Office Waste Deinking

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INTRODUCTION

Due to office paper high consumption in industrialized countries waste paper potentially abonds for the production of high quality recycled papers and waste collection could be easily carried out. There also is a demand for high grade deinked pulp for top quality papers.

The conditions are all set for recycling this type of furnish, then.

The raw materials must be analyzed before designing deinking lines for high grade deinked pulps.

OFFICE WASTE AS RAW MATERIALS

The term "office waste" covers all sorts of waste paper mixed in proportions depending especially on where they come from, and the collecting and pre-sorting methods.

Relying on our experience in the paper field, on our partners', AIKAWA - Japan and FIBERPREP - USA, and on the various trials carried out in our Research and Development Center, we were able to classify these raw materials.

Table-1

Office Waste from "corbeilles de bureaux" as Raw materials - composition in %

Origin	U.S.A.	EUROPE	
		Standard quality	Low grade
White ledger with laser printing	65-75%	60-70%	40-50%
Dyed ledger	8-9%	13-15%	15-25%
Strongly coated paper	2-3%	2-3%	5-8%
Mechanical pulp papers (magazines)	8-11%	8-10%	13-15%
Unbleached papers, boards, envelopes	0.5-3%	0.5-3%	2-4%
NCR facsimile papers, self-adhesive papers, labels	2-5%	2-5%	5-15%
Plastic contaminants, wet-strength, metal particles	2%	2%	2-4%

To estimate their potential, we first determined the quality of the raw pulp obtained after repulping in a medium consistency pulper. Table 2 shows:

- brightness values
- ash contents at 460°C and
- black specks over 50 µm, such as measured by the image analyzer.

It also describes the qualities required for high grade deinked pulp.

Table-2

Qualities of raw materials and of top grade pulps to be made

Origin		U.S.A.	EUROPE	
			Standard quality	Low grade
Raw materials:				
Brightness at 457 nm after pulping	(°)	68-72	66-72	64-68
Ash content at 460°C	(%)	12-18	12-22	15-30
Black specks expressed in :	mm^2/m^2 [*]	1000-3000	1000-3000	800-2500
Quality targets:				
Brightness	(0)	80-85	78-85	76-82
Ash content for LWC	(%)	= 5	= 5	= 5
Ash content for high grade tissue	(%)	= 1	= 1	= 1
Ash content of printing and writing	(%)	5-10	5-10	5-10
Black specks in:	mm^2/m^2 [*]	10-80	10-80	10-80

[*] This result is only relative as it depends on the type of image analyser.

One can see a certain disparity in the raw materials, to which should be added the obstacle of so-called "laser" printing ink detachment.

The irregular quality of the raw material calls for a safe design and therefore some key-units are duplicated.

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CONCEPTION OF THE DEINKING LINES

The technological challenges

To obtain high grade deinked pulps from office waste, the following technological challenges are to be met:

- Detach and nearly totally remove the black specks originating from laser printed waste mainly,
- Perfectly discolour the dyed ledger,
- Thoroughly screen and clean away stickies,
- Optimize bleaching to reach the expected brightness values,
- Partially or totally wash off the fillers, depending on the amount expected in the final pulp,
- Be able to process a certain percentage of facsimile and self adhesive papers.

We will deal with black speck detachment and removal here.

BLACK SPECK DETACHMENT AND REMOVAL

Detachment in the pulper

We have much investigated and optimized the phenomena and equipment having an influence on the detachment of the various types of inks.

A comparison between a high consistency pulper fitted with a helical rotor, a low consistency conventional pulper and drum-pulping on a magazines/ newspapers mix show that nothing compared to Lamort pulping system with helical rotor as regards detachment.

This chart shows high removal efficiency variations on black specks:

- 17 % with low consistency pulping,
- 32 % with drum pulping,
- 84 % with high consistency pulping.

We also proved that pulping time increased to 25-30 minutes raised the pulper specific energy and had a favorable influence on laser-printed ink detachment. Detachment indices can thus rise up to 70-90% depending on the waste paper grades.

Influence of temperature and chemicals added in the kneader over laser-printed ink detachment and brightness values:

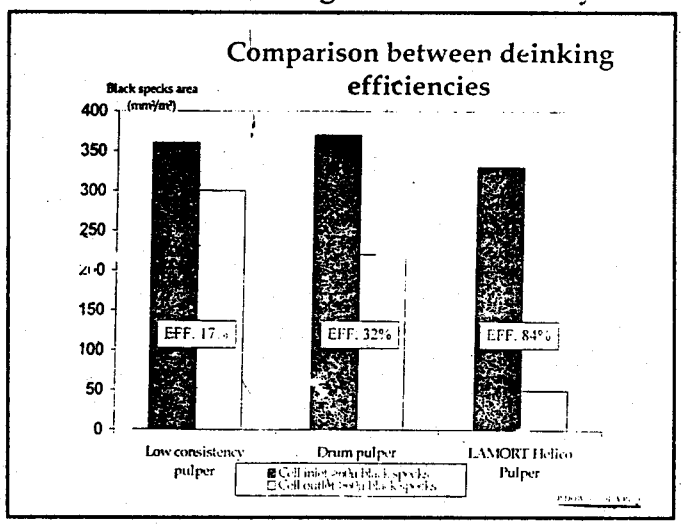
Impact-free printing are experiencing high developments and so does the so-called laser printing technique. Office waste count a lot of printing of this type.

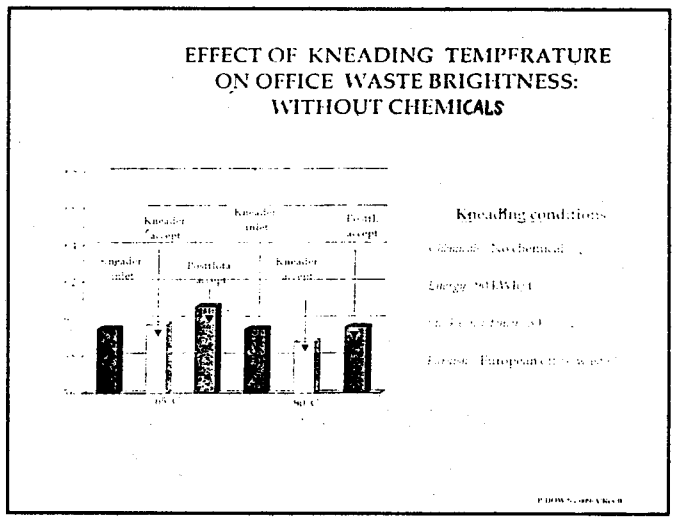
The inks used for these types of printings are very special and highly temperature-sensitive. They become sticky between 68 and 71 °C and their glass transition point is 76 °C.

It appeared inadequate to knead or disperse this type of waste paper at temperatures above 68 °C - 71 °C.

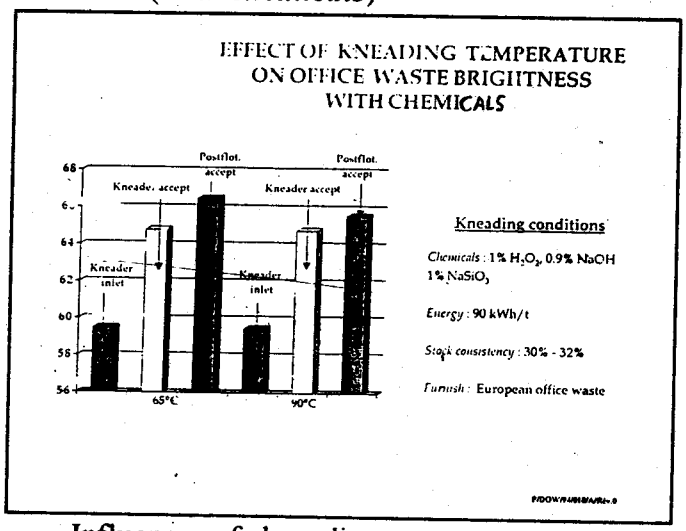
The purpose of our tests is then to analyze the influence of temperature and chemicals added in the kneader over detachment and brightness values (chart attached).

- Influence of kneading temperature on brightness (***without chemicals***).

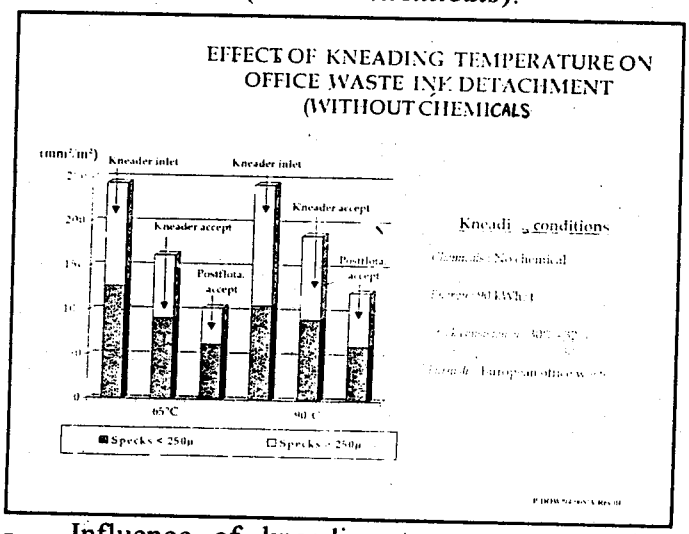




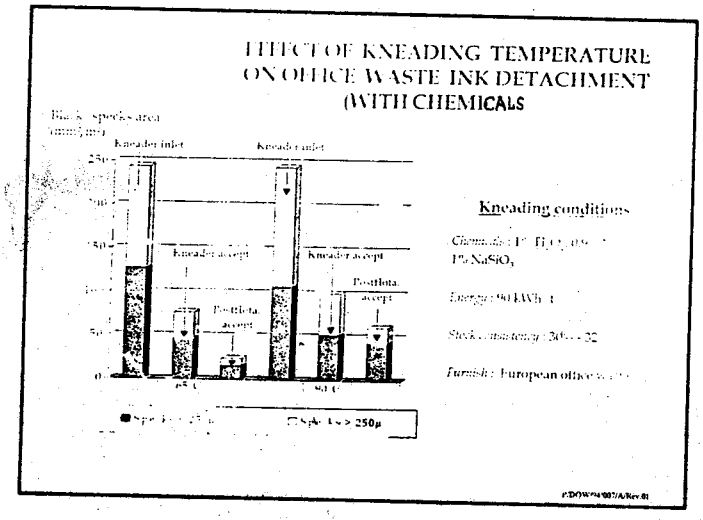
Influence of kneading temperature on brightness (***with chemicals***)



- Influence of kneading temperature on ink detachment (***without chemicals***).



- Influence of kneading temperature on ink detachment (***with chemicals***).

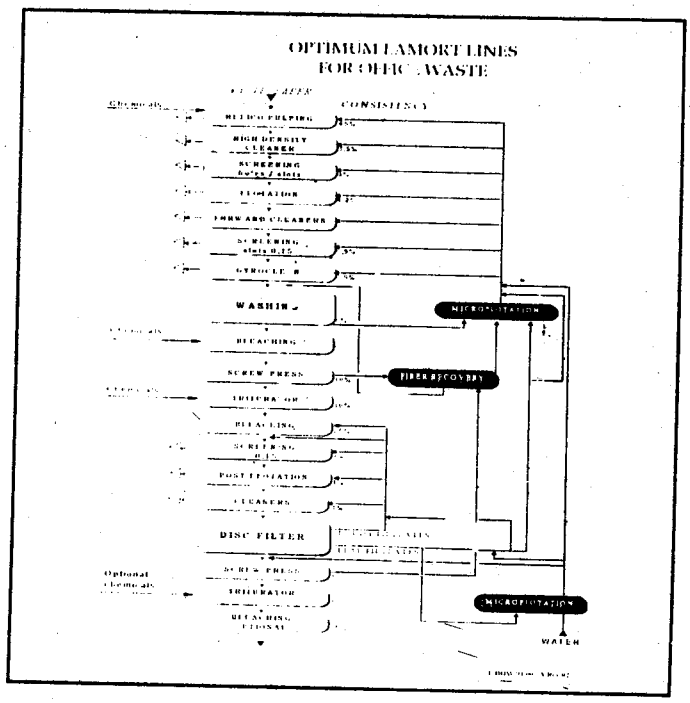


These research works show:

- that over 65°C detachment and brightness values are less good.
- peroxide added in the kneader improves detachment and final brightness.

LAMORT CONCEPT FOR OPTIMAL RESULTS (FS 2428B)

Due to the uneasy to detach laser type printings and the quality targets especially in terms of black specks, the optimal concept lies in a two-loop system.



Our optimal system will then include a first loop ending with a washer (or a low retention thickener), and a second loop ending with either a disk filter (or a high retention thickener) or a washer, depending on the filler removal percentage expected.

Our various surveys have shown that a washer in the first loop greatly improves the bleaching efficiency.

In the first loop optimized high-consistency pulping conditions together with adequate selective flotation (small air bubbles, volume, retention.....), allow a high removal of the black specks present in the stock.

A low-temperature slow operating kneader between the two loops allows additional detachment ideal for preparing the removal of the black specks remaining after the post-flotation and cleaners.

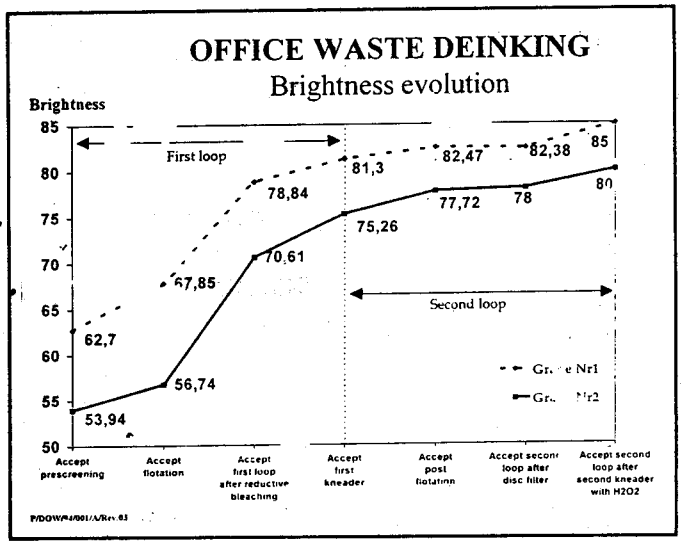
The three slot-screening stages, from 0.20 to 0.15 mm, associated to the Gyroclean and kneading allow high sticky removal. depending on the raw materials contamination one or two slot barriers may be enough.

Careful cleaning of recirculation waters is requisite to control the quality, and requires very closed loops.

RESULTS

Brightness

Some evidences are worth reminding. The final brightness will depend on the office waste used and of their initial brightness (chart attached).



High brightness variations are connected with the bleachings and primary flotation. Due to the high content of coloured-through paper in office waste, reducing bleaching is rather significant in terms of brightness gain.

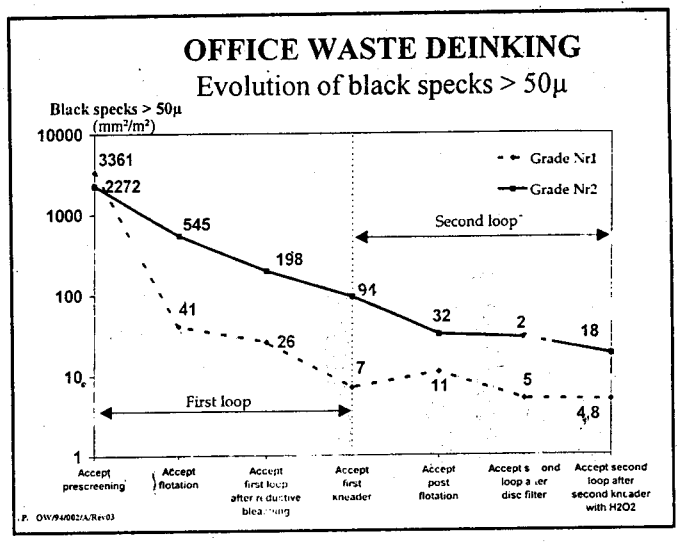
With low grade office waste 78-80 brightness can be achieved while 82-85 brightness can be achieved with high grade office waste.

Black Specks

Black speck reduction is connected with detaching phenomena and flotation cell and cleaner efficiencies.

With so-called high grade office waste black speck removal efficiency is significant at preflotation.

In this very case it also comes from the very good ink detachment achieved in the helico pulper.



With so-called low grade office Waste, the laser printings tested are harder to detach. The slow operated kneader is then necessary to achieve good after-postflotation results with the black specks.

CONCLUSION

An often requisite two-loop system

A second loop, with postflotation is often necessary to achieve the deinked stock quality targets, especially as regards residual black specks. This type of conception also is a safety against quality variations of the office waste as raw materials.

Optimisation of the 1st loop is the key to success

A maximum of Ink, black specks and stickies must be removed by the first loop. The second loop should be considered as a quality optimizing loop. So that adequate pulping at the start is a must in the line.

Adequate complementary detachment leads to 2nd loop high efficiency

Laser inks often stick to the fibrous support. They are sometimes uncompletely removed in the first loop as they remain catch in the fibers. A slow operated kneader at hot temperature and long retention time will be add to detachment.

This unit is all the more necessary as our research proves that low temperature kneading is requisite, which only slow operated kneaders can do efficiently.