Is Inkjet Still a Challenge for the Paper Recycling Process?

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About INGEDE: Research & Communication
- Communicating sustainability of printed products and how to preserve it
- Cooperation with printers and competent bodies in terms of ecolabels
- Cooperation with printer manufacturers, ink manufacturers, adhesive manufacturers etc.
- Testing, discussing results, and consulting

About Paper & Printing
- A printed product can be sustainable – if the recycling cycle keeps running
- Paper is an important renewable resource
- Print products are challenged by digital information
- LCA can be in favour of paper

Printers “Going Green”
- Everybody talks about printing, but what about the prints?

How paper recycling works
- Paper is collected
- Sorted – automatically & by hand
- Paper for deinking has to be free of impurities such as undeinkable papers and board (deinking = removal of ink)
- Neither machines nor workers can separate different printing processes (flexo, inkjet from offset)

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Where does it all go?

Paper Recycling Process: Sorting


Deinking – Chemistry & Physics

Paper Recycling Process: Deinking

- Deinking is the key step in paper recycling.
- Ink is separated from the fibres in several consecutive steps.
Water Recycling Process: Deinking

- Water
- A little bit of NaOH
- Some Na4SiO4
- Soap
- Air
- Does not work with hydrophilic particles!

Ink has to be
- Hydrophobic
- Particle > 150 µm = screenable (stiff!)
- 30 µm < particle < 300 µm = cleanable
- 2 µm < particle < 100 µm = flotable
- Particle < 2 µm = problem

Problems with water based inks!
- (Unless they form insoluble aggregates.)

Dry Toner is good deinkable

Consequences for Printing Ink
Deinking of dry toner

Deinking of inkjet

Water based = Eco Ink?

Prints with water based inks in the recycling process can be like a red sock in the washing machine.
They turn fibers grey like your underwear turns pink.

Dye-based inks are not deinkable:

Problems with soluble inkjet inks

Closed water loops in the paper mill
Soluble inks accumulate in the circulation water.
2% waterbased inkjet prints (unless on special paper) in a load of recovered paper can make the whole load unrecyclable for new graphic paper.

Sample distributed to Qantas Airline passengers to Australia at LAX (Océ Jetstream)
Inkjet can be deinkable:

- Video

Kodak Prosper Press Image Optimizer Station (IOS):

- Roll Coating pre-treatment for inkjet printing on standard paper
- Applies uniform surface treatment to enable any untreated paper
- Up to 300 mpm, 2 side coating in single pass and in-line
- IOS treated coated gloss paper INGEDE Method 11 score of 95 for deinking

Kodak Prosper

- roller coater
- divalent salt (Ca$^{2+}$)
- polymer
- pre-dried
- enhanced durability
Deinking of crosslinked inks

- UV curable inks, varnishes, polyurethanes;
- Photoinitiator induces polymerisation due to oxidative drying
- HP Indigo toner polyethylene film, flexible,
- Landia ink: also polymer film, transferred from blanket to paper
- Mineral-oil free inks: plantseed oils crosslink due to oxidative drying
- HP-Corning, Color Grip
- Polyacrylates, photoinitiator induces polymerisation

Problems with Indigo: Dirt Specks

- First tests in 2014
- Also at Drupa 2016
- Slow build-up, can be cleaned
- High cohesion
- Polyethylene film, flexible
- Landa ink: also polymer film, transferred from blanket to paper
- Also polymer film, transferred from blanket to paper
- KBA RotaJet 76: "Polymer Ink"
Deinking of crosslinked inks

- Problem:
  large particles (too heavy for flotation)
  not or little hydrophobic
- Also: Dispersion varnishes
  and UV-curable offset inks (LE-, LED-UV)
But: Only on coated paper, uncoated:

Uncoated paper according to KM not used for high quality images

… on uncoated:

UV curable inkjet I

UV curable inkjet II

Landa, Drupa 2016

Landa
Testing and Certification

- INGEDE Deinkability Test:
  - Reproducible and well-documented procedure
  - Cooperation with manufacturers, partly under NDA
- Certification:
  - Increasing presence & importance
    in marketing for digital printers
  - Required for Austrian Ecolabel, EU flower,
    Blue Angel (UZ 14, UZ 195), Ecofolio (Citeo, F)

INGEDE …

- Discussion and joint testing with ink manufacturers
  in Germany, Europe, US and Japan
- Discussion with all OEMs
- Discussion with printers and associations

- to be continued …

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INGEDE. We are the Deinkers.

Thank you.