

Alternative approach to the filler recovery from recycled paper waste stream

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Summary:

- Recycled paper contains contaminants such as calcium carbonate, kaolin, inorganic coloured pigments and organic components^[1] that are removed through the deinking process. The waste stream formed is called "Deinking Sludge".
- At the moment, this waste is incinerated at 850-900°C to produce ashes that are used as cement replacement^[2]. The scope of our study is to propose an alternative, recovering the inorganic material for its application as filler for newspapers and/or magazines.

Experimental part:

- "Deinking sludge" was incinerated at 575°C to preserve the calcium carbonate structure^[3] for the application as filler for papermaking;
- The ashes were treated using dithionite^[4] to solubilise coloured metal compounds (i.e. iron, copper...) to increase the brightness;
- The bleached ashes were deagglomerated (Dv50: 11.6 µm) and blended with a recycled paper pulp (5% fibre concentration in water and addition of 10% of ashes on dry pulp). Paper sheets were made to evaluate the physical properties.

Calcium carbonate structure preservation (FTIR analysis)

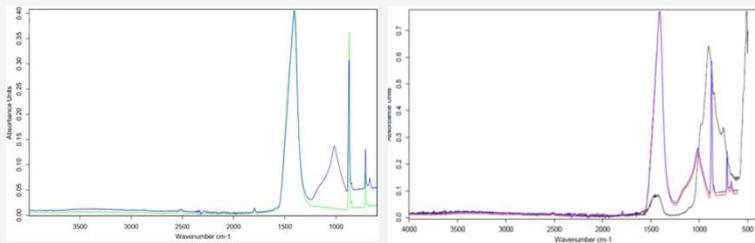


Figure 1: Blue: 575°C ashes
Green: Calcium carbonate

Figure 2: Blue: 575°C ashes Red: bleached 575°C ashes, Black: 850°C ashes

The structure of carbonate was not influenced by incineration at 575°C (typical carbonate, CO₃²⁻, peaks at 1414-1411 cm⁻¹ and 874-873 cm⁻¹). (Figure 1)

The bleaching does not modify the structure of calcium carbonate and kaolin. Instead, the incineration at 850 °C change the structure of the inorganic material by calcium oxide formation and kaolin/chalk decomposition. (Figure 2)

Brightness of ashes

Table 1: Brightness of paper sludge ashes

Sample nr.	Type of sample	ISO (%)	Yield (%)
1	Paper sludge ashes 575 °C	58	-
2	Paper sludge ashes 850 °C	77	98
3	Paper sludge ashes 575 °C + dithionite	73	71

- Sample nr.2 reaches higher ISO value than Sample nr.3 but with lower yield.
- The incineration at 575°C permits to remove the organic components. **Dithionite permits to solubilize and remove colour sources by filtration** i.e. iron and copper compounds.

Blending

Table 2 Mechanical and physical data from paper sheets

Sample	Brightness (% ISO)	Opacity (% ISO)	Porosity (ml/min)	Breaking Length (m)	Ashes (%)
Reference pulp	53	90.3	1001	3429	13.0
Blended pulp	55	93.6	1476	3253	20.5

- Brightness and opacity are improved but the breaking length and porosity are decreased.
- The effective ashes added in the Blended pulp are 7.5 % instead than 10.3 %.
- The differences are caused by the ashes particle sizes and the consistency of the pulp.

Conclusion

The application of this method could be an alternative for the inorganic material recovery and its use as filler. Further studies in terms of process optimization, especially about the particle size, will be done because the commercial filler agents have a particle size that does not exceed 10 µm. Moreover, an economic analysis will be necessary to evaluate a scaling-up.

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