulsifier, cosmetics, thickener