Anionically Surface-Treated Inkjet Inks and Their Deinkability

Veronika Husovska[1], Zheng Wei[1], Paul D. Fleming III[1], Jan Pekarovic[1], Hou T. Ng[2] and John Cameron[1]

[1]Center for Recycling, Department of Chemical and Paper Engineering, Western Michigan University, Kalamazoo, MI 49008-5462

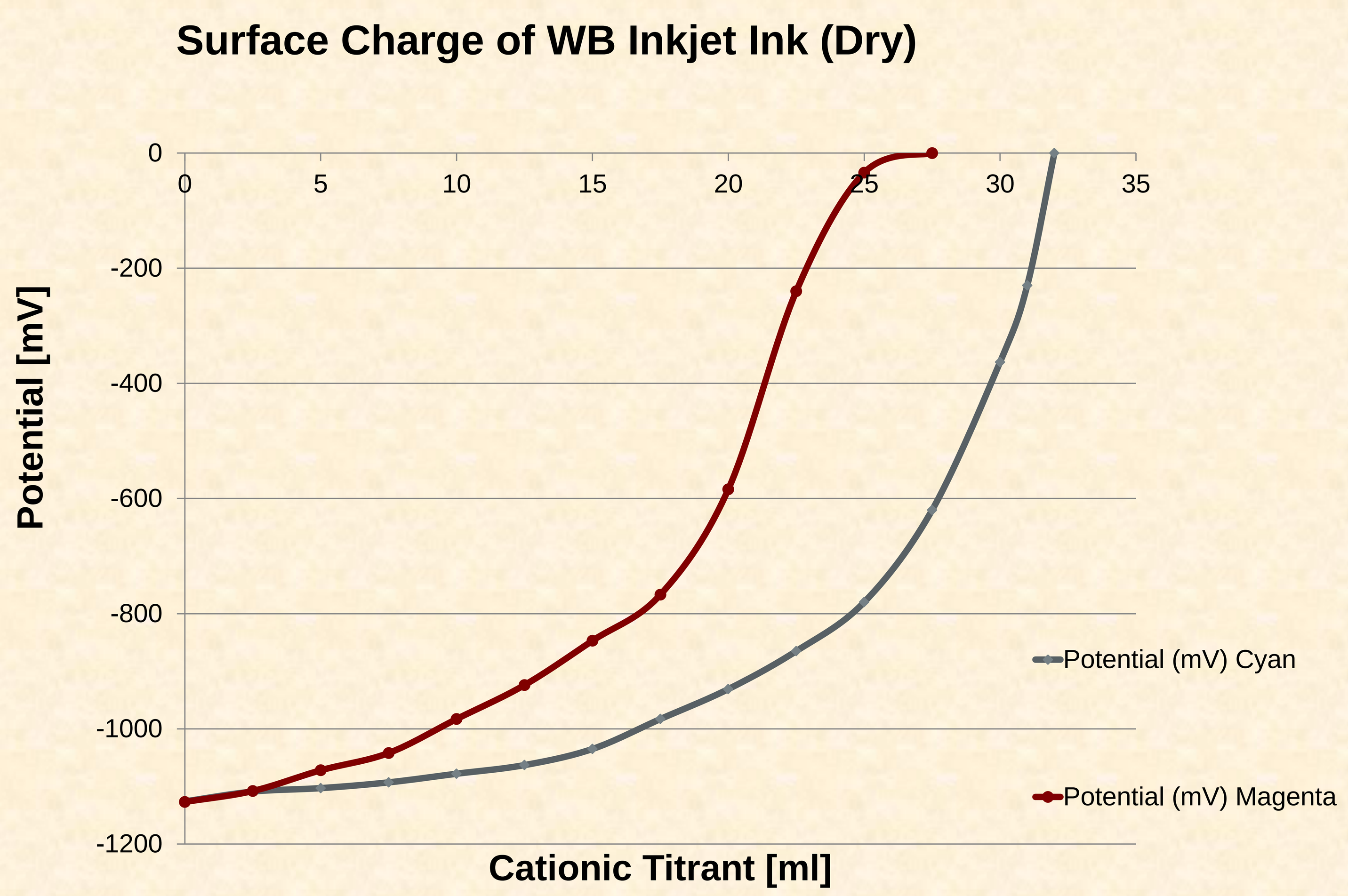
[2]Printing and Content Delivery Lab, HP Labs, Hewlett-Packard Co., Palo Alto, CA 94304

Introduction

Recycling is a challenge that involves pigments, inks, papers and paper treatments. A pre-recycling study of water-based thermal inkjet inks was executed. Pre-flotation experiment were used to determine pigments behavior in specific environments. Flotation deinking of model inkjet inks (no fibers involved) was carried out. Various surfactants with different pH were used to better understand ink behavior. Pre-recycling study was conducted under a wide pH scale. The goal was to understand inkjet ink removal and optimize its detachment during re-pulping.

Analysis

1. Analysis of inkjet ink on PET performed
2. Flotation of printed PET was done

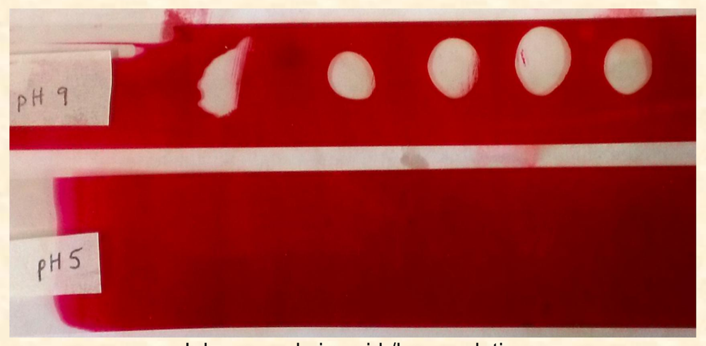


Inkjet Inks

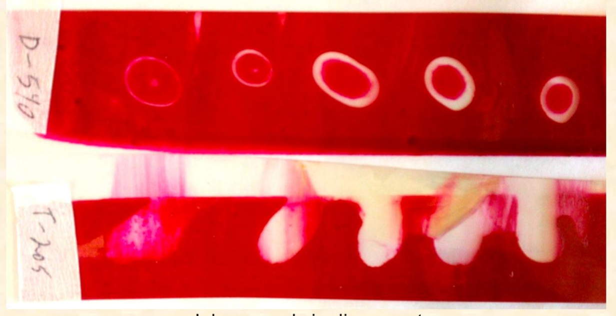
- Colloidaly stable – no particle size increase
- Low viscosity 2-20 cPs
- Ink surface tension ~ 70 dynes/cm
- Particle size ≤ 150 nm
- pH 7.0 – 8.5

Results

Ink Removal from PET					
Deinking Solution	20 min	40 min	60 min	80 min	100 min
Varonic T-205	90%	100%	100%	100%	100%
Solplus D-540	10%	20%	30%	40%	40%
0.1 N NaOH	100%	100%	100%	100%	100%
0.1N HCl	0%	0%	0%	0%	0%

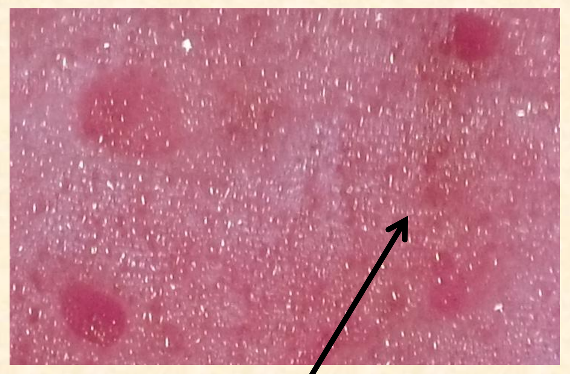


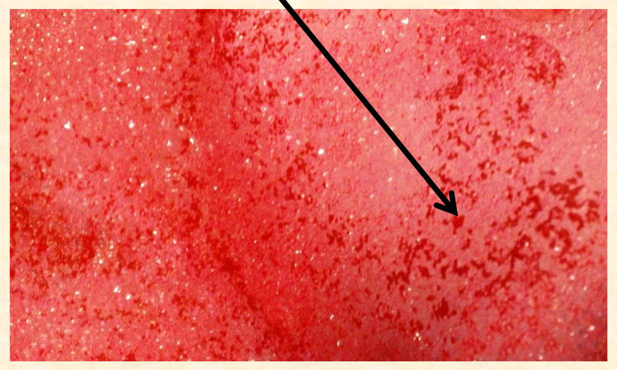
Ink removal via acid /base solution



Ink removal via dispersant

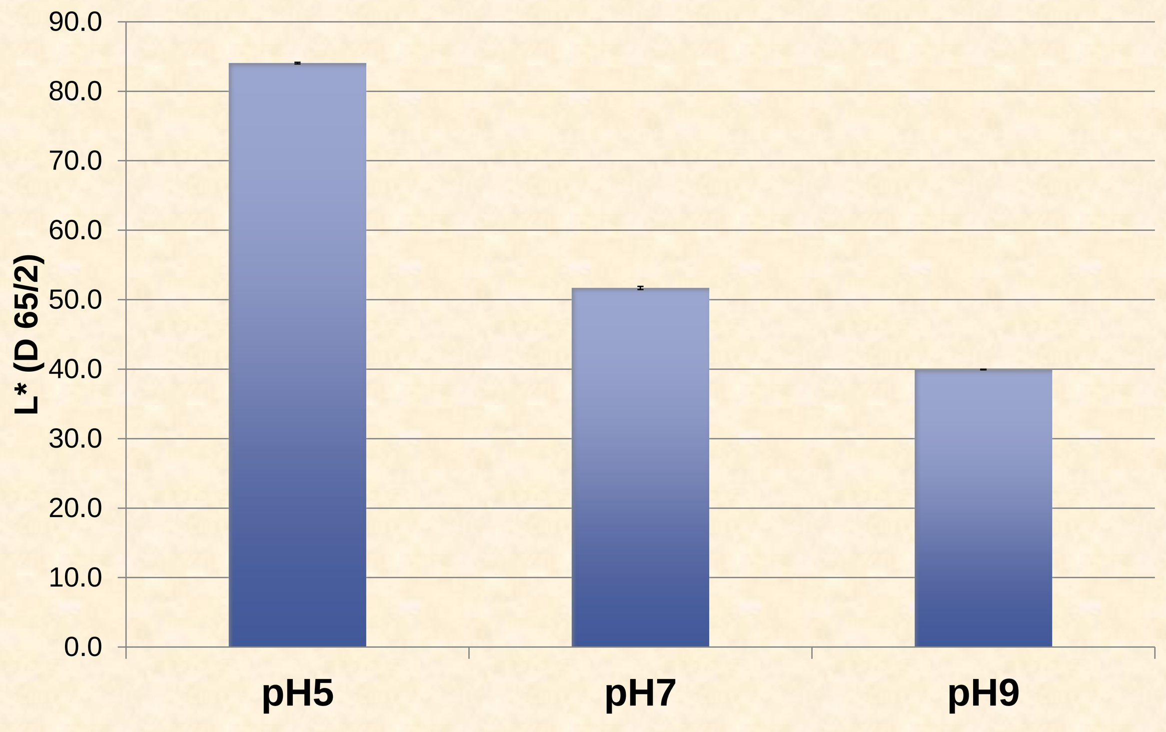
Agglomerated Pigment Particles Effect of pH and cationic surfactant





No visible agglomerates in alkaline deinking

L* value
of residual water after deinking PET



Conclusion

Focused on the pH and its role in the deinking. For ink detachment alkaline pH is desirable. Acrylic polymers in water based inks stay in salt form. Ink agglomeration is essential for its removal. Acidic pH has the ability to agglomerate the pigment.

pH 5 residual flotation cell water | pH 7 residual flotation cell water | pH 9 residual flotation cell water

Low pH causes the ink particles to collide and settle down. Cationic surfactants and polyelectrolytes also cause agglomeration of anionic pigment particle. Combination of alkaline pH/agglomerating agent is desirable for ink jet ink removal.

Deinking Solution	pH	Results
Varonic T-205	10	Good ink detachment / No agglomeration
Solplus D-540	5	No ink detachment/ Good ink agglomeration
INGEDE chemicals	9.5	Good ink detachment / No agglomeration
0.1 N NaOH	13	Good ink detachment / No agglomeration
0.1 N HCl	1.1	No ink detachment/ Good ink agglomeration

REFERENCES

Beneventi, D., Zenob, E., Carreb, B., Allixb, J., Nortiera, P., & Angelierb, M. C. (2010). Understanding the role of surface active substances in flotation deinking mills by coupling surfactant and ink balance with process simulation. *TAPPI Journal, 9* (2), 31-39.

Zhao, Y., Deng, Y., & Zhu, J. Y. (2004). Roles of surfactants in flotation deinking. *Progress in Paper Recycling, 14*(1), 41-45.