PTS THE PAPER TECHNOLOGY SPECIALISTS

REPULPING OF PAPER-BASED COMPOSITE MATERIALS ON A PILOT SCALE FOR THE EVALUATION OF THE DEGREE OF RAW MATERIAL SEPARATION AND RECOVERY

Method Description

PTS/CCF-R/TR08/09

Contents

1 GOAL

Background	Film-laminated and polymer extruded products based on paper or board products, also know as paper-based composite materials, such as liquid packaging board, ream-wrap paper, extrusion coated photographic paper, etc. can, due to the product constructions and paper composition (e.g. wet-strength additives) lead to difficulties during the repulping in standard recovered paper pulping systems if these systems are not technically optimized for these paper-based composite materials.
Goal	This method describes a pilot-scale process for the repulping of paper-base composite materials in order to evaluate the degree of separation and recovery of the raw materials in these products. The goal of this method is to evaluate the repulpability of the composite materials in order to: Recover fiber and filler materials from the paper portion of the composites for use in the production of recycled papers Cleanly separate the film-like, non-paper portion of the composites for use as a raw material, for further cleaning and recycling, or as a fuel for energy production This pilot method is designed to closely simulate the conditions in and the results from a large portion of the industrial recovered paper pulpers.
Repulping, Separation and Recovery Criteria	Criteria for the repulping, separation and recovery are: • Degree of separation of the paper base from the film-like, non-paper portion of the composites (mainly metal foils and/or polymer films) • Degree of damage or break-down of the film-like materials. Larger film sizes are generally preferable to allow effective removal in typical industrial screening after the repulping step. • Degree of break-down of the paper base material. A full breakdown of the paper base to individual fibers and fillers is desired in order to achieve the maximum recovery of this material.

2 METHOD

2.1 Pilot scale method based on the industrial repulping of liquid food packaging board

Starting Material	100 % Paper-based composite material
Repulping and Recovery System	Industrial simulation on a pilot scale: • Repulping in a pilot-scale pulper • Coarse screening • Fine screening on a vibrating screen

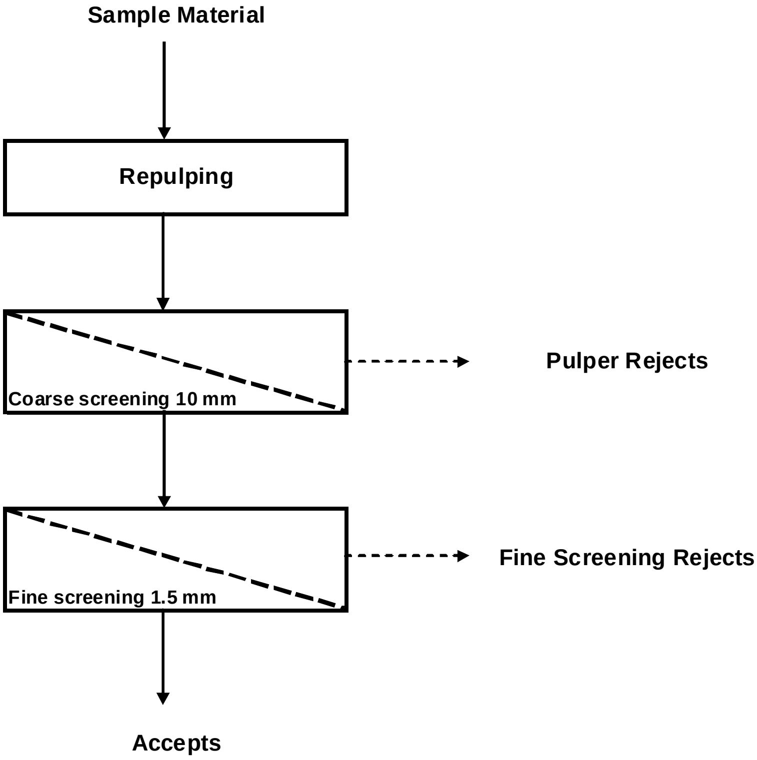


Figure 1 – Flow diagram for PTS pilot plant repulping and screening

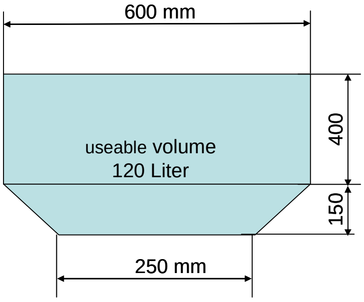
The sample material is repulped in a hydropulper at a stock consistency of 10%. In the standard repulping procedure, a pulping time of 20 minutes is used. In cases where a specific energy input is desired, the pulping time can be adjusted to achieve the target specific energy input. The resulting stock mixture is then coarse screened through the hole plate (10 mm) at the base of the pulper. In this screening step, any large material such as large film-like material is rejected. The rejects are named pulper rejects.

The stock accepts from the pulper are then diluted to a consistency of 0.5% and fine screened through a 1.5 mm vibrating screen at atmospheric pressure. This screening step removes smaller film-like materials as well as fiber bundles. The rejects from this step are named fine screening rejects.

General Repulping and Screening Conditions

Repulping	Unit	
Rotor		MC-Rotor
Hole plate hole size	mm	10
Rotor Speed / Sample Addition	rpm	800
Rotor Speed / Pulping	rpm	1300
Water Addition	dm^3	87
Target Stock Consistency	g/dm^3	100
Water Temperature	°C	45
Sample Addition Time	min	5
Pulping Time	min	20
Washing Water for Pulper Rejects	dm^3	174

Fine Screening	Unit	
Target Stock Consistency	g/dm^3	5
Volumetric Flow Rate	dm^3/min	40
Screen Hole Size	mm	1.5



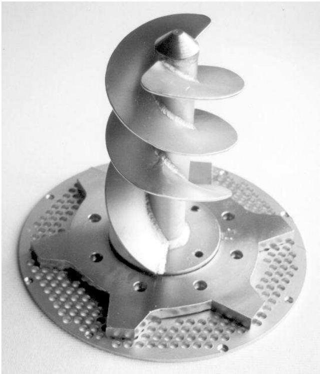


Figure 2 – *Left* - Pulper in the PTS pilot plant; *Right* - MC-rotor and hole plate in the bottom of the pulper (10 mm hole size).

Analyses

In order to determine the fiber recovery yield and to evaluate the quality of the accepts, the following analyses are performed:

- Evaluation of the film (non-paper) weight percent in the sample
- Ease of separation of the film portion from the paper portion of the sample

For the accepts, the following analyses are performed:

Stock Property	Standard
Water retention	DIN ISO 5267-1
COD	ISO 15705 ST-CSB
Average Fibre Length (L(l)c	Metso Fibre-Lab
Ash at 900 ℃	DIN 54370
Ash at 525 ℃	DIN 54370
Fibre bundle determination	ZM V/18/62

OPTIONAL TESTS

- Hand sheets of the accepts can be produced and the properties of the accepts can be determined

Paper Properties	Standard
Lab Hand Sheet Production	DIN 54 358-1
Tearing Resistance (ELMENDORF)	DIN EN 21 974
Tensile Strength	DIN EN ISO 1924
Modulus of Elongation	DIN EN ISO 1924
Burst Resistance	DIN 53 141 - 1
Short-Span Compression Test(SCT)	DIN 54 518
Concora Medium Test (CMT)	DIN EN ISO 7263
Internal Bonding Strength (Scott Bond)	TAPPI 833 pm 94

2.2 Mass Balance Calculations

Equations for Calculations

Stock Consistency **SD** [g/dm³]

$$SD = \frac{M(ovendry)}{V} * 1000$$

M = Sample weight (oven dry) [kg]

V = Water volume [dm³]

Pulper Accepts **A_Z** [kg]

$$A_Z = M - R_P$$

R_P = Pulper reject weight (oven dry) [kg]

Fine Screening Accepts **A_N** [kg]

$$A_N = A_Z - R_S$$

R_S = Fine screening rejects (oven dry) [kg]

Total Repulping Yield **FSA [%]**

$$FSA = \frac{A_N}{M} * 100$$

Maximal theoretical fibre and filler yield:

FSA_{max} = Fibre and Filler (Base paper) percentage – Film Material percentage

Paper Portion Yield **PA [%]**

$$PA = \frac{A_N}{FSA_{max}} * 100$$