

Technology Brief

SMALL-SCALE PAPER FIBER RECOVERY

The lack of affordable, efficient, small-scale technologies for recovery of high-value, low-volume fiber, such as from poly-coated bleached paperboard, poses a significant technological barrier to their recycling. This technology brief details the evaluation of a small-scale system for fiber recovery from milk carton/drink boxes (MCDBs). Pulp characteristics, effluent characteristics, and operating costs were monitored during the system's trial.

Background

Typically, only large-scale paper producers/recyclers are able to sustain the high capital expenditures and low return on investment that are characteristic of most fiber recovery operations.

Pellerin Milnor Corporation, a leading manufacturer of commercial laundry equipment, has developed a modular fiber recovery system that is a variation of an established product line known as the continuous batch Tunnel Washer system. Due to the unique material transfer methods of the Tunnel Washer system, several process functions are combined in a single piece of equipment.

The new technology also allows reasonable return on investment for value-added processing of MCDBs on a scale significantly smaller than conventional paper mill technology allows (e.g., on the order of 3 bone-dry-tons/day versus 300 bone-dry-tons/day). The modular system is characterized by both low capital cost and low operating expenses, thus making small-scale fiber recovery operations feasible.

Prototype Testing and Evaluation

The prototype system consisted of one seven-module continuous batch Tunnel Washer system. Monitored functions included loading, pulping, separating, reject handling, screening, washing/thickening, clarification of liquid streams, and overall system fluid flow. Post-consumer MCDB material from the Louisiana area was the

Key Words

Materials: Paper:
Poly-Coated Bleached Paperboard
Milk Cartons/Drink Boxes (MCDBs)

Technologies: Pulping, Separating, Fiber Recovery.

Applications: Medium grade tissue/toweling; fine printing & writing paper.

Market Goals: Develop niche markets for high-value, low-volume market pulp.

Abstract: Evaluation of prototype system for fiber recovery from milk cartons and drink boxes.

feedstock for this trial.

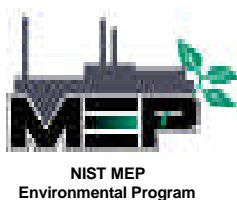
Pulp Quality

Table 1 provides test results for selected pulp characteristics, along with a comparison to typical deink pulp specifications.

	Trial System Pulp Product	MCDB Historical Data	Med. Grade Tissue	Printing/Writing Grade Paper
Optical Properties:				
Brightness (TAPPI)	84.6	65 - 80	75	80 - 84
Dirt Count (PPM)	262 *	5 - 1600	<30	<10
Debris (%)	0.1 *		<0.15	<0.1
Performance/Strength Properties:				
Freeness (CSF, ml.)	673	570-650	500	500
Burst Index (kN/g)	0.87	0.6 - 2.2	--	1.42 - 2.51
Tear Index (mN*m2/g)	6.29	4 - 10	--	7.23 - 10.06
Tensile (kN/m)	1.31	0.6 - 2.5	--	1.76 - 3.02
Elongation(%)	1.88	--	--	2.39 - 4.38
Tensile Index (Nm/g)	20.0	--	--	31.8 - 46
TEA (J/m2)	20.6	--	--	33.5 - 88
Breaking Length(km)	2.04	1.1 - 3.5	--	3.24 - 4.69

Effluents

* Further development work has resulted in significant improvements in optical properties, specifically a dirt count of 10 PPM and debris level of 0.03%.



Effluent streams before and after clarification were evaluated for the following characteristics: Biological Oxygen Demand, Silica, Total Suspended Solids, Total Dissolved Solids, Chlorine, Total Metals Analysis, and pH. Effluent characteristics of the MCDB system were comparable to those for a typical mixed office waste (MOW) deink system. The total metal content values from both the system effluent and the system sludge were within acceptable limits.

Operating Costs

Baseline data includes stream flow rates, operating temperatures and times, and chemical dosages. In Table 2, operating costs are extrapolated to compare a Tunnel Washer system processing MCDBs with a state-of-the-art deink system processing MOW.

	MCDB System 24 Modules (13.5 TPD)	MOW 1 line (270 TPD)
Labor ⁽¹⁾	73.42	14.06
Chemicals ⁽²⁾	25.76	42.84
Energy ⁽³⁾	1.21	27.56
Other ⁽⁴⁾	14.25	16.53
Total	114.64	100.99

- (1) Assumes labor rates held constant for both facilities.
 (2) Assumes cost/unit is the same at both facilities.
 (3) Energy cost/unit assumes steam/energy available from an industrial site.
 (4) Other includes BOD, TSS, effluent flow, residual solids disposal, & fresh water usage; assumes industrial site.

References to operating costs include only variable cost and labor. Semi-variable costs (operating and maintenance supplies) and fixed costs (depreciation, taxes, salaried labor) are not included. The MCDB system is penalized for labor due to lower production capacity; however, the system is more cost effective than a state-of-the-art deink system for chemicals and energy. Effluent treatment and residual disposal are comparable between the two systems.

The test system yield was 63.8% BDT to BDT (bone dry ton of feed stock to bone dry ton of pulp product) for post-consumer MCDB. For variable costs to be comparable to a state of the art, optimum sized, market deink pulp mill, the yield on milk carton would need to be approximately 73% BDT to BDT.

Future Development

Further development work has resulted in significant optical property improvements: a dirt count of 10 PPM and debris level of 0.03%.

Additional testing must be performed to demonstrate improved strength properties. *(Strength properties, with the exception of freeness, did not meet typical deink pulp specifications for fine printing/writing grade paper, but did fall within typical historical parameters for post-consumer MCDB pulp.)*

Work is currently underway to process other waste paper feedstocks, in addition to MCDBs.

Equipment Availability

Pellerin Milnor Corporation has created a new recycling systems company, Regenex L.L.C, dedicated to the design, development, manufacture and marketing of this fiber recovery technology. Modular fiber recovery systems can be sized to produce from 3 to 250 tons per day. For more information on current product offerings, contact: Dan Mulligan, Regenex L.L.C; P.O. Box 400, Kenner, LA 504-467-9591 or 206-869-8648.

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For More Information

On This Subject: To order a copy of the full report, *Small Scale Paper Fiber Recovery*, call the Center's subscription line at (206) 587-5520. For more information on this subject call the CWC at (206) 464-7040.

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