

Publications by the Technical Committee Deinking Facts about paper recycling

(Translation from the German Final Draft)

Deinkability of printed matter

Recovered paper is the most important raw material for the paper industry.

Paper recycling conserves raw materials and contributes to climate protection. Political bodies in Germany and elsewhere in Europe are therefore demanding for more intense recycling efforts. As part of the „European Declaration on Paper Recycling“ [1], the major stakeholders in the paper value chain emphasize their commitment to increase the recycling rate to 66 percent by 2010. The recycling rate is the proportion of recovered paper fed to recycling as a percentage of the paper, carton and cardboard used.

The European Declaration specifies measures that aim to optimize handling of recovered paper throughout the entire value addition chain – from paper manufacture through its processing and printing to the collection, sorting and transport of the recovered paper, carton and cardboard. The signatories to the Declaration include the European Associations of the paper and printing industry, publishers of newspapers and magazines, as well as manufacturers of printing inks and adhesives.

More and more recycled paper is to be used for higher quality graphics papers. The classical recycling paths are now exhausted – carton, board and newspapers are now generally manufactured entirely from recycled paper.

More and more paper is now being collected, often at the expense of quality – also more papers unsuitable for being recycled to yield new graphic paper reach the paper mill. The mills therefore have to produce a higher quality product from a continuously deteriorating raw material – and that in competition with paper from virgin fibres.

Recovered paper therefore has to remain recyclable

New printing technology can present problems for recycling: The printing inks used in flexographic newspaper printing today are not generally suitable for deinking. This holds equally for digital printing with liquid toners and inkjet printing. Deinkable printing inks have not yet established themselves in UV printing either.

Problem: Flexographic printing

The presence of newspapers printed using flexographic processes, even in small quantities, amongst newspapers and magazines printed using offset and rotogravure processes can render them unusable for recycling. For years, all those affected have been researching ways of introducing improvements. The first printing inks with somewhat improved deinkability are presently being tested. Higher-quality recycling papers, however, cannot be produced. The paper industry, together with research institutions,

is therefore developing new automated sorting methods that recognize and remove flexographic newsprint.

The challenge: Digital printing

Digital printing processes are about to supplement offset printing in many areas and to open up new business opportunities, including higher-volume print runs.

Very different ink systems are used for digital printing and not all of them can be removed without difficulty in the paper mills.

Inkjet inks contain either soluble dyes or pigments that are very fine. The presence of either in just small quantities has an adverse effect on the outcome of deinking as the separation processes developed for offset inks and rotogravure inks do not work for them. This also applies for liquid toners that can severely contaminate the deinked material.

(Photo) Caption: Liquid toners can leave visible residues (dirt specks) in recycled paper.

Dry toners can generally be deinked without difficulty. Inkjet or liquid toner processes should therefore not be used for high print runs such as newspapers, magazines, direct mail or inserts.

Rarely recyclable: UV printing

UV-curing printing inks have only rarely satisfied the criteria for good recyclability to date. All of the inks investigated so far result in the presence of printing ink particles in the recovered paper that is too high. These particles cannot be removed to a satisfactory degree, if at all. This also applies for a further variant of UV-curing inks that are used in inkjet printers.

Papers printed with UV-curing inks can adversely affect the deinkability of individual recovered paper batches. Such products therefore have to be collected separately already at the production site and sent for disposal (printers' waste) or – in an ideal case with corresponding labelling – should be pre-treated by the recovered paper dealers (covers of magazine returns).

One possible solution is the development of new printing inks that can be removed under the conditions used for processing of recovered paper, i.e., the inks are removed from the fibres in the alkaline environment of paper treatment and can then be separated through flotation.

Water not better than oil: Printing ink

The deinkability of printing inks varies depending on the ink. Water-based inks present problems since they also dissolve in the recycling process. Cross-linked ink particles cannot be removed either mechanically (through a sieve) or through flotation because of their size, flexibility or surface characteristics.

At the same time, because the weight of the newspaper paper is falling and there is a tendency towards more 4-color pictures, the paper mills must remove increasing quantities of printing ink from fewer and fewer fibres.

The paper mills, together with manufacturers of printing inks, their associations and publishers, are continuously investigating the deinkability of current print products.

Efforts are also being made in co-operation with manufacturers of printing inks to replace inks that have a poor deinkability with inks that are better in terms of recycling.

(Diagram)

German	English
Deinkingschaum	Deinking foam
Luft	Air
Faser	Fibres
Druckfarbenteilchen	Printing ink particles

Caption: Upon deinking, small air bubbles transport the printing ink removed from the fibres to the surface.

(Diagram)

German	Englisch
Wasserbasierend	Water-based
öl-/lösungsmittelbasierend	Oil/solvent-based
Vernetzt	Cross-linked
Partikelgröße	Particle size
Konventioneller Flexo Industrieller Einsatz	Conventional flexo Industrial use
Verbesserte Flexo Experimenteller Einsatz	Improved flexo Experimental use
Offset (Mineralöl)	Offset (mineral oil)
Offset (Pflanzenöl)	Offset (vegetable oil)
Tiefdruck	Rotogravure
Trockentoner Kopierer, Laserdrucker	Dry toner Copier, laser printer
Flüssigtoner Erste Generation	Liquid toner First generation
Verhalten beim Flotationsdeinking	Behaviour upon flotation deinking

Evaluation of deinkability

Investigation of deinkability according to INGEDE Method 11 is now recognized as an international standard and has also been incorporated into criteria for eco-labels [2]. A deinkability scoring system has been developed based on this method and was approved by the European Recovered Paper Council in March 2008. The Council is the committee of signatories and supporters of the European Declaration on Paper Recycling.

Points for good performance enable comparison

Samples of graphic printed products are analyzed in the laboratory under standardized conditions. These tests deliver values for luminosity, colour change, dirt area, ink elimination and discoloration of white water.

Ranges have been defined for these points on the basis of random samples. Printed products must lie within these ranges to be considered recyclable.

Points are calculated from the test results. A single value is calculated in which the parameters are weighted according to their importance. This enables comparison of different categories of printed products. The maximum number of points that can be attained is 100.

Upper and lower threshold values or a value range have been laid down for this points system – depending on the parameters. The values measured must satisfy the relevant requirements. These

threshold values are independent of the category of the print product and are listed in Table 1. The print products must meet the threshold values for all parameters. If a product fails to meet one of the threshold values then it is to be regarded as “not suitable for deinking”.

Parameter	Y [points]	a* [-]	A [mm ² /m ²]	IE [%]	ΔY [points]
Lower threshold value	47	-3.0		40	
Upper threshold value		2.0	2.000		18

Table 1: Threshold values of deinkability scores

Evaluation criteria

The first three parameters are quality characteristics of the deinked pulp – brightness, colour and cleanliness (luminosity Y, colour shade a* and dirt area A). The other two are process parameters (ink elimination IE and discoloration of the filtrate ΔY). They are representative of the effect of the printed matter on the operation of the plant and are to be regarded as supporting parameters.

Target values apply for all print products and parameters (Table 2). The target values for the parameters colour (a*), dirt area (A) and filtrate discoloration (ΔY) are the same for each print product category. The target values for the luminosity of the deinked pulp (Y) and the ink elimination (IE) vary from one category to another.

Print product category	Y [points]	a* [-]	A [mm ² /m ²]	IE [%]	ΔY [points]
Newspapers	60	-2.0 to +1.0	≤ 600	70	≤ 6
Offset magazines and flyers, uncoated	65			70	
Offset magazines and flyers, coated	75			75	
Rotogravure magazines and catalogues, uncoated	70			80	
Rotogravure magazines and catalogues, coated	75			85	
Toner prints on woodfree paper	90			80	

Table 2: Target values

Maximum of 100 points

Points are awarded and added together for the 5 parameters. The parameters are weighted differently – the most important parameters (luminosity and dirt area) account for 60 of the maximum of 100 points. The sum enables simple overall evaluation of the deinkability of print products with a numerical value between 0 and 100 points (Table 3). If a threshold value is not reached then the overall score is 0.

Points	Evaluation of deinkability
71 – 100	Good deinkability
51 – 70	Fair deinkability
0 – 50	Poor deinkability
Negative (failed to meet at least 1 threshold value)	Not suitable for deinking (may be recyclable without deinking)

Table 3: Deinkability evaluation

What can you do?

- For production processes with higher print runs do not invest in inkjet technology or liquid toner processes if deinkability has not been established.
- UV-print products should not be included in products for deinking in larger quantities. For example, overprint should be collected separately from other paper and disposed of appropriately. Inks that have better deinking characteristics should be preferred if available.

Further information: Guidelines

The international associations CEPE, CEPI, FAEP, FEICA, INGEDE and INTERGRAF issued the “Guide to an Optimum Recyclability of Printed Graphic Paper” in 2002 [3]. These associations have declared their willingness to continue their activities to improve the recyclability of printed paper products.

Sources

[1, 2, 3]: Further information on the European Declaration, the guidelines and deinkability scores system, as well as a link to the EU Eco-label (European environment symbol), is provided at www.ingede.org.

This translation is for information purposes only. It has not been approved by the signatories of the original German document.