

# Beyond their use – the after-life of paper products

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International Association of the Deinking Industry  
(INGEDE)

**Specialty Paper and Packaging online 2020**

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# INGEDE

INGEDE is the organisation of deinking mills.

INGEDE was founded 1989  
by 12 companies.

Today, most companies in Europe  
with deinking plants are  
members of INGEDE.

In addition, INGEDE has 9 partners –  
companies in the  
paper recycling value chain



# It's all about recycling

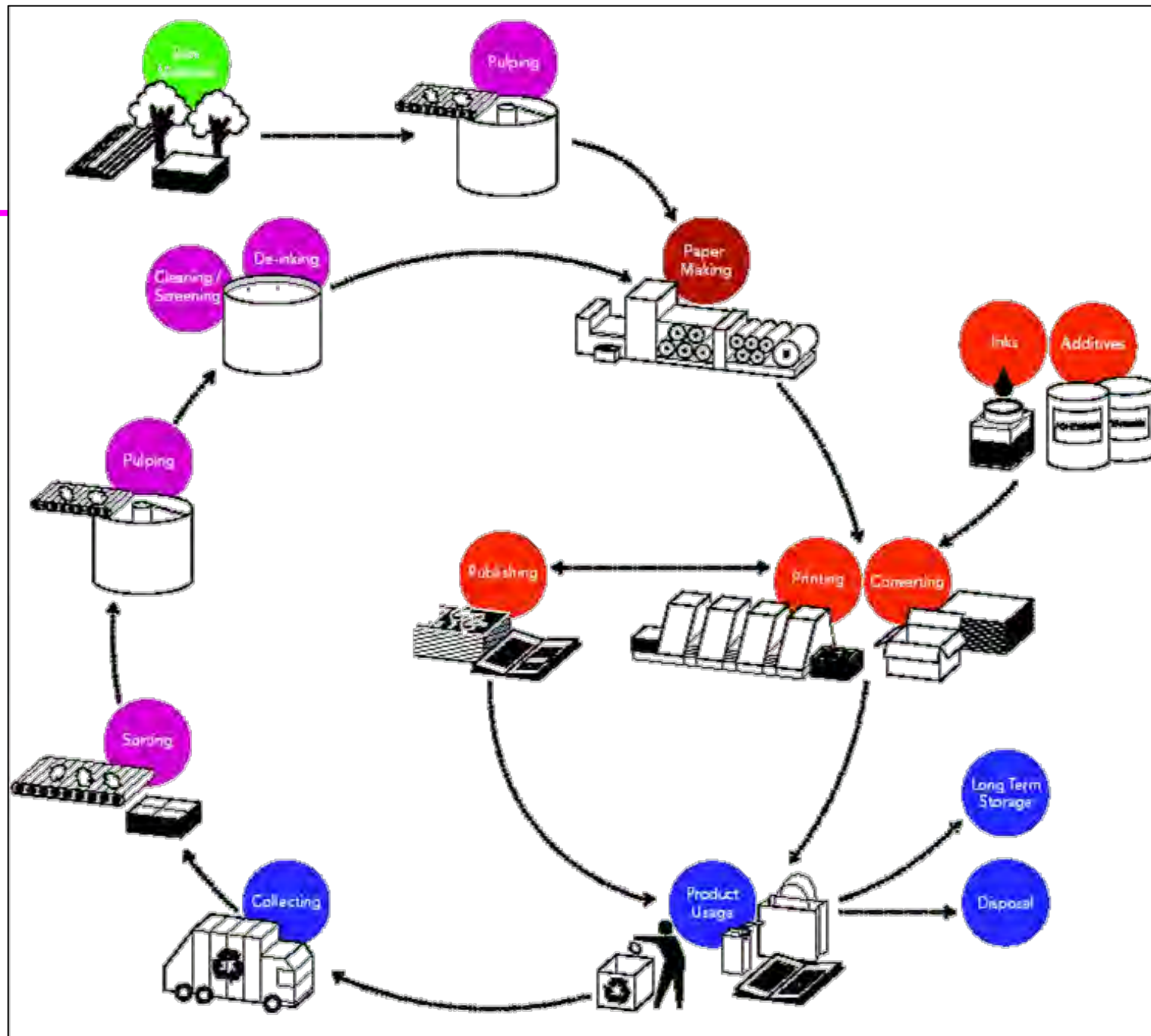
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Paper belongs to the best recycled materials!

**You**

are needed to keep paper recycling successful!

# The paper loop



Recyclability  
Paper for Recycling  
Deinking Process

Source: CEPI

# Some data

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**72%** paper recycling rate in 2019 in Europe

About **80%** is the theoretical maximum

Reasons:

- Long-term storage (books, archives)
- Use as building material (wallpaper, furniture)
- Hygiene papers
- Not recyclable products

# Main papers, boards and products made entirely or partly of paper for recycling

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Recyclability

Paper for Recycling

Drinking Process

## Graphic papers

- Newspapers, magazines, brochures, office papers

## Packaging papers and boards

- Corrugated boxes, folding boxes – grey, brown and white
- Other packaging papers

## Hygiene papers

- Hand towels, kitchen wipes, toilet paper

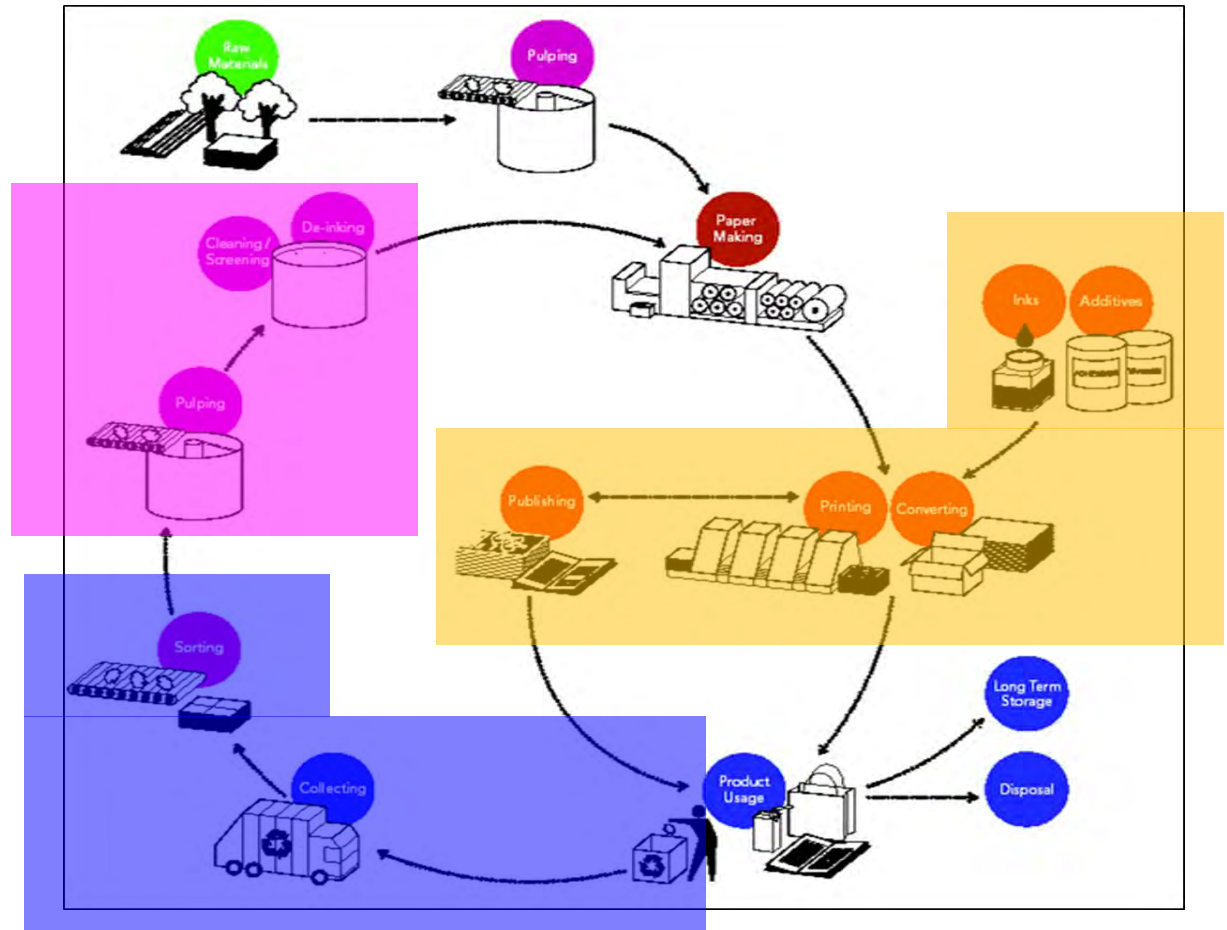
**General objective** of the paper industry:

**Keep the quality level as high as possible!**

# Recycling and Recyclability

The influences come from:

- **Product design**
- **Collection concept**
- **Treatment process**

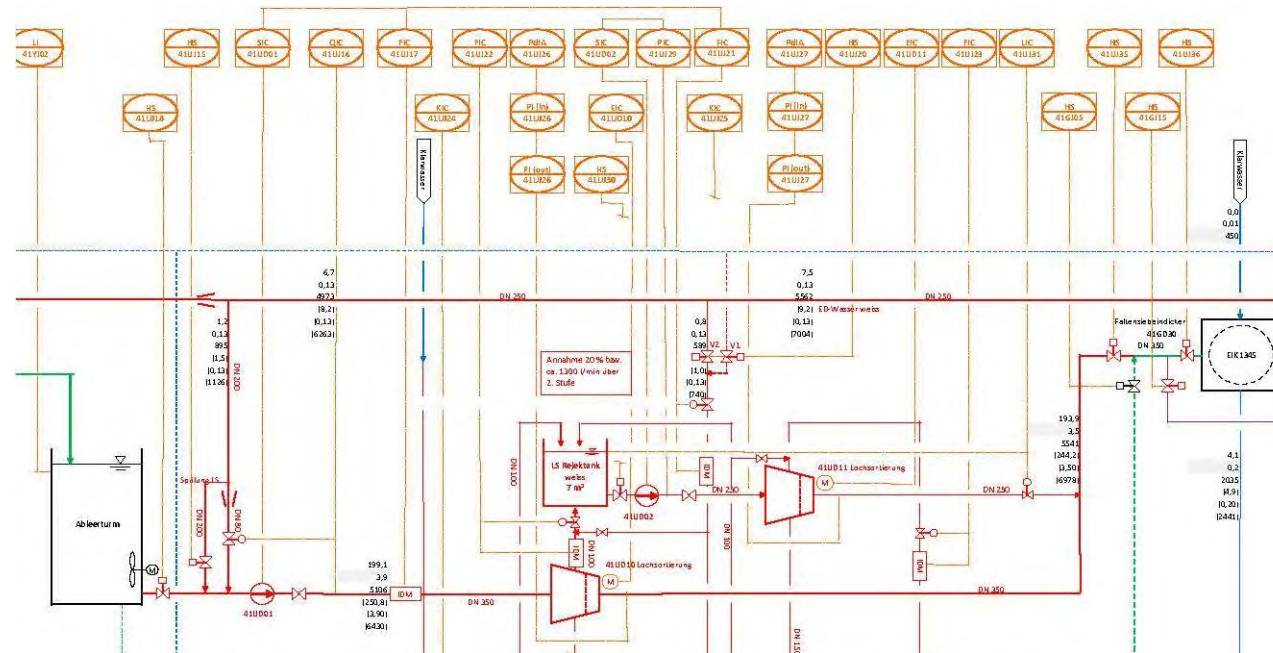


# Treatment process

Recyclability

Paper for Recycling

Drinking Process





# Key process steps in paper recycling – Pulping

**Mixing of paper for recycling with water under shear forces to disintegrate the paper structure into individual fibres**

– No cutting, only turbulence and friction –

Machines: **Vat pulpers** or **drum pulpers**

<b>Brown Packaging</b>	<b>X</b>
<b>Graphic</b>	<b>X</b>
<b>Hygiene</b>	<b>X</b>
<b>White Packaging</b>	<b>X</b>



# Key process steps in paper recycling – Cleaning and screening (1)

Removal of  
**heavy non-paper material\***  
by centrifugal forces  
and  
**light non-paper material\***  
by preventing them to pass  
through cylinders with  
small holes or slots

Machines: Cleaners and screens

<b>Brown Packaging</b>	<b>X</b>
<b>Graphic</b>	<b>X</b>
<b>Hygiene</b>	<b>X</b>
<b>White Packaging</b>	<b>X</b>



\*Heavy non-paper material: Sand, stones, glass, staples  
Light non-paper material: Plastic, adhesive applications, ...



# Key process steps in paper recycling – Cleaning and screening (2)

## Coarse pre-screening:

- Non-pulpable material

## High density cleaners:

- Stones, glass, staples, paper clips

## Low density cleaners:

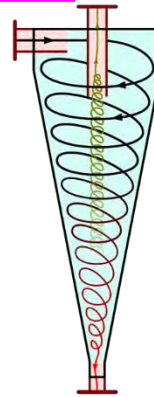
- Sand

## Hole screens:

- Pieces of plastic films

## Slot screens:

- Adhesive applications



# Key process steps in paper recycling – Deinking – General

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Deinking is a **three-step** process:

- **1<sup>st</sup>: Detachment** of ink from the fibres  
(during slushing of the paper for recycling)  
with the aid of detergent-like substances
- **2<sup>nd</sup>: Fragmentation** of the ink film into a suitable size  
range (for flotation: about 5-150 µm)
- **3<sup>rd</sup>: Removal** of ink from the system
  - mostly used: flotation
  - in certain cases: washing

<b>Brown Packaging</b>	
<b>Graphic</b>	X
<b>Hygiene</b>	X
<b>White Packaging</b>	(X)

# Key process steps in paper recycling – Deinking – Flotation

Brown Packaging	
Graphic	X
Hygiene	X
White Packaging	(X)

- Air is injected into the diluted pulp
- Hydrophobic ink particles attach to air bubbles
- The air bubbles carry the ink to the surface and form a foam
- The ink-loaded foam is removed from the pulp slurry





# Key process steps in paper recycling – Deinking – Washing

Recyclability

Paper for Recycling

Drinking Process

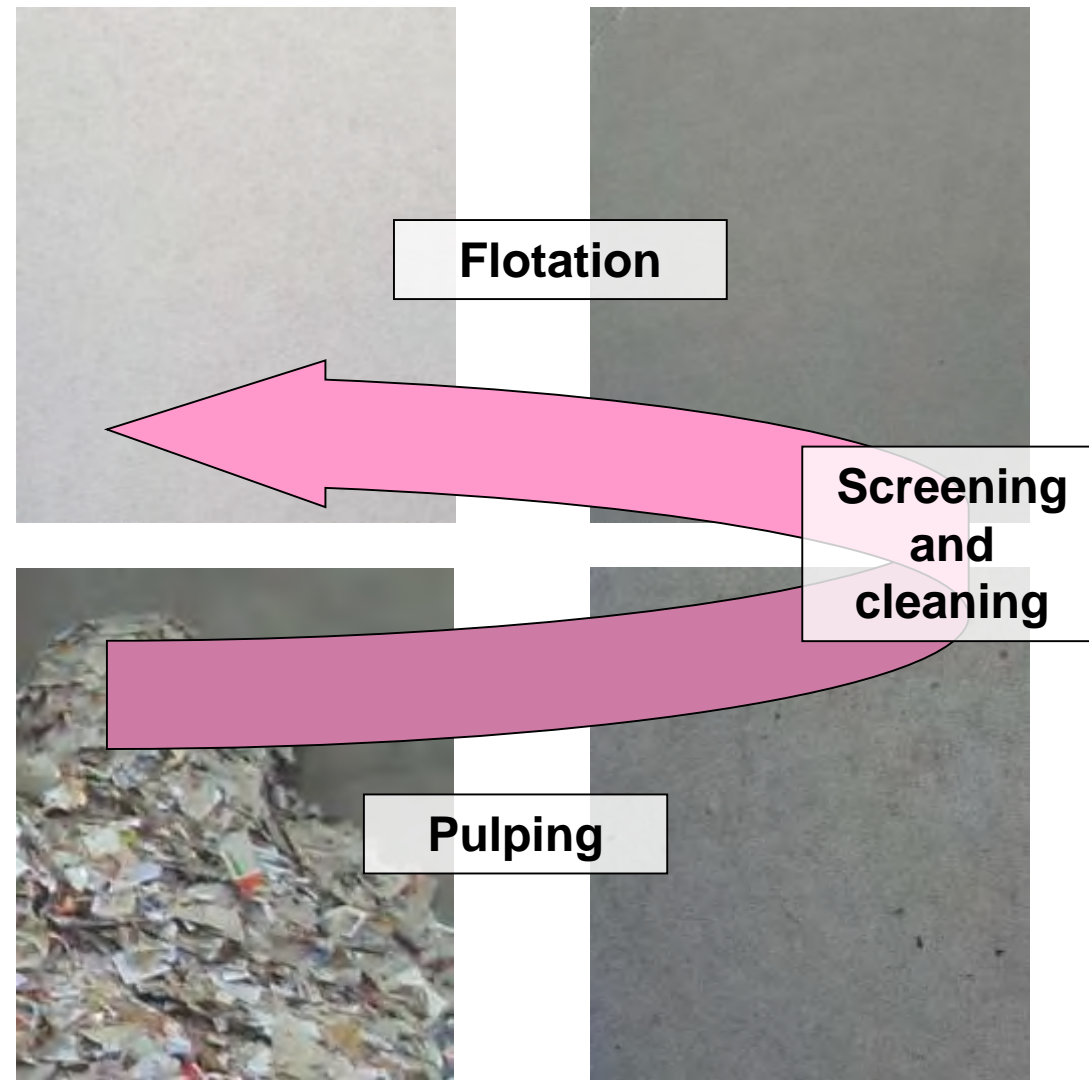
- Application: Low content of minerals in deinked pulp
- Drawbacks: low material yield and higher water usage
- Ink and minerals are removed by a screen
- Additional water treatment is needed

Brown Packaging	
Graphic	
Hygiene	X
White Packaging	



# Development of pulp quality in a flotation deinking plant

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# Auxiliary process steps in paper recycling

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- Dewatering and thickening
  - to separate water loops within a mill
- Dispersing or kneading
  - to diminish unwanted particles which are not removed otherwise
- Bleaching
  - to increase brightness and/or reduce colour shade
- Refining
  - to equalize pulp quality and to develop strength (the latter has only a small effect with paper for recycling)



# Paper for recycling

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# Two main groups of paper for recycling

Recyclability

Paper for Recycling

Deinking Process

Mixed  
and  
packaging  
(without  
deinking)



Graphic  
(with deinking)



# Main sources of paper for recycling



Recyclability  
**Paper for Recycling**  
 Drinking Process

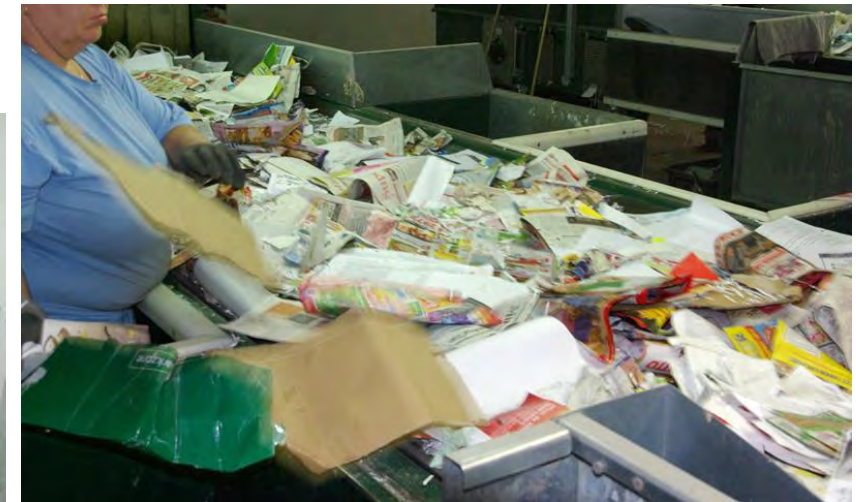
Source	Quality	Remarks
Households	Mostly mixed (graphic and packaging), sometimes selective	Mixed requires sorting or is sold as mixed
Retailers, other trade	Mostly packaging	
Offices	Mostly graphic	
Printing and converting industry	Either graphic or packaging	



INCLIDE

# The sorting process

- Ballistic and spikes
  - separation of (large) board by size and stiffness
- NIR and optical
  - separation of small board and non-paper material
- Manual
  - removal of remaining unwanted material, quality control



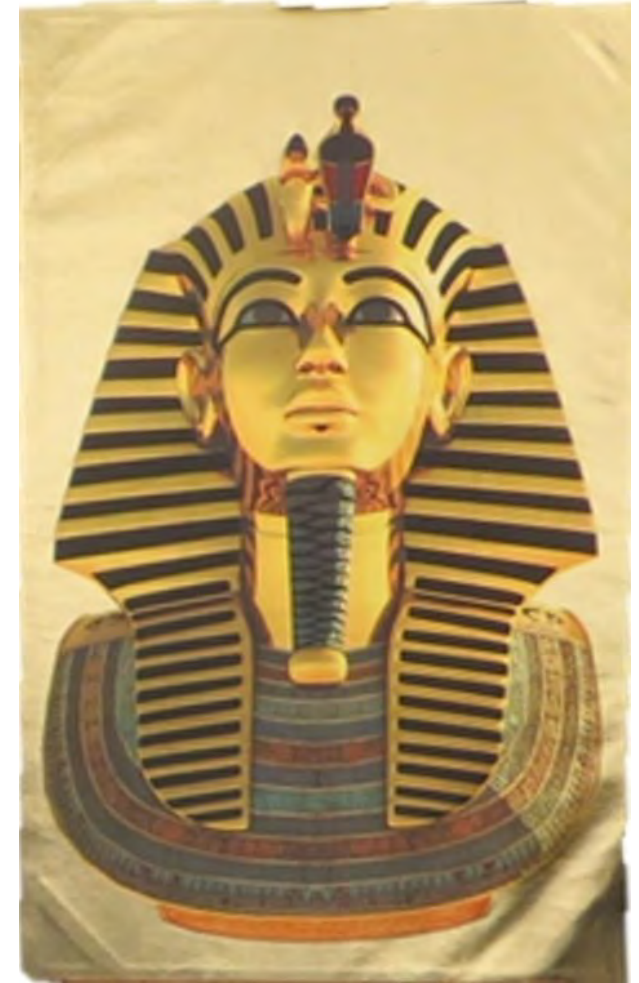


# White packaging ...

... should be fit for deinking as well!



# Recyclability (product design)



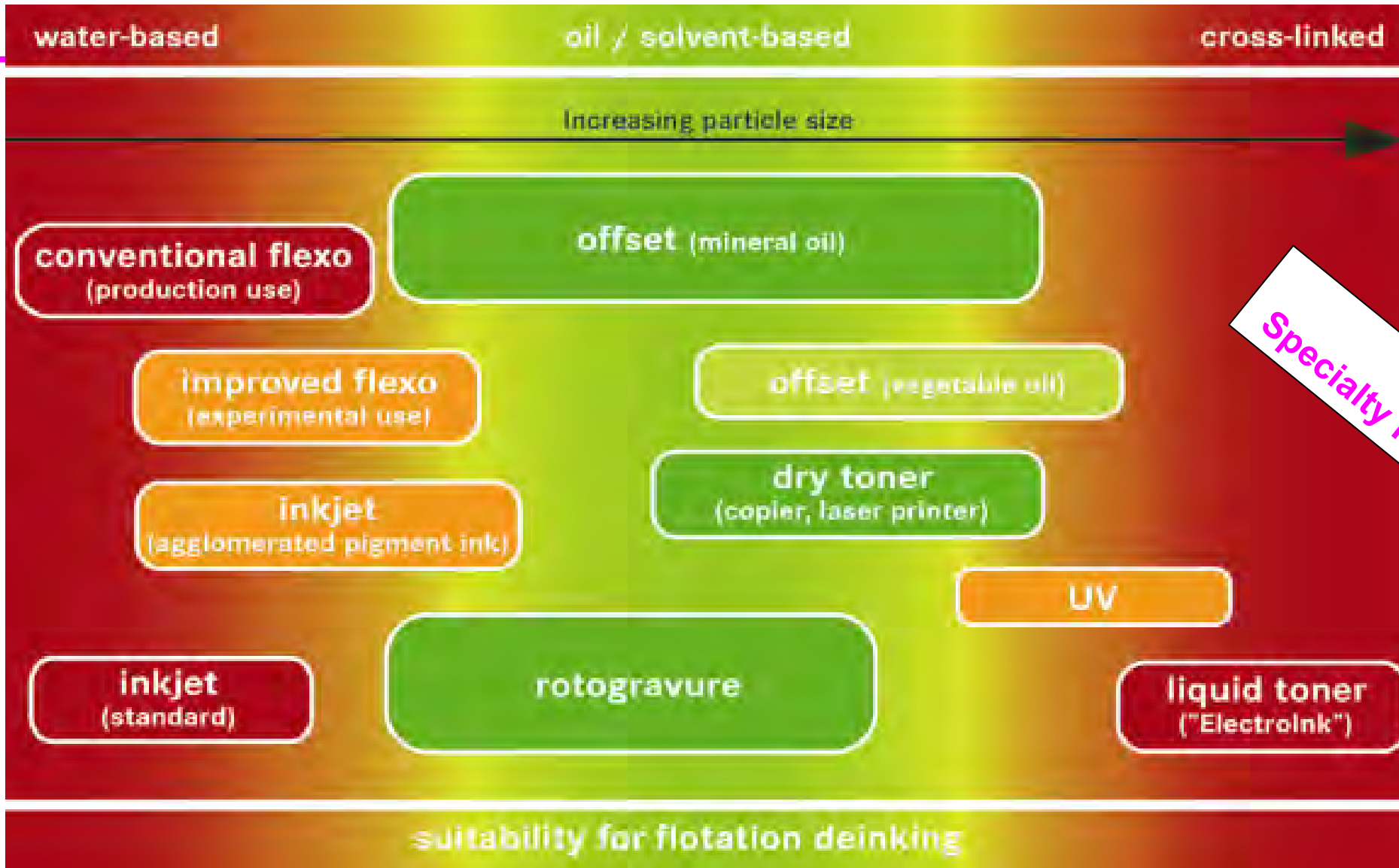
# Aspects of recyclability

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- **Repulpability** – difficult with wet-strength papers and with laminates (two sided)
- **Deinkability** – most of printed products are deinkable, some are causing problems or even pose threats to deinking operations (little experience with printed packaging)
- **Stickies** – adhesive applications have to be **removable** or at least recyclable friendly (wish list!)
- **Ingredients** – substances in paper products should not be harmful for usage of recycled products



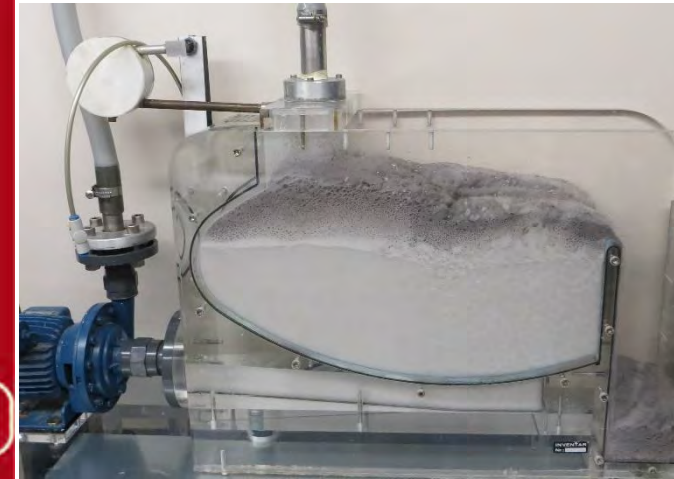
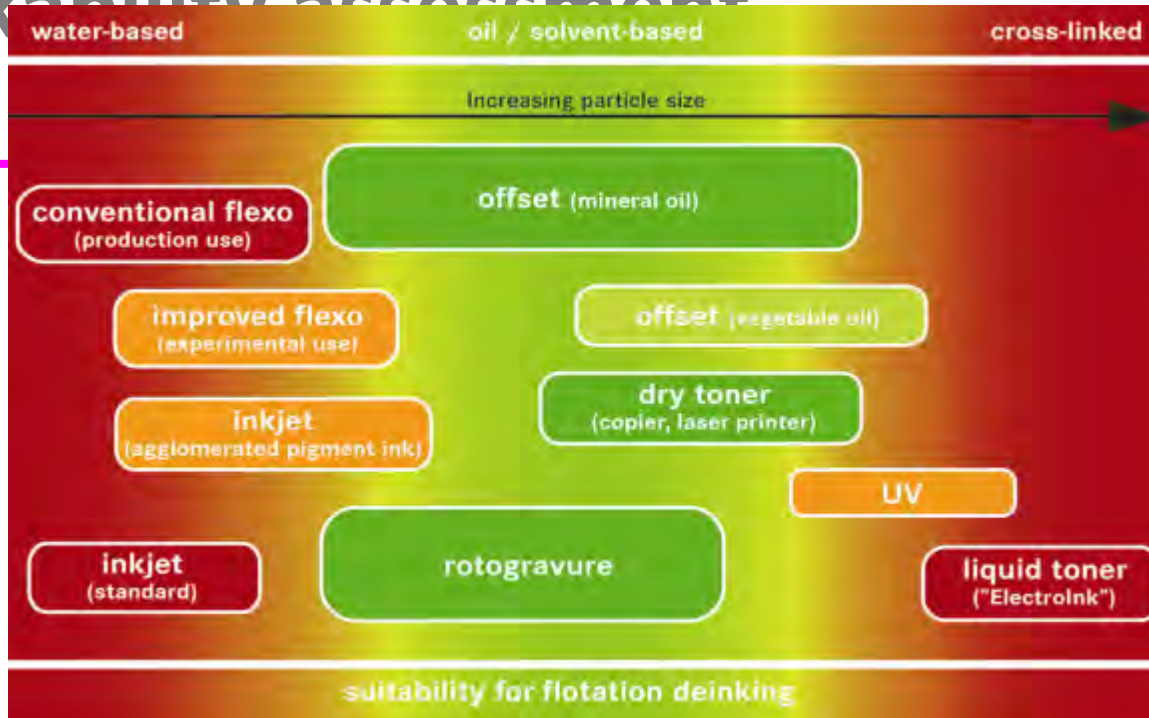
# Operating window of flotation deinking



See also:  
Specialty Papers Europe 2016



# Deinkability assessment



Objectives	Evaluated Parameters
High Reflection	Luminosity Y of Deinked Pulp
High Optical Cleanliness	Dirt Area A* of Deinked Pulp
No Color Shade	a* Value of Deinked Pulp
High Ink Removal	Ink Elimination IE
No Discoloration of White Water	Filtrate Darkening $\Delta Y$

Quality Parameters

Process Parameters

Deinking cell: PROPAKMA GmbH

# Possible impacts of adhesive applications

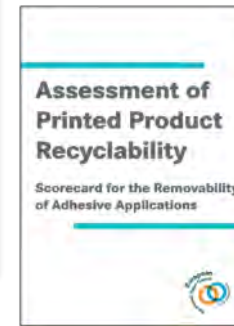
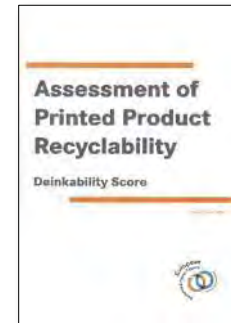
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- **Macrostickies** – large primary macrostickies can be screened out with reasonable efficiency
- **Microstickies** – may pass screening stages and may agglomerate later in the production process (deposits on wires, felts, cylinders and rollers)
- **Dissolved and colloidal stickies** – are usually not removed, accumulate in the process water loops, may also agglomerate as secondary macrostickies (downstream of the screening stages)
- **Stickies** can affect paper & board production, but also converting & printing as well as quality of the final product

# Recyclability assessment

- The European Paper Recycling Council issues scorecards

- Deinkability
- Removability of adhesive applications



- contents and test methods are from INGEDE

- Ecolabels for printed matter use these scorecards



# Trends and challenges

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- New paper products, mainly in packaging
- Not all of them are or will be recyclable in standard processes
- Collection, sorting and logistics have to transfer these products to suitable treatment processes
- Consumers have to be made aware of proper separation – also on the (packaging) **product itself!**



# Conclusion

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- The treatment processes for paper for recycling are rather complex
- The exact process design is depending both on the raw material and on the required quality of the treated pulp
- **Main influencing factors** of the raw material are:
  - **Product design** – for recyclability (repulpability, deinkability, removal ability of adhesive applications and absence of critical substances)
  - **Collection system** and handling of paper for recycling – for purity of grades and content of non-paper components
- **Avoid overdesign!**





**Thank you very much for  
your attention!**

# INGEDE

We are the deinkers.

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