

The Development of New Disperse Dye Ink for Inkjet Textile Printing

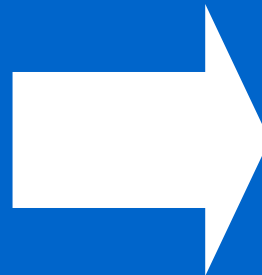
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Change of apparel production pattern

Diversification of preference among people
Difficulty in prediction of fashion modes

Today's production

Large batch
Stock



Future production

Small batch
Supplementary

*with information feedback
from sales*

Speeding up production time by IJ printing

Traditional (Screen print)

Inkjet



Design
Digital image processing
Sample proofing
Print
Fixing & Finishing

Design
Trace
Plate making
Sample proofing
Print
Fixing & Finishing

New Inkjet Textile Printing System for production



High quality & productivity & reliability

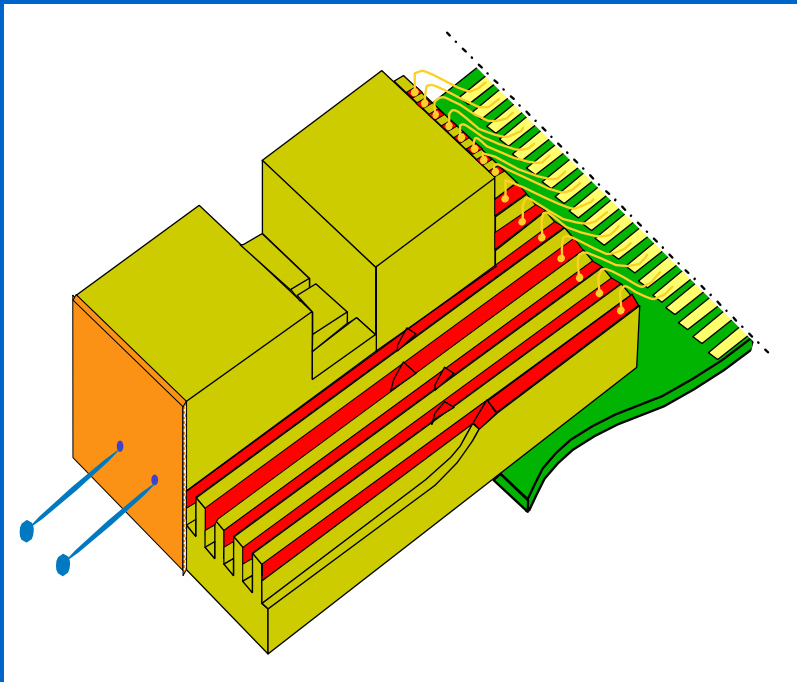
Features of the new printer

| | Nassenger | Nassenger V |
|----------------------|-----------------------|-------------------------|
| Print speed (max) | 10m ² /h | 60m ² /h |
| Head number | 64 nozzle × 8 head | 256 nozzle × 16 head |
| Head drive frequency | | c.a. 2 times |
| Droplet size | | c.a. ¼ |
| Fabric drive | Roller drive | Belt drive |
| Ink Type | Disperse, Reactive | Disperse, Reactive |

Requirements:

new inks for high speed and small droplets printing

Droplets slow down upon intermittent firing



| | Dry condition | Wet condition | |
|--------------|---------------|---------------|------------------|
| Pigment Ink | X | O | Vaporization |
| Disperse Ink | XX | X | Vaporization + ? |

What is “?”; what causes the slow down?

Features, difficulties and targets

Disperse dye inks:

- 1- For polyester fabrics
- 2- Hydrophobic dyes dispersed in an aq. media.
- 3- High colorants' conc. for high printing density

Difficulties and targets:

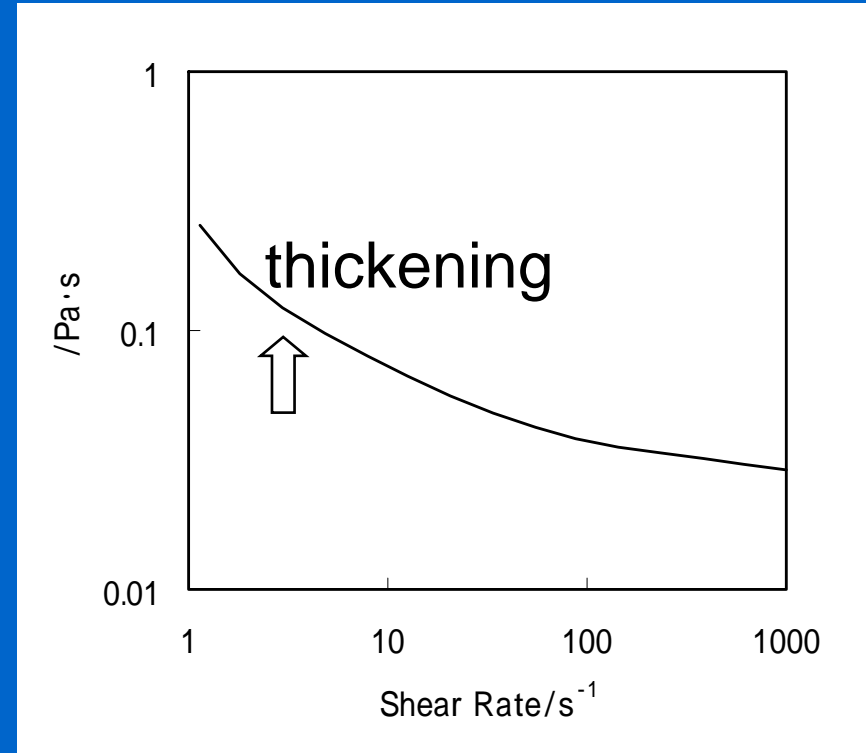
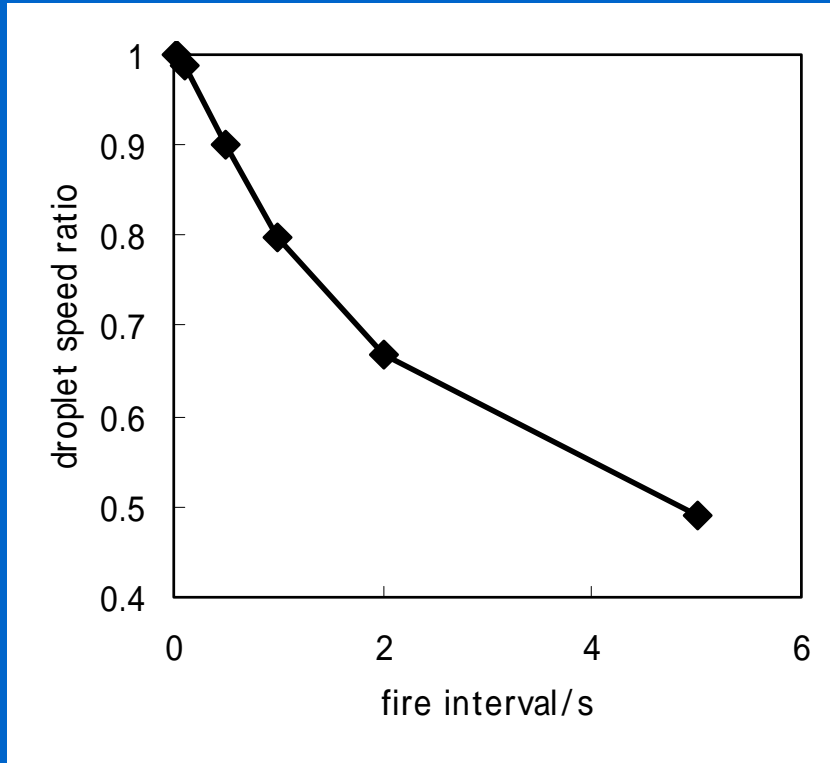
- 1- High stability for ink storage

NIP19: 2003, International Conference on Digital Printing Technologies, 630-632.

- 2- High stability for firing**

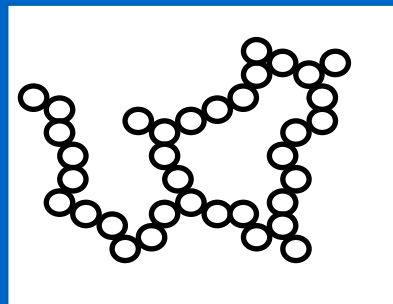
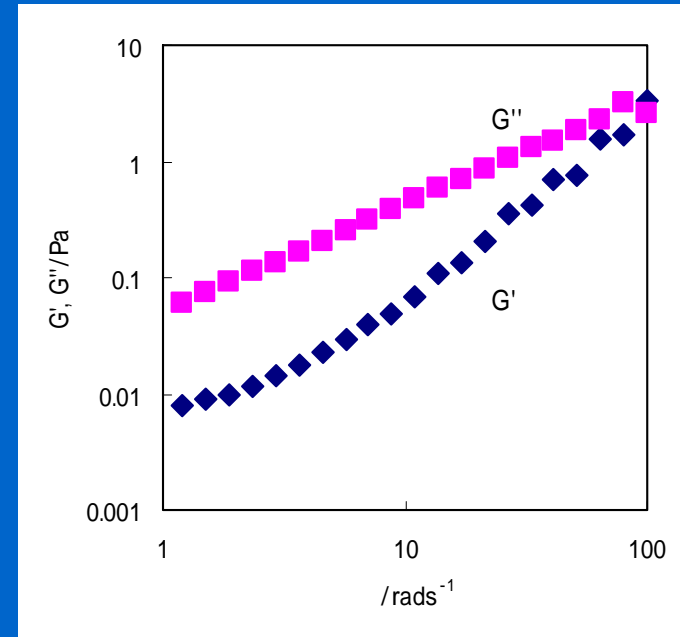
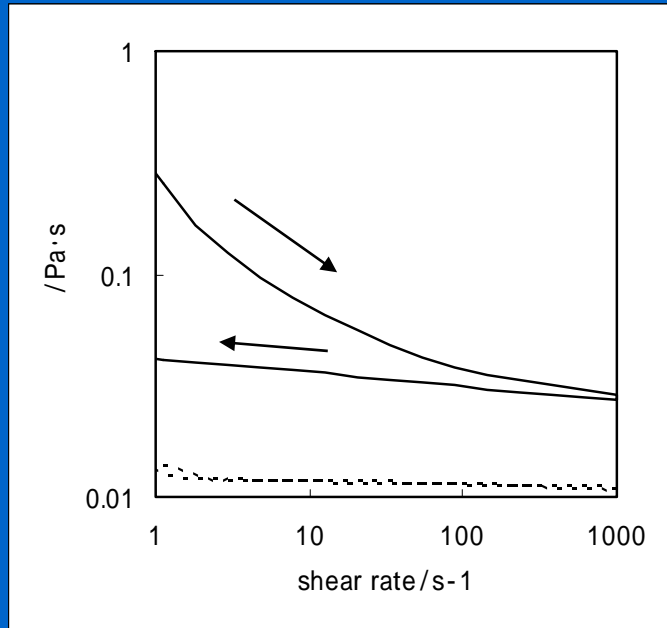
Slow down by viscosity thickening

v f (viscosity, surface tension)



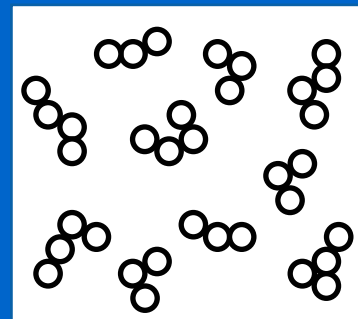
@ wet condition

Flocculation to viscosity thickening



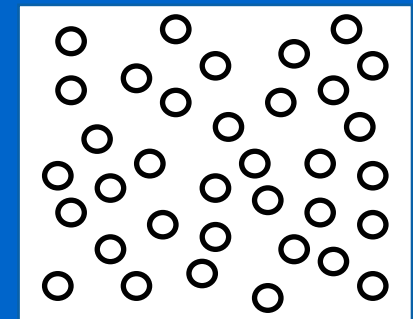
Flocculation

shear




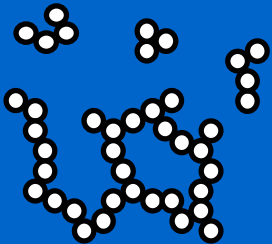


Agglomeration

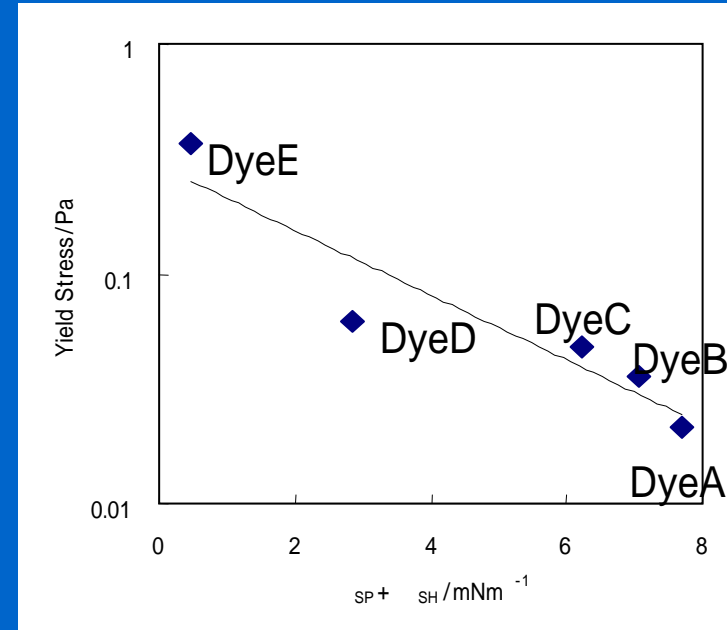
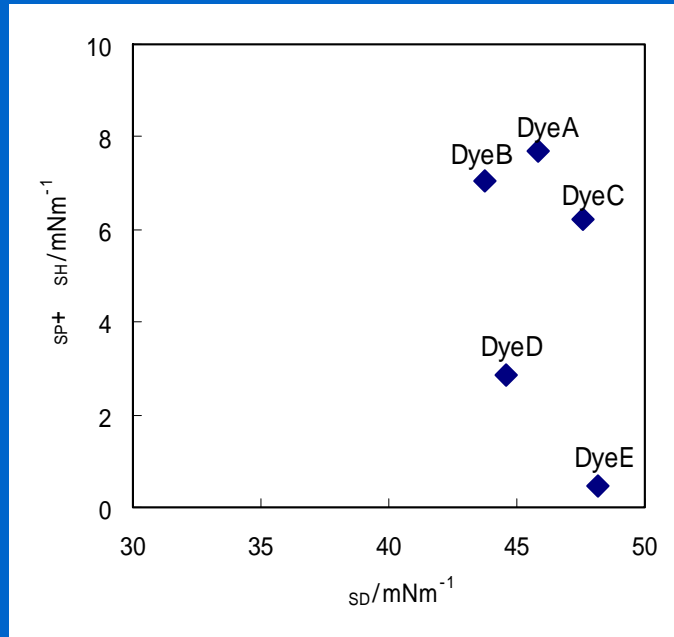
shear



Dyes cause the flocculation

| | | |
|--|--|---|
| <p>Dispersants</p>  |  | <p>Independent on dispersants conc.</p> |
| <p>Dyes</p>  |  | <p>Dependent on dyes</p> |

Flocculation vs dyes' hydrophobicity

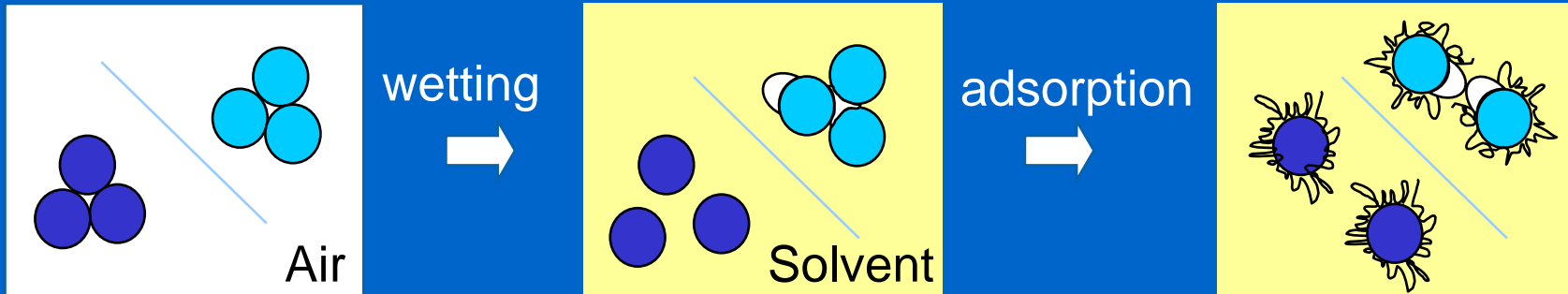


More hydrophobic



more flocculating

“?” = flocculation/hydrophobicity



| | |
|---------------|---------------------------------------|
| Pigment inks | Vaporization |
| Disperse inks | Vaporization + <u>Flocculation</u> |

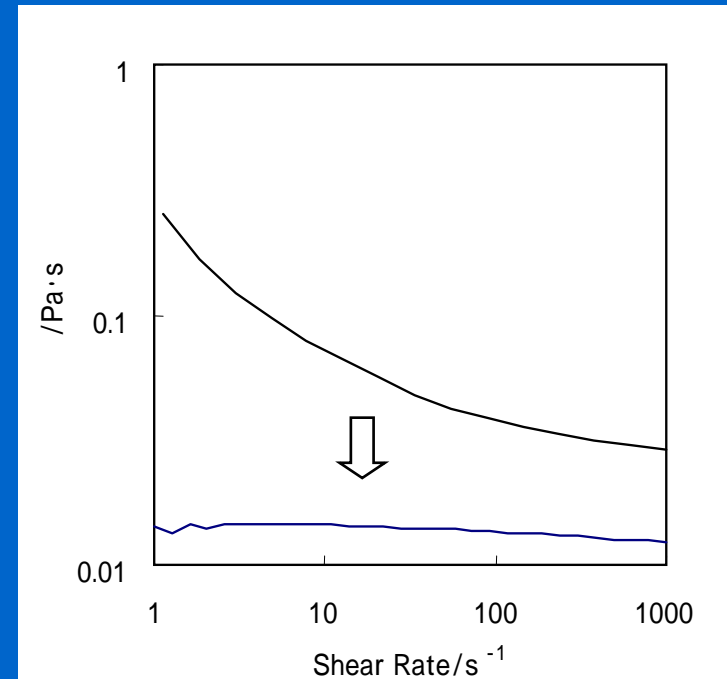
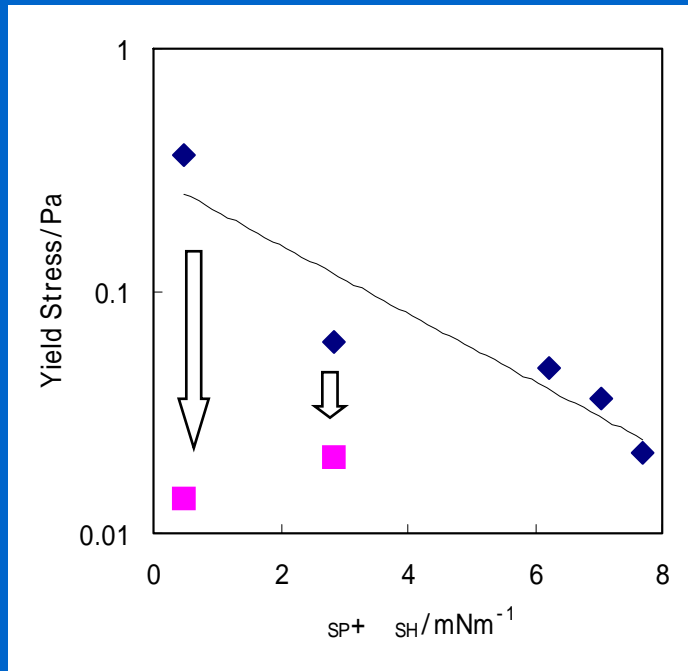
→ Hydrophobicity

A wetting agent improved rheologic properties

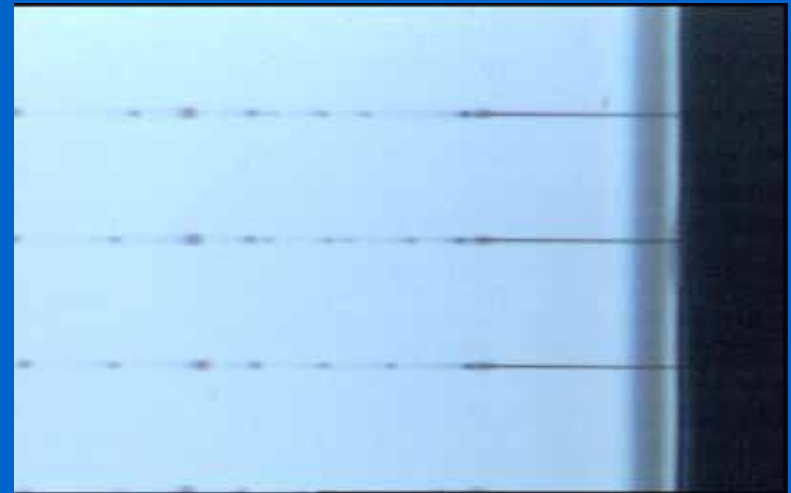
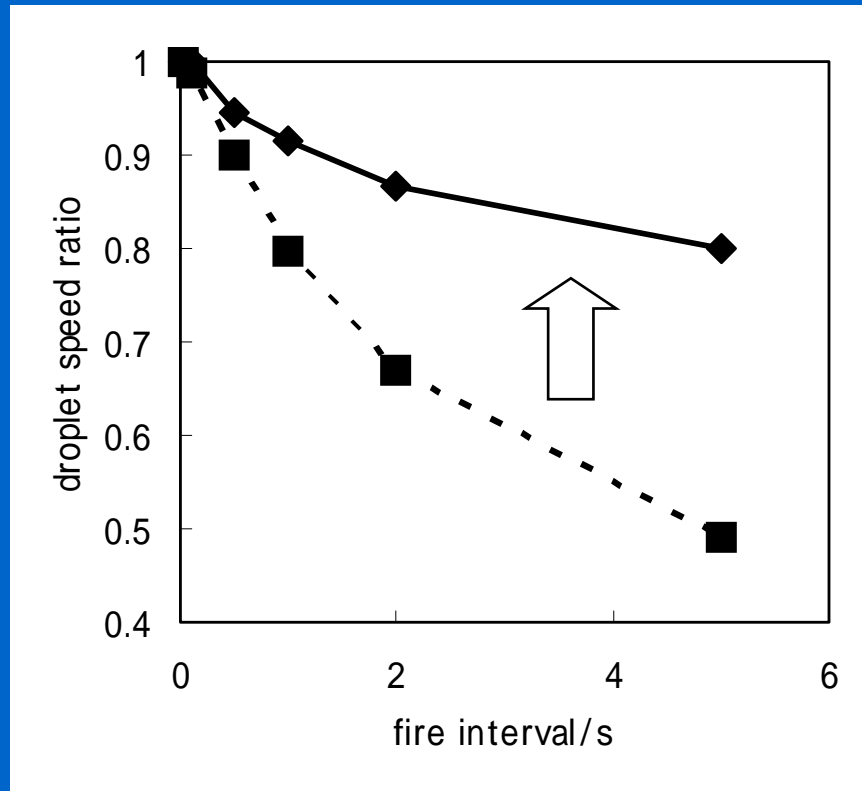
Less flocculating = less hydrophobic



combination with a wetting agent



High stability for intermittent firing



Slow down by intermittent firing was improved greatly.

Summary

- Disperse dye inks showed poorer firing properties than pigment inks did.
- Dyes' flocculation caused the slow down as well as vaporization of inks.
- Dyes' hydrophobicity caused the flocculation.
- A wetting agent improved the firing properties.
- We finally succeeded to develop a highly stable (for firing & ink & image) and safe disperse inks.