

Cost Saving Strategies in Papermaking Chemistry

FOREWORD

The authors of this handbook first became involved in the presentation of this subject matter in the form of a two-day course prepared for TAPPI, the Technical Association of the Pulp and Paper Industry. In our experience, such courses can provide an ideal environment for discussion, answering individual questions, and working in groups on case studies. We recommend off-site courses as a great opportunity to enrich your skills, make useful contacts, and begin to develop ideas that you can implement once you get back to your worksite.

However, not everyone has the time flexibility or budget opportunities to attend an off-site course. It can be hard to justify time away from the job, even when the training may help you prepare for the implementation of cost-cutting strategies.

The target audience for this handbook includes two groups: 1) those who will read the book on their own, and 2) those who are fortunate enough to participate in a course. As members of the papermaking community we are proud to uphold a TAPPI tradition of providing technical books. Books are a time-proven medium for dissemination of helpful information, enabling the reader to study the material at a self-selected rate, while providing the opportunity to skip directly to the subject matter of most interest and importance. Readers of this handbook should likely

include engineers, scientists, paper mill staff, chemical company technical support representatives, students, and people from other disciplines who are interested in promoting the economic success of papermaking operations.

As far as the authors have been able to determine, based on our search of the literature, there has never been a textbook devoted to the cost impacts of papermaking chemical additives. Many articles have been published over the years on the economic aspects of papermaking chemistry, but apparently there has been no attempt to gather such material into an organized, relatively concise package. Subjects are not covered in great detail in this handbook; therefore, the reader is encouraged to refer to the annotated bibliographies at the end of each chapter for additional resource materials on selected topics.

TABLE OF CONTENTS

CHAPTER ONE

OVERVIEW .....	.1
Profits .....	.2
Introducing Three Paper Machines for Case Studies .....	.3
Some Key Definitions .....	.4
Depreciation .....	.5
Bibliography .....	.7

CHAPTER TWO

LOSSES .....	.9
Pulping Yield .....	.9
Recycling Yield .....	.10
Material Losses .....	.11
Retention Chances .....	.12
Forming Section Retention .....	.13
Retention Aid Use .....	.15
Save-Alls .....	.17
Wastewater Treatment .....	.19
Sludge Solids Recycle .....	.20
Case Study	
ABC PM#2 Losses: What is the Overall Yield? .....	.21
Bibliography .....	.24

CHAPTER THREE

INCREASED PRODUCTION .....	.27
Freeness Testing .....	.30
Chemicals Impact Dewatering .....	.31
Water Retention Value .....	.34

Chemical Additives Promote Dewatering	35
Alum and Poly-Aluminum Chloride (PAC)	36
High-Charge Cationic Polymers	38
Choke-Point Mechanism for Dewatering	41
Microparticle Drainage and Retention Programs	43
Enzymatic Treatments Promote Dewatering	45
Entrained Air	45
Wet-End Additives vs. Wet-Press Dryer Performance	45
Case Study:	
ABC PM#3 Speed-Up: Can We Justify the Variable and Fixed Costs?	47
Bibliography	51

CHAPTER FOUR

DECREASED DOWNTIME	59
Just-in-Time Manufacturing Principles	60
Pareto Analysis	61
Boilouts	62
Defoamers and Deposited Material	65
Slime Control	66
Case Study:	
How Much Would You Pay to Decrease Downtime?	69
Bibliography	73

CHAPTER FIVE

USING FUNCTIONAL ADDITIVES MORE EFFICIENTLY	83
Wet-End Sizing Agents	84
TiO ₂ and Other Opacifying Pigments	88
Wet Strength Resin	91
Anionic Additives for Charge Balance	97
The Size Press	98
Size Press Viscosity	99
Case Study:	
Rising Retention Aid Costs	100
Bibliography	103

CHAPTER SIX

USING PROCESS ADDITIVES EFFICIENTLY AND REDUCING VARIABILITY	115
Defoamer Addition	119
Retention Aids	122
Canister-Type Filters	122
Pumping of Process Additives	123

Dilution Water	124
Verifying Effectiveness and Linearity	124
Online Control of Retention	126
Charge Variations and Variable Retention	127
Addition Points	129
Microparticle Systems	130
Case Study:	
ABC PM#1: Can We Justify Online Control of Chemicals?	133
Bibliography	136

CHAPTER SEVEN

MAKING IT POSSIBLE TO REDUCE FIBER COSTS	149
Cationic Starch	151
Addition Points	158
Synergy Between Additives for Dry Strength	160
Filler-for-Fiber Substitution	162
Dry-Strength Chemicals and Fillers	163
Alkaline Darkening	165
Case Study:	
ABC PM#1: Should We Attempt to Reduce Fiber Costs?	166
Bibliography	170

CHAPTER EIGHT

ENERGY ISSUES AND HANDLING CHEMICAL ADDITIVES EFFICIENTLY	173
The Dryer Section	173
The Wet-Press Section	176
Pressing and Drying	178
Fillers and Drying Energy	178
The Forming Section	179
Web Temperature	181
Chemical Handling	181
Afterword	183
Bibliography	184

APPENDIX 1

A BRIEF INTRODUCTION TO SOME ACCOUNTING TOOLS	189
Return on Investment (ROI)	190
Net Present Value (NPV)	190
Internal Rate of Return (IRR)	191
Payback Period	191
Literature References	192

APPENDIX 2

SUPPLEMENTAL INFORMATION ABOUT CASE STUDIES	193
Case Study for Chapter 1:	
Course Introduction and Overview	193
Case Study for Chapter 2:	
ABC PM#2 Losses: What is the Overall Yield	195
Case Study for Chapter 3:	
ABC PM#3 Speed-Up: Can We Justify the Variable and Fixed Costs?	198
Case Study, Chapter 4:	
How Much Would You Pay to Decrease Downtime?	200
Case Study for Chapter 5:	
Rising Retention Aid Costs	203
Case Study for Chapter 6:	
ABC PM#1: Can We Justify Online Control of Chemicals?	204
Case Study for Chapter 7:	
ABC PM#1: Should We Attempt to Reduce Fiber Costs?	206
 GLOSSARY OF TERMS	 209
 SUBJECT INDEX	 223
 ADDITIONAL TAPPI RESOURCES	 235