



شبكة المعلومات الجامعية





شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
على هذه الأفلام قد أعدت دون أية تغيرات



يجب أن

حفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15-25 مئوية ورطوبة نسبية من 20-40%

To be Kept away from Dust in Dry Cool place of
15-25- c and relative humidity 20-40%



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم

***OXIDATIVE DELIGNIFICATION
OF SOME AGRICULTURAL
RESIDUES***

THESIS

Submitted for

Ph.D. Degree In Chemistry

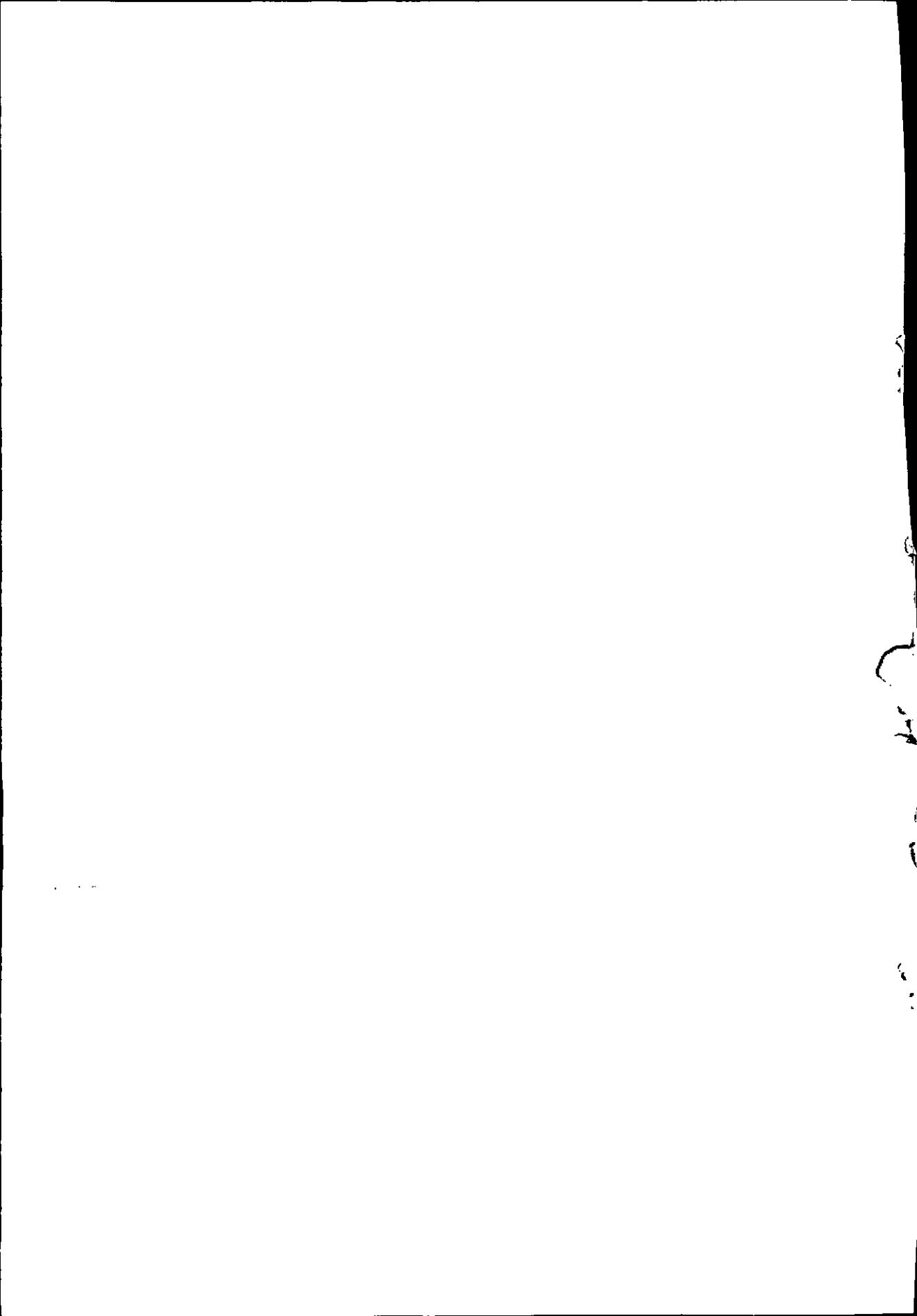
By

Hussien El-Bayoumi Abou-Yousef

M.Sc. Degree, Faculty of Science
Ain Shams University, 1996

**FACULTY OF SCIENCE
AIN SHAMS UNIVERSITY**

1999



APPROVAL SHEET

OXIDATIVE DELIGNIFICATION OF SOME AGRICULTURAL RESIDUES

Thesis Approved

Thesis Advisors

Prof. Dr. A.M. Khalil

Faculty of Science, Ain Shams Univ.

A. M. Khalil

Prof. Dr. Y.A. Fahmy

Cellulose & Paper Dept., NRC.

Y.A. Fahmy

Prof. Dr. A.A. Ibrahim

Cellulose & Paper Det., NRC.

A.A. Ibrahim

Prof Dr. A.M.A. Nada

Cellulose & Paper Dept., NRC.

J.H. Nada

Credit

Prof. Dr. A.F. Fahmy

A.F. Fahmy

Head of Chemistry Department



ACKNOWLEDGEMENT

Deep appreciation and special thanks are extended to my supervisor Prof. Dr. A.M. Khalil for the interest, support, encouragment and great contribution to the revising of the thesis.

I wish to express my sincere thanks to Prof. Dr. Y.A. Fahmy for supervision, encouragement and guidance throughout the progress of the study.

I wish to express my gratitude to Prof. Dr. A.A. Ibrahim for support, valuable discussions and contributions during the study.

I indebted to Prof. Dr. A.M.A. Nada for the support, encouragement and the endless discussions trying to solve scientific problems which encountered the study.



CONTENTS

	Page
List of Tables	i
List of Figures	v
 CHAPTER I :	
INTRODUCTION	1
I.A. Conventional Pulping processes.	1
I.A.1. Mechanical pulping.....	3
I.A.2. Chemical pulping	3
I.B. Organosolv pulping as a non conventional method for pulping of fibrous raw materials.....	4
I.B.1. Differentiation of organosolv processes	5
I.B.2. Chemistry of organosolv pulping	7
I.C. Peroxyacid acid pulping as an oxidative delignification system	9
I.C.1. Chemistry of peracids	9
I.C.2. Reaction of peroxyacids with lignin	10
I.C.3. Pulping with peroxyacids	11
I.D. Kinetics of organosolv pulping..	13
I.E. Bleaching processes	14
I.E.1. Conventional processes used in bleaching of the lignocellulosic materials	15
I.E.2. Oxygen-based chemicals for pulp bleaching	17
I.F. Spectroscopic studies on lignin.	27
I.G. Fibrous Raw Materials for pulp Manufacture	27
I.G.1. Bagasse as a promising source for pulp industry.	28

I.H. Paper Making.....	31
I.H.1. Beating.....	31
I.H.2. Paper sheet formation.....	32
I.H.3. Paper sheet properties	32
I.I. Object of investigation.....	34

CHAPTER II

EXPERIMENTAL	36
II.A. Materials	36
II.A.1. Raw material used.....	36
II.A.2. Analysis of raw material	36
(i) Resin and Wax determination....	36
(ii) Furfural Estimation.....	36
(iii) Lignin Estimation.....	38
(iv) Ash content determination	38
(v) Alpha cellulose determination....	38
II.B. Techniques.....	39
II.B.1 Pulping	39
(i) One-stage peroxyacetic acid pulping	39
(ii) Two-stage peroxyacetic acid pulping (AcOH/PAA)	40
(iii) Two-stage peroxyacetic acid (PAA/AcOH)	40
(iv) Three-stage peroxyacetic acid pulping	41
(v) Comparison between different peroxyacetic pulps	41
(vi) Pulping processes used in kinetic study.	42
(vii) Pulp washing.....	42
II.B.2. Analysis of unbleached pulps.....	42
(i) Kappa Number.....	42
(ii) Degree of polymerization.....	43

(iii) Permanganate Number	44
(iv) IR of different pulps and lignin	44
(v) Determination of metal ions	45
II.B.3. Bleaching processes.....	45
(i) Analysis of bleached pulps.....	46
(ii) Determination of residual peroxide.....	47
II.B.4. Paper sheet making.....	47
(i) Beating.....	48
(ii) Testing of paper sheets	48

CHAPTER III

PEROXYACETIC ACID PULPING.....	49
III.A. One-stage peroxyacetic acid pulping of bagasse.....	49
III.A.1. Effect of peracetic acid concentration and pulping temperature	49
III.A.2. Effect of pulping time.....	60
III.B. Two-stage peroxyacetic acid pulping (Acetic acid/peroxyacetic acid).....	63
III.B.1. Optimization of the first stage	64
III.B.2. The second stage in AcOH/PAA pulping process.....	72
III.C. Prediction of PAA pulp properties in (AcOH/PAA) process	95
III.D. Two-stage peroxyacetic acid pulping (Peroxyacetic acid/ acetic acid)	96
III.E. Three-stage peroxyacetic acid pulping (PAA/AcOH/PAA)	99
III.E.1. Effect of the total peracetic acid charge used in three-stage pulping.....	99

III.E.2. Partition of the total PAA dose between the first and third stage ..	101
III.E.3. Effect of sulphuric acid addition in addition in the acidolysis stage....	104

CHAPTER IV

COMPARISON BETWEEN	
DIFFERENT PEROXYACID PULPS ..	106
IV.A. The bleachability of the pulp	106
IV.B. Beatability.....	109
IV.C. Peroxyacetic acid pulping selectivity.....	115

CHAPTER V

PEROXYACETIC ACID PULPING	
KINETICS	118
V.A. One-stage peracetic acid pulping kinetics	119
V.B. Two-stage peracetic acid pulping kinetics	125

CHAPTER VI

CHARACTERIZATION OF THE LIGNIN AND PULPS PRODUCED FROM	
PEROXYACETIC ACID PULPING.....	133

CHAPTER VII

BLEACHING	146
VII.A. Bleaching of three-stage peracetic acid pulps.....	146
VII.B. Bleaching of two-stage peroxyacetic acid pulps.....	154

VII.C. Improvement of reactivity kraft bagasse pulp towards peroxide bleaching.....	160
VII.D. Improving hydrogen peroxide bleaching by removal metal ions in the pulp.....	167
CHAPTER VIII	
SUMMARY AND CONCLUSIONS	170
REFERENCES	174
ARABIC SUMMARY.	

