This book is intended to serve as an introduction and reference to today's technology on secondary fiber recycling for those with either formal engineering training or direct operating experience. Topics include: the U.S. solid waste dilemma; recycled-versus virgin-fiber characteristics; print quality of recycled-fiber papers; the impact of secondary fiber on the paper machine; fiber reactivity versus chemical use; characterization of wastes and emissions from mills; nonpaper uses for recovered paper; sourcing and grading; recovered paper contaminants; and secondary-fiber processing including storage, inspection, screening, cleaning, deinking, and bleaching. Contains over 300 figures and tables; bibliographical references.

Table of Contents

Chapter 1 Recovered Paper and the U.S. Solid Waste Dilemma, by Rodney Young
  Introduction and Overview
  Paper Industry Response to the Solid Waste Issue
    U. S. Recovered Paper Consumption
    U. S. Trade in Recovered Paper
    U. S. Recovered Paper Recovery
    Recovered Paper Supply and Cost
  Bibliography
  Resources

Chapter 2 Recycled - Versus Virgin-Fiber Characteristics: a Comparison, by R. L. Ellis and K. M. Sedlachek
  Introduction
  Literature Review
    General Effect of Recycling
    Effect of Furnish
    Effect of Initial Beating of Virgin Pulp
    Theory for Tensile Strength of Paper
      First Assumption
      Second Assumption
    Theory Verification
  Interactions Between Fiber Properties and Process Variables
  Reformulation of the Page Equation
    Approach
    Results and Discussion
      Fiber Strength
      Coarseness/Perimeter
      Freeness Change of Recycled Fibers
  Conclusions
Chapter 3 Print Quality of Recycled-Fiber Papers: a Review, by Joseph S. Aspler

Introduction

Changes in Fiber Properties and Their Influence on Sheet Structure
Changes in Printing Properties
  - Newsprint and Mechanical Grades
  - Coated and Wood-Free Grades
  - Fines and Ink Holdout

Optical Properties
Linting and Picking
Water Absorbency of Recycled-Fiber Paper
Dimensional Stability
Web Breaks
Summary and Conclusions
Acknowledgements

Bibliography

Literature Cited

Chapter 4 the Impact of Secondary Fiber on the Paper Machine, by William E. Smith and Linda Brooks Bunker

Introduction

Machine Runnability
  - Buildup of Suspended Solids
  - Suspended Particulate Materials
  - Microbiological Deposits
  - Buildup of Dissolved Solids
  - Fiber Fragments and Suspended Wood Tissue

Sheet Properties
  - Residual Contamination
  - Effects of Dried Fibers and Higher Fines Content

Bibliography

Resources

Chapter 5 Fiber Reactivity Versus Chemical Use, by J. M. Gess

Introduction

Background

Discussion
  - The Handling of Noncellulosic Particulate Materials from Waste
  - Potential Problems Relating to Those Chemicals Coming with Waste Fibers
  - Carry-Over from the Preparation of Recycled Fibers
  - The Use of Strength Additives, Sizing Agents, and Retention Aids in Furnishes Containing Large Amounts of Recycled Fiber

Conclusions

Bibliography

Literature Cited

Chapter 6 Characterization of Wastes and Emissions from Mills Using Recovered Fiber, by Reid Miner, Arun Someshwar, Paul Wiegand, Robert Fisher, Herbert Berger, Dennis Borton, and Jay Unwin

Introduction

Wastewater Characteristics
  - Wastewater Loads
  - Wastewater Treatment Technologies
  - Specific Chemical Constituents of Wastewaters
  - PCBs in Wastewaters
  - Bioassay Responses

Air Emissions
  - Repulping and Deinking Operations
  - Bleaching Operations
  - Manufacture of Paper and Board
  - Volatilization in the Waste Treatment System
Burning of Recovered-Fiber Wastes and Fossil Fuels
Solid Wastes from Recovered-Fiber Paper Mills
The Origin of Solid Wastes
   Pulper
   Contaminant Removal Prior to Deinking
   Deinking
   Contaminant Removal after Deinking
Factors That Influence Solid-Waste Characteristics
Quantities of Solid Waste Produced
Sludge Dewatering
Physical Properties of Recovered-Fiber Sludge
   Ash Content
   Other Physical Properties
Chemical Properties of Recovered-Fiber Sludge
   Constituents of Sludge Extracts
   PCBs in Deinking Sludges
Sludge Disposal Alternatives
   Current Practices
   Research into Alternative Disposal Methods
Summary
Bibliography
Chapter 7 Nonpaper Uses for Recovered Paper, by Thomas Friberg
Scope and Opportunity
Description of Raw Materials
Products
   Loose Fiber
   Fuel
   Insulation
   Molded Pulp
   Animal Bedding
   Fillers
   Bonded Systems (Composites)
   Chemical Derivatives
Processes
   Collection
   Sorting
   Wet Processing
   Dry Processing
   Chemical Processing
Recyclability
Economic Considerations
Summary
Bibliography
Chapter 8 Sourcing and Grading of Secondary Fiber, by Daniel B. Mulligan
Introduction
Considerations
EPA Guidelines
Sourcing
Grading
Bibliography
Chapter 9 Recovered Paper Contaminants, by Barbara M. Balos and James V. Patterson
Introduction
Paper Additives Become Potential Contaminants
Relationships Between Products from Secondary Fiber and Their Original Paper Sources
Review of Major Contaminants, Resulting Problems, and Methods of Removal
   Fillers, Clays, Titanium Dioxide, Calcium Carbonate, and Talc
   Rosin, Alum, Natural Resins, and Wax Sizes
   Starches and Gums
   Dyes and Pigments
Chapter 10 Introduction to Secondary-Fiber Processing, by Richard J. Spangenberg

Chapter 11 Receiving, Inspection, and Storage of Secondary Fiber, by Bob Miller

Chapter 12 Pulping of Secondary Fiber, by F. Clint Cleveland

Chapter 13 Cleaning for Contaminant Removal in Recycled-Fiber Systems, by Kevin Merriman
Chapter 14 Screening, by Terry Bliss

Introduction
- Debris in Secondary Fiber
- Debris Size, Shape, and Orientation

Pressure Screen Principles
Mechanism of Debris Removal in Pressure Screens
- Positive Size Separation
- Debris Orientation
- Other Debris Removal Mechanisms

Pressure-Screen Cylinders
- Holes
- Slots
- Turbulence-Generating Screen Cylinder Designs

Measuring Screen Performance
- Debris Rejection
- Rejection of Long Fibers
- Determining Debris Content

Pressure Screen Applications in Secondary-Fiber Systems
- Controlling Pressure Screens
- Secondary Pulpers
- Rejects Screens
- Vibrating Screens
- Batch Reject Screens
- Modern Continuous Reject Screens

Screening-System Design Considerations
- Avoid the Disintegration of Debris
- Series Screening
- Match Tailing Efficiency to the Efficiency of the Main Stream
- Practice Good Housekeeping and Maintenance
- Strive for Stable Operation

Summary

Bibliography

Chapter 15 Flotation Deinking, by Michael a. McCool

Introduction
Flotation Deinking Market
Flotation Theory
Flotation Chemistry
- Deinking Chemicals
  - Soaps
  - Synthetic Collectors
Flotation Cells
- History of Flotation Deinking Cells
- Modern Flotation Deinking Cells
Beloit PDM Flotation Cell
Bird-Escher Wyss CF/CFS/CFC Cells
Black Clawson IHI/BC Flotation Cell
Lamort Da Verticel
Kamyr GSC Flotation Device
Voith Multi-Injector Elliptical Cells
Other Flotation Cells

Flotation Deinking Systems
Flotation Only Systems
Combination Systems
Single-Loop Combination Systems
Two-Loop Combination System
   Acid Loop Systems
   Post Flotation Loop
   Washing Loop
   Soaking Stage
Three-Loop Combination System

Measurement of Flotation Efficiency
   Brightness
   Ink Removal
   Stickies Removal
   Rejects Rate
   Deinking Efficiencies
Quality of Deinked Pulp
Conclusions

Chapter 16 Washing, by R. G. Horacek Updated by William Forester

Introduction
   Washing
      Froth Flotation
      Other Mechanical Devices
Thickening vs. Dilution Washing
Theory of Countercurrent Dilution Washing
Hot-Loop System Design
Effect of Particle Size and Ink Dispersion
Operating Characteristics of Washers
Low-Consistency Washers
   Sidehill Screens
   Gravity Deckers
   DSM Screens
   Hydrasieves
Intermediate-Consistency Washers
   Inclined Screw Extractor
   Vacuum Filter
   Vario Split
   Double-Nip Thickener
High-Consistency Thickeners
   Screw Press
Economic Comparison of Washing Devices
Comparison of Washing and Froth Flotation

Chapter 17 Conditioning of Secondary Fibers, by Bill Carty

Introduction
Differences Between Secondary and Virgin Fibers
General Aspects of Refining
   Purpose of Refining
   Refining Mills
Wood Fiber Structure
The Refining Process
Refining Action
Refining Intensity and Refining Power
Refining Consistency
Other Considerations
Double-Disk Refiner
Stock Flow
Refiner Plates
Secondary-Fiber Refining
OCC for Board Grades
Other Considerations for OCC
Fractionation and Refining
High-Consistency Refining
Deinked Ledger Grades for White Paper
Deinked Newsprint for Newsprint
Refiner Piping Arrangement
Typical Refiner Installation
Series Arrangement
Parallel Arrangement
Deflaking
Conclusion
Bibliography
Chapter 18 Dispersion of Contaminants in Recovered Paper Stock, by A. C. Alexander, Rolf Kurtz, and Donald H. McBride
Introduction
The Process of Dispersion
Development of Dispersion Systems
Dispersing Factors
Heat-Softening of Contaminants
Contaminant Size Reduction and Mixing
The Blow Valve
Disk Refiner
Kneading Machines
The Dispersion System
Thickening Stage
Heating Zone
Dispersion
Kneading-Type Dispersers
The Future of Dispersion Systems
Case Studies
The Effects of Dispersion on Flotation for Ledger Furnishes
Cold Dispersion Increases Deinking Efficiency at Japanese Tissue Mills
Further Japanese Mill Experience
Deinking of ONP for Newsprint Production
Placement of Kneading Equipment
Bibliography
Chapter 19 Fractionation of Fibrous Stocks: Fundamentals, Process Development, Practical Application, by W. Musselmann
Introduction
Fractionation - an Effective Approach Toward Limiting the Variant Physical Properties of Raw Materials and Controlling Their Quality
Theoretical Considerations of Fractionation Technology
Example 1 - Fractionation and Joint Processing
Example 2 - Fractionation and Separate Processing
Theoretical Considerations and Laboratory Tests for Limiting Recovered Paper Physical Properties
Demands on a Fractionation System
Variables Influencing the Fractionation Effect
Terminology
Rejects Conveying
Wires
Rejects Dewatering
  Inclined Screw Thickeners
  Reciprocating Piston Presses
Dewatering Gritty Rejects
  Sediment Separators
Configuration of Rejects-Handling Equipment in a Deinking Facility

Sludge Pressing
Dewatering Parameters
Sludge Composition
Equipment Review
  Plate and Frame Press
  Centrifuge
  Vacuum Filter
  V-Belt Press
  Belt Filter Press
  Screw Press
Sludge-Thickening Process Flow
What Lies in the Future for Sludge Dewatering?
Disposal Alternatives and Equipment Selection

Conclusion
Bibliography

Chapter 23 Flowsheet Considerations, by Timothy K. Estes and Richard . Spangenberg

Introduction
Process Parameters That Influence the Design of Flowsheets
Examples of Flowsheets
  Very Simple System
  Crude Cleaning
  OCC System
  Systems for Deinking Newsprint and Magazine Papers
  Deinking of Printing and Writing Grades

Conclusions