

**OPTIMIZATION OF HYDROLYSIS CONDITIONS FOR NANOCRYSTAL
CELLULOSE (CNXL) FABRICATION**

NOORFAZILA AMIN

**Final Year Project Submitted In
Partial Fulfillment of the Requirements For The
Bachelor of Science (Hons.) Polymer Technology
Faculty Of Applied Sciences
Universiti Teknologi Mara Malaysia**

May 2008

This Final Year Project Report entitled “**Optimization of Hydrolysis Conditions for Nanocrystal Cellulose (CNXL) Fabrication**” was submitted by Noorfazila Bt Amin, in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Polymer Technology, in the Faculty of Applied Sciences, and was approved by



Associate Professor Madya Dr. Rahmah Mohamed
Supervisor
Faculty of Applied Sciences
Universiti Teknologi MARA

Associate Professor Dr. Azemi Samsuri
Head of Programme
B.Sc. (Hons.) Textile Technology
Universiti Teknologi MARA

Associate Professor Dr. Saifollah
Abdullah
Dean
Faculty of Applied Sciences
Universiti Teknologi MARA

Date: _____

TABLE OF CONTENTS

ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURE	vii
LIST OF ABBREVIATIONS	ix
ABSTRACT	x
CHAPTER 1: INTRODUCTION	
1.1 Background	1-4
1.2 Significant of study	5-6
1.3 Objectives of study	6-7
CHAPTER 2: LITERATURE REVIEW	
2.1 Cellulose Chemistry	
2.1.1 Origin	8-9
2.1.2 Molecular and Supramolecular Structure	9-15
2.1.3 Properties	16-17
2.1.4 Cellulose Degradation	17-19
2.2 Celulose Nanocrystal	
2.2.1 Nanocrystal	19-20
2.2.2 Crystal Structure	20-23
2.2.3 Cellulose Nanocrystal	24-25
2.3 Scanning Electron Microscope	26-27
2.3.1 Scanning Process and Image Formation	27-28
2.3.2 Magnification	28-29
2.3.3 Sample Preparation	29-30
2.3.4 Resolution of the SEM	30-31
2.4 Polarized Light Optical Microscope	31-32
CHAPTER 3: METHODOLOGY	
3.1 Material	33
3.2 Characterization of Raw Material	34
3.3 Experimental Method	
3.3.1 Preparation of Acid	34
3.3.2 Acid Hydrolysis	34-36
3.4 Characterization	37
3.4.1 Scanning Electron Microscope	37
3.4.2 Polarized Light Microscope	37
CHAPTER 4: RESULT AND DISCUSSION	
4.1 The Diameter Distribution of Nanocrystal Cellulose	38-39
4.2 The Comparison of the Size of the Microcrystalline	

ABSTRACT

OPTIMIZATION OF HYDROLYSIS CONDITIONS FOR NANOCRYSTAL CELLULOSE (CNXL) FABRICATION

This study describes an acid hydrolysis technique with subsequent ultrasonification time to produce nanocrystal cellulose (CNXL) from microcrystalline cellulose (MCC). The microcrystalline cellulose was hydrolyzed at difference conditions. The concentration of 40%, 50% and 55% of sulphuric acid were used. Hydrolysis was done at room temperature and 50° C for 30 minutes, 60 minutes and 90 minutes. The colloidal suspension of nanocrystal cellulose produced undergoes centrifugation, followed by filtration, ultasonication and drying in vacuum oven. The nanocrystal cellulose produced was characterized using SEM and Polarized Light Microscope. Difference in hydrolysis conditions affected the size distribution of nanocrystal cellulose produced. The range size distribution of the nanocrytal produced was wide between 85nm-333nm.

CHAPTER 1

INTRODUCTION

1.1 Background

Cellulose by far is the most abundant natural polymer that exists on this planet and presents scientists with the advantage to utilize it as an inexhaustible source of raw material in the synthetic development of environmentally friendly and biocompatible products. Due to its availability and low cost, cellulose and its derivatives are extensively used in industries consisting of textiles, plastics, wood and paper products, coatings, and pharmaceuticals among others. Its structural framework consists of extensive intra and intermolecular hydrogen bonding that makes it completely insoluble in normal aqueous solvents and solutions. Cellulose fibrils contain highly crystalline regions that co-exist with amorphous regions, which has a capacity of holding relatively large amounts of water, thus making it a very hygroscopic molecule. These crystalline regions can be conveniently separated from the low order regions to form rod-like cellulose microcrystallites. The rod-like particles can be coupled with various synthetic polymer structures forming hybrid copolymer blocks that display properties of amphiphiles.(Abhishek Dhawan,2007)