

CONTENTS

ABSTRACT & SUMMARY	iv
INTRODUCTION	1
Main Components of Lignocellulosic Materials	2
Cellulose	2
Hemicellulose	3
Lignin	3
Minor Components	4
Ash Content	5
Local Lignocellulosic Raw Materials	5
Bagasse	5
Cereal Straw	6
Rice Straw	7
Cotton Stalks	7
Corn Stalks	8
Flax, Hemp, Jute and Kenaf	8
Other Fiber Sources	8
Conventional Pulping Processes	9
Mechanical Pulping	9
Chemical Pulping	10
(i) Alkaline Pulping	10
(ii) Sulfite Pulping	10
Bleaching Processes	11
Oxygen-based chemicals for pulp bleaching	12
(i) Oxygen bleaching practices and benefits	13
(ii) Oxidation of Lignin by Molecular Oxygen	13
(iii) Using hydrogen peroxide in pulp bleaching	13
(iv) Utilization of peroxyacetic acid in the chemical pulp bleaching	14
(v) Potential using for Peroxymonosulphate in Bleaching	14
(vi) Alkali treatment of cellulose	15
(vii) Effect of presence of salts during alkali treatment of cellulose	17
Paper Making	18
Beating	19
Paper sheet formation	19
Paper sheet properties	19
(i) Tensile strength	20
(ii) Burst strength	20
(iii) Tear Resistance	21
(iv) Optical Properties	21
Aging and Accelerated Aging	21
Aim of the work	27
EXPERIMENTAL	28
Material and Chemicals	28
Raw material used	28
Chemical treatment of Kraft wood pulp	28
Moisture content	29
Paper sheet manufacture	29
Accelerated aging	29

CONTENTS

Testing paper	29
a) Mechanical properties:	29
Elongation	30
Tensile breaking strength	30
Bursting strength	30
Brightness	31
Opacity	31
b) Chemical testing of paper:	32
Estimation Of Pentosan	32
Lignin Estimation	33
Determination of carboxyl groups	34
Degree of Polymerization (D.P.)	35
c) physical properties of paper:	38
X-Ray Crystallinity	38
Scanning Electron Microscope (SEM)	38
FTIR Spectroscopy	39
 RESULTS & DISCUSSIONS	 40
1.Sample Preparation	40
2.Effect of heat treatment (aging) on the physical properties of paper sheets (Blank sample)	42
3.Effect of treatment with sodium hydroxide solutions physical properties of paper sheets	45
3.1.Thermally treated samples	45
3.2.Effect of treatment with 2 % sodium hydroxide and 0.5 % zinc chloride at different time intervals on physical properties of paper sheets	48
3.3.Effect of treatment with 6 % sodium hydroxide and 0.5 % zinc chloride at different time intervals on physical properties of paper sheets	51
3.4.Effect of treatment with 10% sodium hydroxide and 0.5% zinc chloride at different time intervals on physical properties of paper sheets	54
3.5.Effect of treatment with 14% sodium hydroxide and 0.5% zinc chloride at different time intervals on physical properties of paper sheets	57
3.6.Effect of treatment with 18% sodium hydroxide and 0.5% zinc chloride at different time intervals on physical properties of paper sheets	60
4.Effect of thermal aging and sodium hydroxide concentration on each physical properties of paper sheets alone	63
4.1.Elongation percent	63
4.2.Breaking Length	65
4.3.Burst Factor	68
4.4.X-ray Crystallinity	70
4.5.Degree of Polymerization	74
5.Infrared spectra	77
5.1Crystallinity indeces	86
5.2.Mercerization depth	88
5.3.Relative absorbance	90
6. Super Molecular Structure of Cellulose Samples	92
7. Effect of aging on chemical & optical properties	97
7.1.Chemical and optical properties of aged samples without sodium hydroxide treatment	97

CONTENTS

7.2. Chemical and optical properties of pulp samples treated with sodium hydroxide	99
7.3. Chemical and optical properties of samples treated with 2 % sodium hydroxide and aged for different times	101
7.4. Chemical and optical properties of samples treated with 6 % sodium hydroxide and aged for different times	103
7.5. Chemical and optical properties of samples treated with 10 % sodium hydroxide and aged for different times	105
7.6. Chemical and optical properties of samples treated with 14 % sodium hydroxide and aged for different times	107
7.7. Chemical and optical properties of samples treated with 18 % sodium hydroxide and aged for different times	109
CONCLUSIONS	111
REFERENCES	113
ARABIC SUMMARY	1

Key wards:

**Paper pulp – Paper making – Paper testing – Document paper
– Aging – Accelerated aging.**