GRA634 - Special Project Final Report

Evaluation on Soy-based Inks

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Overview

- Introduction
- Equipment and materials used
- Results
  - Colour Reproduction
  - Rub Resistance
  - Ink Opacity
- Recommendations
- Conclusion

Introduction

- ✓ The benefits of Soy-based inks over the traditional petroleum-based inks?
- ✓ Sustainability? Green Printing?
- ✓ Soy-based inks, the better alternative?

- **Objectives:**
  - To determine whether soy-based inks would be preferable alternative
  - To evaluate the colour reproduction
  - To differentiate between strong and weak ink coverage of both inks as well as their adhesions to the substrate
  - To evaluate and compare the opacity, strength and colour hue of both inks
  - To identify the shortcomings of the soy-based inks

Testing Principles

Colour Reproduction test	Rub Resistance test	Ink Opacity test
To determine if the same amount of soy-based and petroleum-based inks generate similar **ink densities** and **colours** • Ink densities • L*a*b* values • Delta E (ΔE) values **Equation** $\Delta E = \sqrt{(\Delta L)^2+(\Delta a)^2+(\Delta b)^2}$	To determine the rub resistance by using a **4lb weight** to rub over the printed sample for **90 times** repeatedly • The ability of inks that can withstand against friction • The ability of the adhesion to the substrate	To evaluate both soy-based inks and petroleum-based inks by the **drawdown technique**. • Ink coverage (opacity) • Colour strength (hue and brightness) • Mass-tone difference * Able to prove if **both results** from colour reproduction test and ink opacity test match or not

Equipment used

Colour Reproduction test

Prüfbau Printability Tester
Prüfbau Dr-Ing.H Dürner, 82380 Peißenberg/München

X-Rite eXact Spectrodensitometer
520 series Certified

Equipment used

Rub Resistance test

Sutherland Rub Tester
U.S. PAT 2734375 Canadian PAT 532864

Ink Opacity test

Drawdown Bar
Precision Gage & Tool Co. B-3

Materials used

- **Inks:**
  - Traditional petroleum-based offset inks (CMYK)
  - Soy-based offset inks (CMYK)
    - Free samples from Universal Color Corporation
- **Papers:**
  - Supreme Gloss Offset (coated)
  - Earnscliffe Linen Bond Paper (uncoated)
  - Newsprint

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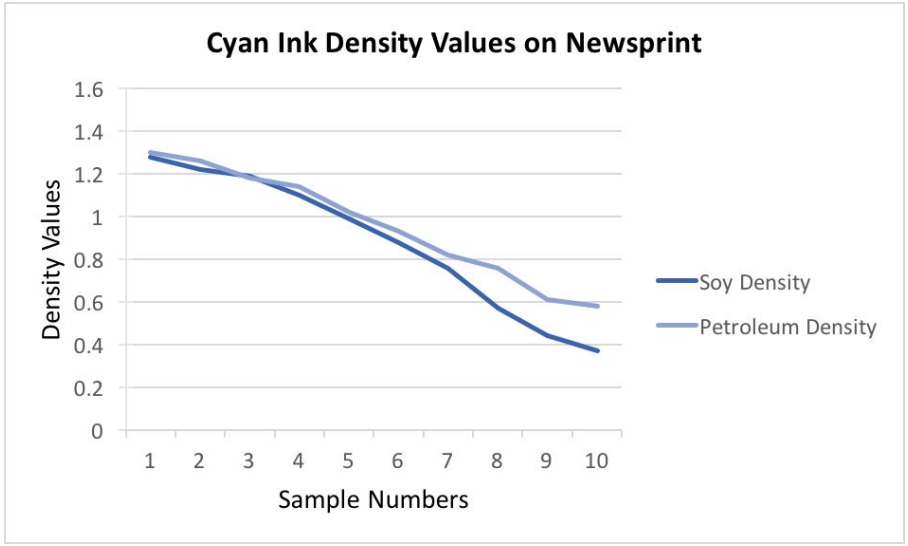
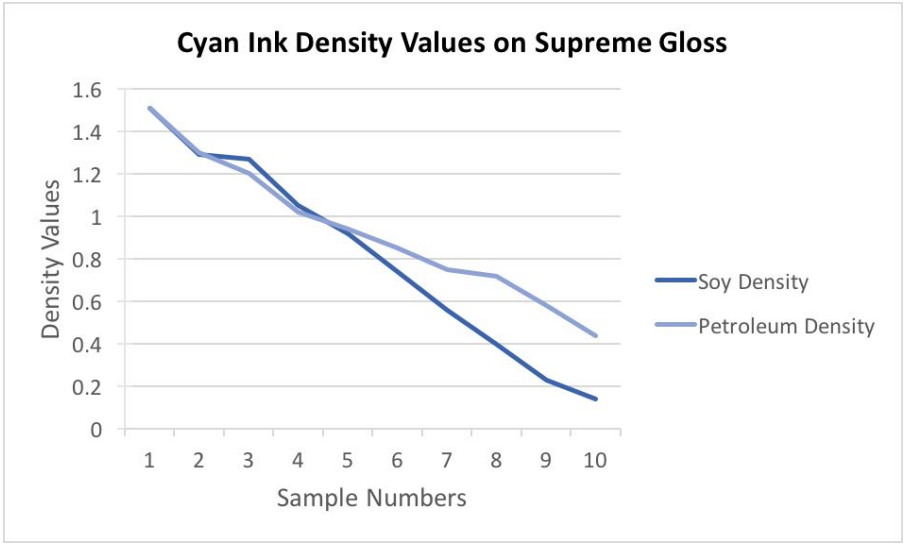
Colour Reproduction

Ink Densities, L*a*b* & Delta E (ΔE) Values

Colour Reproduction

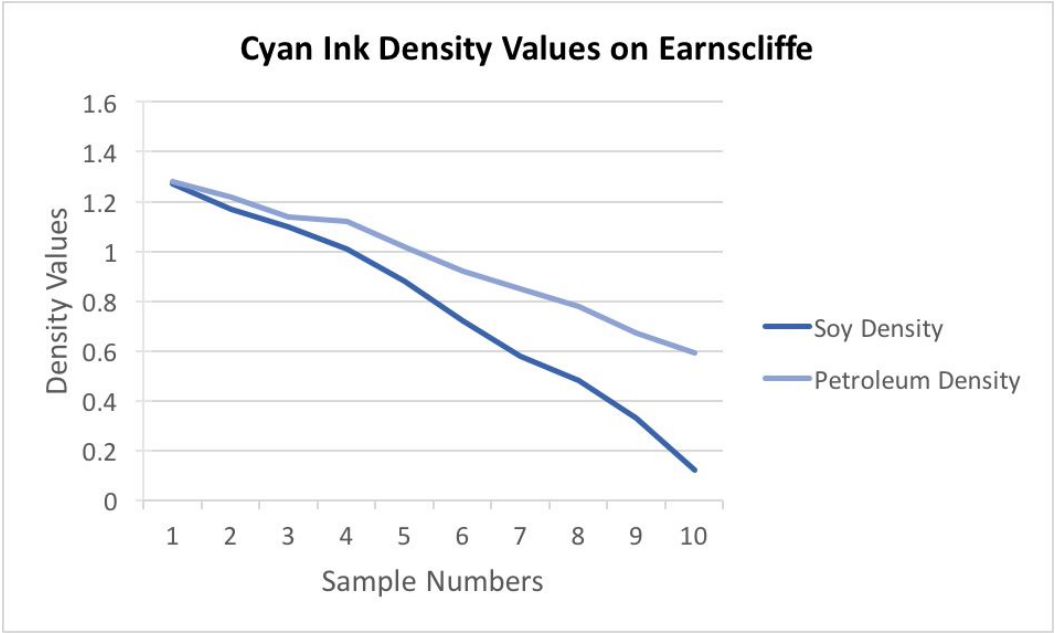
Ink Densities





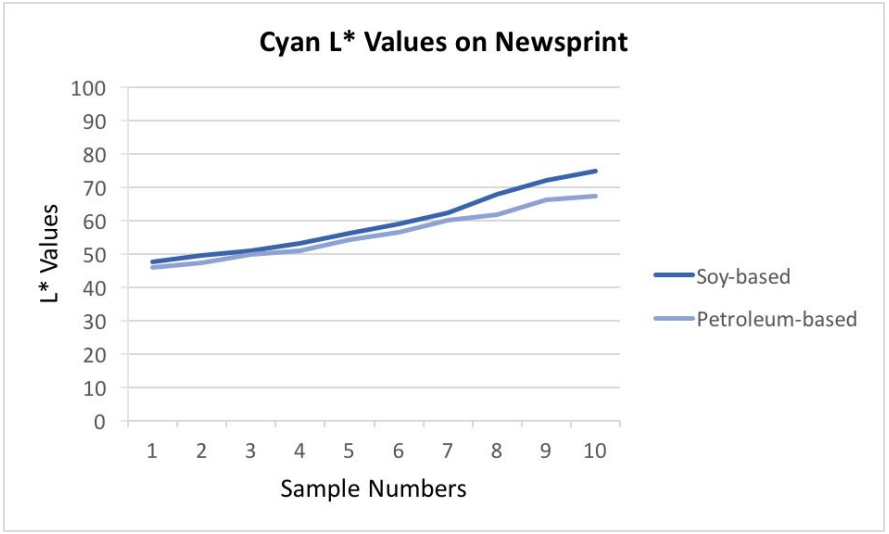
Colour Reproduction

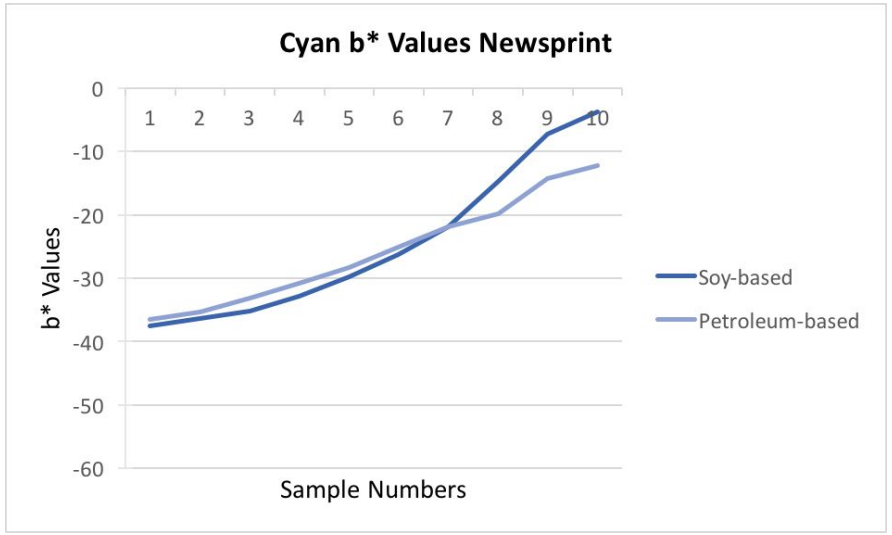
Ink Densities



Colour Reproduction

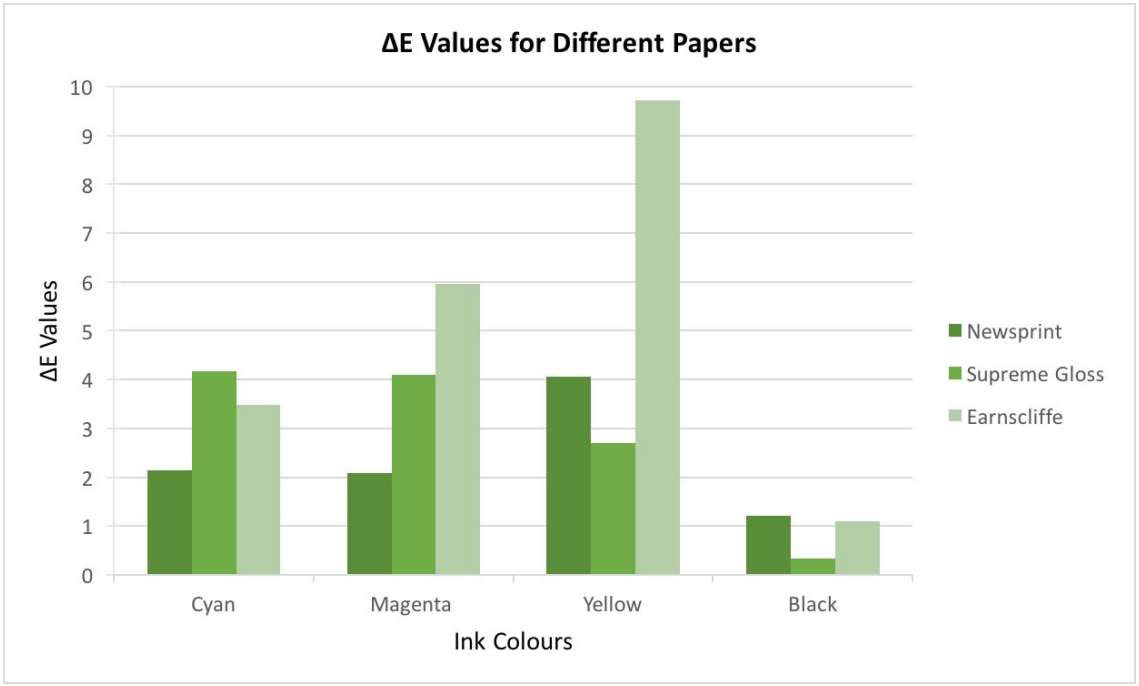
L*a*b* Values





Colour Reproduction

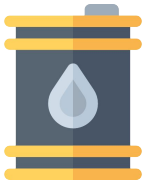
Delta E (ΔE) Values



Delta E (ΔE) Values			
Ink Color	**Newsprint**	**Supreme Gloss**	**Earnscliffe**
Cyan	2.14	4.17	3.49
Magenta	2.08	4.09	5.96
Yellow	4.06	2.70	9.73
Black	1.21	0.33	1.09

Colour Reproduction
Overall Performance

Advantage printing on Newsprint
Yield the least colour difference. Best at producing bright and saturated colours on prints.



Colour is not as bright!
Colour tends to be duller when printed. Petroleum oil is naturally murky, can affect colour pay-off.

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Rub Resistance

4lbs weight to rub over the printed samples

Rub Resistance

Magenta inks

Rub resistance of Soy-based inks		
Newsprint	Earnscliffe	Supreme Gloss
		

Rub Resistance

Magenta inks

Rub resistance of Traditional Petroleum-based inks		
Newsprint	Earnscliffe	Supreme Gloss
		

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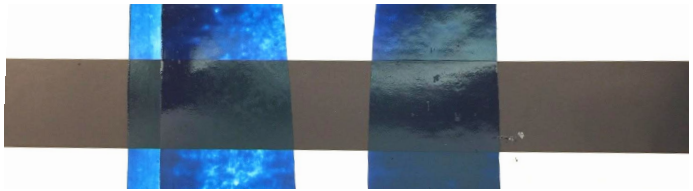
Ink Opacity

Visual inspection on ink coverage and colour strength

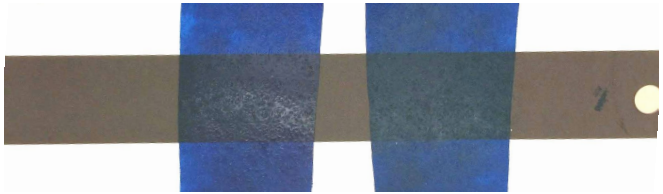
Ink Opacity
Ink Coverage

Cyan Inks on Coated paper



Left: Petroleum-based ink | Right: Soy-based ink

Cyan Inks on Uncoated paper

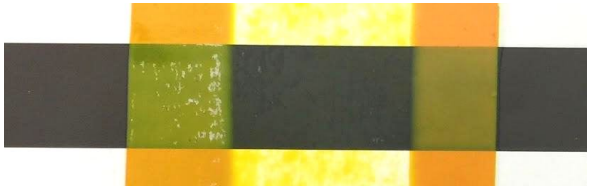


Left: Petroleum-based ink | Right: Soy-based ink

- **Soy-based inks:**
  - Better ink covering ability
  - Less transparent on coated paper
- **Petroleum-based inks:**
  - Show through more on the black strip

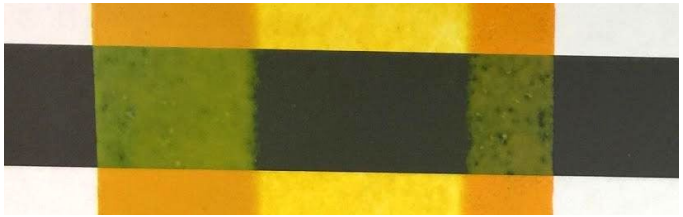
Ink Opacity
Colour Strength

Yellow Inks on Coated paper



Left: Petroleum-based ink | Right: Soy-based ink

Yellow Inks on Uncoated paper



Left: Petroleum-based ink | Right: Soy-based ink

- **Soy-based inks:**
  - Colours are more vibrant and intense
  - Soybean oils have the ability to dilute the colours → greater printing mileage
  - Less pigments → achieve the same optical effect of colours
- **Petroleum-based inks:**
  - Colours are darker and murkier

4 Recommendations

Printability, Runnability & End-use

Recommendations

Printability

Better ink choice to print on newsprint
Ink saturation and clarity on dull colored paper

Capable to print more impressions
Suitable for mass production

Better ink coverage
Same amount of ink to achieve brighter and more solid colours

Recommendations

Runability

Better ink quality
Reduce ink waste and extra makeready

Smoother ink flow during the press run
Reduce print spoilage

Recommendations

End-use applications

Packaging Products
Apply a layer of gloss on the coated substrate

More cost-efficient
For mass production with petroleum-based inks

Newspapers
Soy-based inks would be more expensive for large quantity printing

5 Conclusion

Better alternative to replace petroleum-based inks?

Conclusion

The Future Green Printing

Go Green?

In overall

- Soy-based inks is able to produce similar or even **better quality** than the petroleum-based ink
- A **better** alternative option
- Ink cost may be a **concern** to the printer

Depends on the printer itself:

- Practices sustainable green printing
  - The future printing trend
- Or save cost on inks and materials

Thank You!

Think green.

Print green.