CHAPTER 5

CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

The pretreatment process is necessary for the textile jet ink printing. The fabric is porous, soft, and pliable, in which the pretreatment limits the excessive spreading of inks; thus, the fabric needs to be pretreated prior to printing with appropriate quality of ink so as to achieve high printing quality. A set of four-color pigmented ink jet inks was prepared in-house. The functional groups of the pigmented ink jet inks and the pre-treating materials were characterized by FT-IR spectroscopic method. The pigment surfaces were modified with sulfonate groups by the manufacturer. The pre-treating solutions of the amino compounds (aspartic acid, serine, glycine, sericin, chitosan and Sanfix 555) padded on the bleached silk fabric were confirmed by FTIR-ATR characterization by which the existence of NH_3^+ group was obtained on the pretreated layer of the fabric surface. The sulfonate group of the pigmented ink can interact with the protonated amino group of the pretreated fabric by a dipole-dipole interaction.

Pigmented ink jet

The average particle sizes of the four-color pigmented inks were in the range of 60 – 105 nm. The dispersed particle sizes of the cyan and yellow inks were stable for one year while the large-sized particles of the magenta and black inks were increased in size and detected at approximately 1.7×10^4 nm after 10 months of storage. The freshly prepared inks were judged to be suitable for a piezo type ink jet printer because the inks provided high surface tension with low viscosity of the

Newtonian flow. The ink could be jetted evenly and smoothly from the printer nozzles. Higher print density of the inks on the non-treated fabric was realized with high surface tension and low viscosity inks in good agreement with the Lucas – Washburn equation in terms of ink penetration depth.

Ink penetration, color gamut and crock fastness of the treated fabrics

The hydrophilicity of the fabrics was improved by amino acid pretreatments. The pretreatments of the amino acid having low viscosity gave a deeper ink penetration described by the Lucas – Washburn equation and confirmed by the cross-sectional micrographs of the printed fabrics. The serine and glycine solutions penetrated deeper into the fibers and could not hold much ink on the fabric surface. The printed fabrics thus exhibited excellent crock fastness when they were subjected to the crock fastness test. As such the color gamut of the amino acid treated fabrics was broader than that of the non-treated fabric but was narrower than those treated with chitosan, sericin or Sanfix 555. The sericin and chitosan are viscous solutions and yield a short distance of ink penetration. These pre-treating solutions can partly bind or fill the inter-fiber spaces; thus, the inks were mostly deposited on the yarn surfaces, providing a larger color gamut. Sericin pretreatment provided the excellent dry crock fastness, whereas chitosan slightly increased wet and dry crock fastness. Sericin increased the hydrophilicity of fabrics while the hydrophilicity of the fabrics was decreased by chitosan.

At the highest concentration of the pretreatments, the results indicated that the sericin, chitosan, and Sanfix 555 pretreatments yielded a greater improvement in both chroma and color strength than did the amino acids.

Stiffness and air permeability of the pre-treating agents

The stiffness and air permeability of the glycine coated silk fabrics are close to that of the non-treated fabric because these pretreatments did not change the fiber arrangement. The stiffness of the silk fabrics treated with chitosan was significantly higher than other pretreatments because the viscous chitosan solution gathered the silk fibers together and diminished flexibility of its individual fiber. The air permeability of the chitosan coated silk fabric was the highest because the chitosan solution was not only coated the yarns but also glued each fiber to a bundle of fiber and formed a packed yarn, introducing a wider inter-yarn space for air to pass through. The tendency of stiffness and air permeability of sericin pretreated fabrics yielded the same result as for the chitosan treatment. Wash fastness after printing is excellent because the binder in the ink formulation helped improve the ink fixation on the silk surfaces.

Commercial pretreatment for textile printing

Sanfix 555 (commercial pretreatment) provided the similar ink penetration, stiffness and air permeability of the printed fabrics to that of the amino acid. The color gamut from Sanfix 555 pretreatment was similar to those of chitosan and sericin. Unfortunately the crock fastness of the Sanfix 555 pretreated fabrics could not be improved.

5.2 Suggestions for Future Work

5.2.1 Apart from the present work on pigment dispersion technique, we have expected that other pigment dispersion techniques such as, micro-encapsulation provide a different property of the printed silk namely, color appearance and color reproduction, permanence and service performance.

5.2.2 The lower molecular weight of the chitosan should be further studied as the pretreatment can improve air permeability and stiffness of the fabric. Investigation of all the pretreatments on the silk fabrics printed by the most recent Epson printer to evaluate the print quality of the pretreated fabric with the commercial inks could be of economical sufficiency (setakit porpiang).