Eco Design for the Enhancement of Central Europe
Paper Based Products Recycling Loop

Deinkability of graphic products – news and results
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Why Deinking?
Principal process steps in a deinking plant

1. Pulping
2. Screening and cleaning
3. Flotation
Flotation deinking
Basics of deinking

• 1\textsuperscript{st}: Detachment of ink from the fibers (during re-pulping of the paper for recycling)

• 2\textsuperscript{nd}: Removal of ink from the system
  • mostly used: flotation
  • in certain cases: washing
Efficient flotation deinking needs …

- a solid particle to be removed (will not work with dyes)
- a certain size range of the particles (ideally between 10 and 100 µm)
- hydrophobic particles
- the proper chemistry (deinking processes for newspapers and magazines use a detergent-like mix of chemical additives)
Printing – Deinking

- **water-based**
  - conventional flexo (production use)
  - improved flexo (experimental use)
  - inkjet (agglomerated pigment ink)
  - inkjet (standard)
- **oil / solvent-based**
  - offset (mineral oil)
  - offset (vegetable oil)
  - dry toner (copier, laser printer)
- **cross-linked**
  - rotogravure
  - UV
  - liquid toner ("ElectroInk")

Increasing particle size

- suitability for flotation deinking
Laboratory hand sheets from deinked pulp

- Waterbased Flexographic Newspaper
- Good Deinkable Offset Newspaper
- Offset Newspaper with too many dirt specks
- Digital News on UV Offset Preprint
Evaluation of deinkability

INGEDE Method 11: Simulation of pulping and flotation

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Evaluated Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Reflection</td>
<td>Luminosity Y of Deinked Pulp</td>
</tr>
<tr>
<td>High Optical Cleanliness</td>
<td>Dirt Area A* of Deinked Pulp</td>
</tr>
<tr>
<td>No Color Shade</td>
<td>a* Value of Deinked Pulp</td>
</tr>
<tr>
<td>High Ink Removal</td>
<td>Ink Elimination IE</td>
</tr>
<tr>
<td>No Discoloration of White Water</td>
<td>Filtrate Darkening ΔY</td>
</tr>
</tbody>
</table>

Conversion of the results to a score system
Assessment of deinkability

- Procedure in the “Deinking Scorecard”
  - Simulation of essential process steps in laboratory scale (INGEDE Method 11)
  - Assessment of five parameters (cleanliness in two sub-categories)
  - Definition of a threshold (equal for all product categories) for each parameter
  - Definition of a target (depending on the category of the printed product – newspaper, magazine, stationery) for each parameter
  - Calculation of a score for each parameter
- The total score of all parameters allows an overall assessment of the product’s deinkability
- If one or more of the thresholds is not achieved, then the assessment is “not suitable for deinking”
# Deinkability Score

**Assessment of test results**

<table>
<thead>
<tr>
<th>Score</th>
<th>Assessment of deinkability</th>
</tr>
</thead>
<tbody>
<tr>
<td>71 to 100 Points</td>
<td>Good deinkability</td>
</tr>
<tr>
<td>51 to 70 Points</td>
<td>Fair deinkability</td>
</tr>
<tr>
<td>0 to 50 Points</td>
<td>Tolerable</td>
</tr>
<tr>
<td>negative</td>
<td>Not suitable for deinking*</td>
</tr>
<tr>
<td>(failed to meet at least one threshold)</td>
<td></td>
</tr>
</tbody>
</table>

*The product may be well recyclable without deinking*
Revision of the Deinking Scorecard (1)

- Total yield replaced by **fibre yield** and minimum set to **65%**
- Luminosity replaced by **brightness** to distinguish between the two product categories “Low ink coverage products”
- **Luminosity target lowered** from 90 to **80** for category “Low ink coverage products > 75”
- **Luminosity threshold increased** from 47 to **67** points for this category
Revision of the Deinking Scorecard (2)

- **Distinction** between “Magazines” and “Low ink coverage products” **improved** – by a more detailed description and by measuring mean grey value in case of doubts
- Definition how to assess print products with a very **low ink coverage** (if all results but IE are positive)
- **Reporting**
- **Exemptions from testing** for products which are usually good deinkable
Deinkability tests

EcoPaperLoop
• about 80 newspapers and magazines
• 2013 to 2014
• originating from Germany, Hungary, Italy, Poland and Slovenia

INGEDE
• about 470 printed products of all categories
• 2005 to 2014
• from Northern, Southern and Western Europe, as well as occasionally from USA and Japan
Deinkability of Newsprint (Offset)
Deinkability of uncoated magazine (Offset)

Deinkability Score

Score for Filtrate Darkening ΔY
Score for Ink Elimination IE
Score for Dirt Speck Area A 250
Score for Dirt Speck Area A 50
Score for Colour a*
Score for Luminosity Y

INGEDE  DE  DE  HU  HU  HU  HU  HU  HU  PL  PL  PL  PL  PL  PL  SI

Central Europe
European Union
ERDF

Erma concepts
Paper Technology Consulting GmbH
Deinkability of coated magazine (Offset)
Deinkability of uncoated magazine (Rotogravure)
Deinkability results of liquid toner prints from different vendors

- Score for Filtrate Darkening $\Delta Y$
- Score for Ink Elimination IE
- Score for Dirt Speck Area A 250
- Score for Dirt Speck Area A 50
- Score for Colour $a^*$
- Score for Luminosity Y

All products

Toner Liquid

OEM A - Test / Commercial

OEM B - Test
Individual deinkability results of inkjet prints grouped by ink technology and substrate
Average deinkability results of inkjet prints grouped by ink technology and substrate.

Deinkability Score

- 589 72%
- 120 33%
- 2 0%
- 21 2%
- 41 17%
- 27 70%
- 4 75%
- 5 100%
- 20 20%

- Score for Filtrate Darkening ΔY
- Score for Ink Elimination IE
- Score for Dirt Speck Area A 250
- Score for Dirt Speck Area A 50
- Score for Colour a*
- Score for Luminosity Y

Categories:
- All products
- Inkjet
- UV cured
- Dye based ink / mix dye
- Pigment
- Pigment based ink
- Inkjet paper
- Paper pretreated online
- Non-aqueous ink
- Unspecified
Deinkability results of test, demo and commercial inkjet prints
Deinkability results of test, demo and commercial inkjet prints
Average deinkability results of test, demo and commercial inkjet in comparison with offset, gravure and dry toner prints.
Conclusion

- **Deinkability results** of newspapers and magazines from EcoPaperLoop partner countries do not show a significant difference to existing data.
- Deinkers are concerned about liquid toner and inkjet prints.

**Liquid toner:**
- Deinkability issue: Many and large dirt specks.
- There is no sign from the field of a better deinking performance of the prints from the market leader.
- Competitive systems with better deinkability are not installed yet.

**Inkjet:**
- Deinkability issue: Low brightness, filtrate darkening, partly discoloration.
- All prints from the field failed in deinkability.
- Even R&D based test prints in average perform worse than offset, rotogravure and dry toner prints.
Thank you very much for your attention!

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www.ecopaperloop.eu
Sources

Pictures
• http://www.persoenlich.ch
• INGEDE
• http://www.graphische-revue.at

Deinkability results
• EcoPaperLoop
• INGEDE