

PULP AND PAPER: POLLUTION AND SOLUTION

AHSANI AHMAD SULAIMAN

DIPLOMA IN WOOD INDUSTRIES
UNIVERSITI TEKNOLOGI MARÀ

2000

ACKNOWLEDGEMENTS

Alhamdulillah, finally this project paper is finished without too many difficulties. It has been quite an experience to finish this task. The determination to keep a consistent commitment, the obstacles in finding the acquired materials and everything else along the way have given me a different view of life and made me a better person, especially in the field of academia.

I would like to take this opportunity to express my greatest appreciation upon my advisor, Mr. Syaikh Abdul Karim Yamani Zakaria for his continuous guide and support, the Department of Wood Industries course tutor, Prof. Dr. Jamaludin Kasim, Malaysian Timber Industry Board (MTIB) for providing information with sheer professionalism and pleasant reception, Mr. Wan Mohd. Nazri Wan Abd Rahman for his advice and encouragement, fellow friends and everyone that I forget to put here.

This paper is dedicated to those mentioned above and to whom it may provide useful knowledge.

Thank you all.

TABLE OF CONTENTS

Page	
APPROVAL SHEET.....	ii
DEDICATION.....	iii
ACKNOWLEDGEMENTS.....	iv
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
LIST OF ABBREVIATIONS.....	x
ABSTRACT.....	xiv
ABSTRAK.....	xv

CHAPTER

1 INTRODUCTION.....	1
2 PULP & PAPER INDUSTRY.....	6
2.1 Raw Materials.....	6
2.1.1 Production.....	6
2.1.2 Exploitation.....	6
2.1.3 Storage.....	7
2.1.4 Preparation.....	7
2.2 Processes.....	7
2.2.1 Pulping.....	7
2.2.1.1 Mechanical pulping.....	8
2.2.1.2 Chemical pulping.....	11
2.2.1.3 Chemi-mechanical and semichemical pulping	14
2.2.2 Bleaching.....	17
2.2.2.1 Mechanical bleaching.....	18
2.2.2.2 Chemical bleaching.....	19
2.2.3 Papermaking.....	20
2.2.3.1 Stock preparation.....	21
2.2.3.2 Sheet formation.....	21
2.2.3.3 Drying.....	21
2.2.3.4 Finishing.....	22

3	POLLUTION CAUSED BY PULP AND PAPER INDUSTRY	24
3.1	Types of Pollutant.....	24
3.1.1	Solids.....	26
3.1.2	Liquids.....	30
3.1.3	Gaseous.....	31
3.1.4	Sludge, the triple threat.....	35
3.2	Environmental effects.....	38
3.2.1	Impact on soil and topology.....	39
3.2.2	Impact on water sources.....	40
3.2.2.1	Suspended solids.....	41
3.2.2.2	Biochemical oxygen demand.....	42
3.2.2.3	Toxicity.....	42
3.2.2.4	Temperature.....	44
3.2.2.5	Taste, odour and colour.....	44
3.2.3	Impact on air quality, odour and noise.....	44
3.2.4	Impact on organisms.....	47
3.2.4.1	Human.....	47
3.2.4.2	Flora, fauna and ecosystem.....	50
4	THE SOLUTIONS.....	52
4.1	Industrial strategy.....	52
4.1.1	Modified processes.....	52
4.1.1.1	Displacement bleaching.....	52
4.1.1.2	Oxygen bleaching.....	53
4.1.1.3	Alkali-oxygen extraction.....	53
4.1.2	Alternative methods.....	53
4.1.2.1	Elemental chlorine-free.....	53
4.1.2.2	Total chlorine-free.....	54
4.1.2.3	Process chlorine-free.....	54
4.2	Institutional strategy.....	56
4.2.1	Legal approach.....	56
4.2.2	Campaign and information.....	57
4.2.3	Training and management.....	57
4.2.4	Environmental impact assessment.....	58

PULP AND PAPER: POLLUTION AND SOLUTION

By

AHSANI AHMAD SULAIMAN

October 2000

Along with many industrial activities, pulp and paper is an industry with potentially serious impact on air and water quality, resource consumption and worker safety. As worldwide experience has shown, inadequate consideration of the environmental impact of pulp and paper production can lead to severe damage. On the other hand, major progress has been made by the industry in recent years and modern technologies for the treatment of effluents have greatly reduced their volume and toxicity. Cleaner production is a continuous application of strategies to minimize the generation of wastes and emissions. The effectiveness of cleaner production as a management tool is most encouraging. Management commitment and team spirit are pivotal in a successful implementation and practice of cleaner production.