

Deinking of Inkjet Printed Paper

PTS Deinking Symposium
April 27-29, 2010

DPDA

Overview for Today

- Who is the DPDA
- Dye Based Ink Investigation and Results
- Comment on Lab Methods vs Commercial Conditions
- Continued Investigations and Next steps

The Digital Print Deinking Alliance



Objectives and Purpose of DPDA

- Consolidate OEM resources for production inkjet printing and investigate deinking concerns related to inkjet technology
- Understand and define the specific issues and concerns of inkjet printing. Determine seriousness, urgency and resources required for problem solving
- Identify system based solutions including inks, papers, and deinking technologies that will be cost effective and practical
- Collaborate with deinking industry associations, related businesses and research organization for long term solutions
- Facilitate the sharing of information and best practices

Definition of Problem

- A concern has been raised, based upon Method 11 lab testing, regarding flotation deinking performance of inkjet printed papers
- Yet, commercial deinking mills typically have not reported lower brightness due to inkjet prints.
- Despite 40 years of production inkjet printing, currently inkjet's share of total print is < 1%. Now high growth in some market applications.
- We need to investigate what issues aqueous inkjet inks may pose to current recycling mills and plan for solutions in 5 - 10 year horizon.

Dye Based Ink Investigation

- What was tested
- Experimental protocol
- Black dye inkjet results
- Cyan dye inkjet results
- Magenta dye inkjet results
- Yellow dye inkjet results
- Summary

Test Objectives

- Determine if one dye set can be established for future deinking testing
 - n Speed and Economy of testing
 - n Determine if dye type or OEM source matters
 - Investigate parameters of various lab scale flotation deinking methods
 - n Test conditions: Method 11, CTP
 - n Additional variables commonly used in commercial mill systems
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Test Parameters

- Three OEM supplied aqueous dye based inks
- Four colors (CMYK)
- High and Low density print
- Uncoated woodfree paper (office type)
- Three bleaching chemistries
 - n Peroxide
 - n Hydrosulphite
 - n Ozone

Experimental Protocol

- Samples were printed with “INGEDE test form”

- CTP Pulping conditions:
 - n 15% pulp consistency,
 - n 128 mg Ca²⁺/l hardness,
 - n 45°C,
 - n 0.6% NaOH,
 - n 1.8% silicate
 - n 0.8% Serfac MT90 soap
 - n in a NCM10 Hobart pulper with 1 min agitation (speed 2), then
 - n 0.7% peroxide is added and agitated for another 20 min.

Experimental Protocol For Bleaching

○ Peroxide

- 80°C
- 10% consistency
- 1% NaOH
- 1% H₂O₂
- 2.5% silicate
- 0.15% DTPA
- Mixed and held for 90 min

○ Hydrosulphite

- 55°C
- 3% consistency
- 1% hydrosulphite
- gentle agitation and held for 15 min

○ Ozone

- 2.5% consistency
- 2% ozone

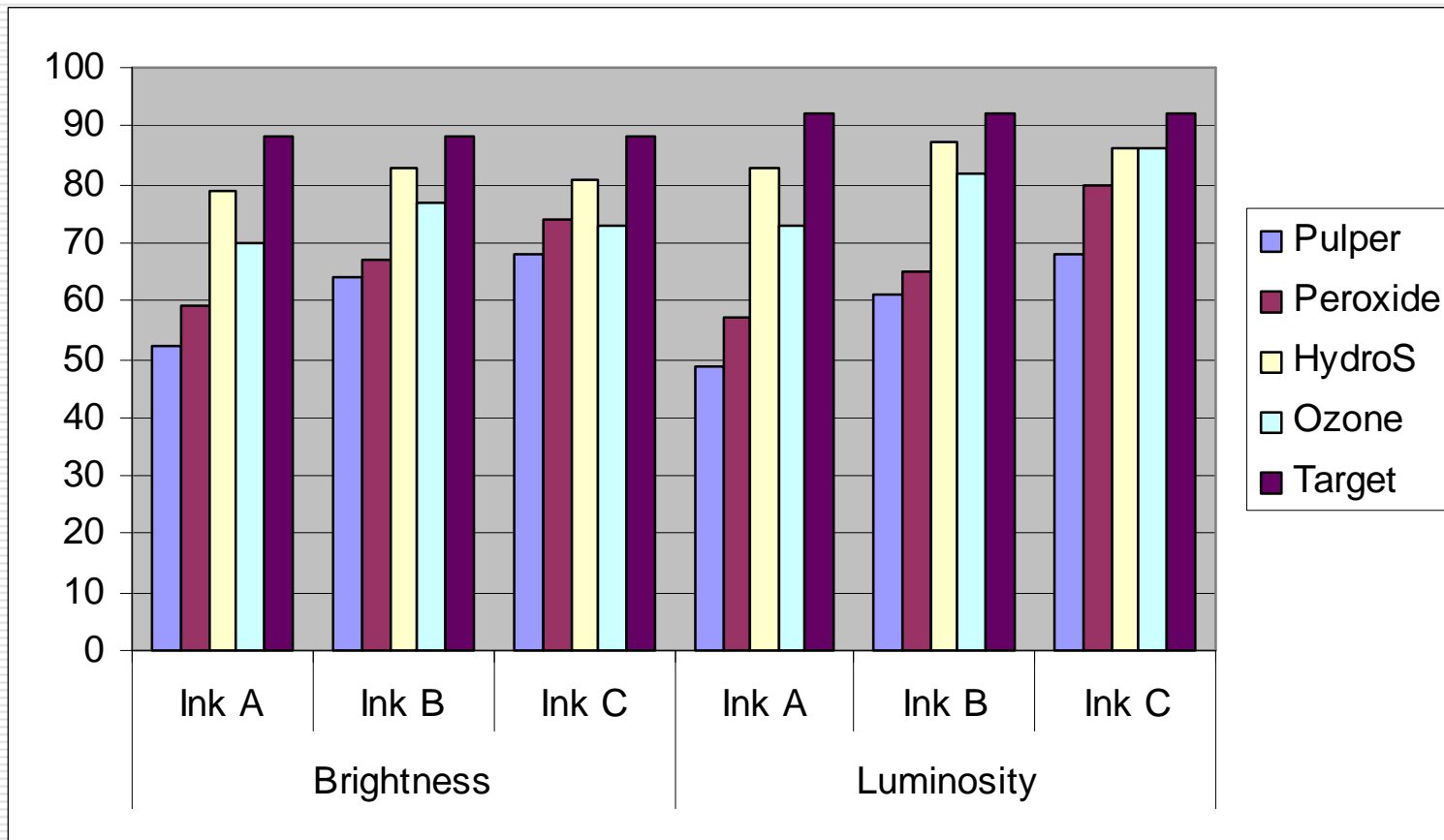
Black Dye Results

	Brightness			Luminosity		
	Ink A	Ink B	Ink C	Ink A	Ink B	Ink C
Pulper	52	64	68	49	61	68
Peroxide	59	67	74	57	65	80
Hydro	79	83	81	83	87	86
Ozone	70	77	73	73	82	86

Brightness of unprinted paper = 88

Luminosity threshold = 47

Black Dye Results



Cyan Results

	a* Target: -0.5			b* Target 3.5		
	Ink A	Ink B	Ink C	Ink A	Ink B	Ink C
Pulper	11	8	7	10	7	5.5
Peroxide	10.5	7.5	6.5	10	8	5.5
Hydro	6.5	3.5	0	5	3	2.5
Ozone	5.5	4	2	4	3	1

Deinkability of cyan inkjet printed uncoated, bleached wood free paper

Magenta Dye Results

	a* Target: -0.5			b* Target 3.5		
	Ink A	Ink B	Ink C	Ink A	Ink B	Ink C
Pulper	9	9	6	4.5	6.5	4
Peroxide	10	7	4	5	6	3
Hydro	0	0	0	0	0	0.5
Ozone	0.5	3.5	4	1.5	3	0.5

Deinkability of magenta inkjet printed uncoated, bleached wood free paper

Yellow Dye Results

	a* Target: -0.5			b* Target 3.5		
	Ink A	Ink B	Ink C	Ink A	Ink B	Ink C
Pulper	3	14	11	2	8.5	7
Peroxide	0	16	10	0	12	7.5
Hydro	0	7	7	0	5.5	5
Ozone	1	14	9	0	9.5	6

Deinkability of yellow inkjet printed uncoated, bleached wood free paper

Summary of Test Results

- Noticeable differences were observed between dyes,
 - n Between OEM's and also within colors.
 - n Premature to select a representative ink system

- Hydrosulfite bleaching performed the best and increased pulp brightness and luminosity for all dye inks tested.
 - n Better than Ozone bleaching
 - n Peroxide had little to no improvement

- Dye based inks on office paper (UWF) are unlikely to pass Method 11. Modifying test conditions has significant impact.

- Some dyes are easily deinked using existing commercial mill conditions

Next Steps

- Repeat study using aqueous pigment based inks
- Begin to test impact of paper types on deinkability
 - n Mechanical and Chemical
 - n Coated, treated and uncoated
 - n Paper componentry
 - n Mixed furnish impact
- Investigate additional commercial deinking process variables and degree of impact compared to lab tests

Questions?
