CHAPTER 1

INTRODUCTION

Four-colour inkjet printing is a non-impact printing technology that has been rapidly developed in both the printing and material technology. In terms of materials, the developments are two fold, the development of inks and the development of substrates. Various different types of inks have been developed and used in inkjet applications.[1] Generally, they are composed of two main components, ink bases and colorants. Aqueous-based or water-based inks are commonly used in the home and in the office. Their drying mechanisms are penetration and absorption. It has been known for some time that substrates with a coated water-receiving layer can greatly improve both optical density and resolution by controlling the ink spreading and penetration at the coated layer.

In the colorant component, there are a number of pigments or dyes that are used to produce inkjet ink. The pigment-based inkjet ink has been developed by several companies, such as 3M, Dupont, and Kodak. One significant advantage of pigment-based ink is its superior to dyes in colour durability in terms of water fastness and lightfastness. However, dyes are mostly used for production of inkjet printed on paper because of small particles and water-soluble dyes. The selection of dyes is dependent on their physical properties such as water solubility, waterfastness and lightfastness, and optical properties such as colour strength, absorption coefficient (K) and scattering coefficient (S). These properties will be optimised to obtain the appropriate dyes so as to use for a four-colour ink set: cyan, magenta, yellow and black in a

printer. These inks provide an optimum size of colour gamut. However, the time involved in obtaining the properties of a large number of dye-base inks and in making the best decision is obviously great. Nowadays, not only the four-colour ink set is used but also High-fidelity colour printing using more than four coloured inks is employed to provide the widest colour gamut. This research investigated the faster and simpler way of achieving the optimum colour gamut from the minimum number of inks in order to reduce time and cost. The simulation of colour gamut of inkjet ink systems by developing tools based on the optical properties of inks was carried out. The optical properties of inks are determined by using the two-constant Kubelka-Munk (KM) model. The method used in this study involves the calibration of the set of inkjet printing inks to determine the optical properties. The investigation method concerns the development of a spreadsheet application that determines the colour gamut that is obtained from the selected number of inks from the database.

1.1 Objective

To create a tool for color gamut prediction of inkjet ink sets on coated and uncoated substrates.

1.2 Scope of the Research

This research involves the simulation of colour gamut of inkjet ink systems by using two-constant KM theory. The two substrates used in this work are coated and uncoated substrates, these are Canon PR-101 Ink Jet paper and plain paper

respectively. There are 14 dyes used to print on the substrates. They are composed of three shades of red and yellow, two shades of black and blue, and one shade of magenta, orange, green and violet. The inks are diluted into 7 levels to obtain the database. They are printed onto coated and uncoated substrates using the yellow print-head of the BJ F850 Canon printer. Subsequently, the reflectance values, the XYZ tristimulus values and CIE L*a*b* coordinates of printed sample patches are measured by Gretag Macbeth Color Eye 7000 spectrophotometer, geometry: diffuse/8°. The reflectance spectrums attained are used to determine K and S coefficients of dye-base ink. The relationship between K and dye-base ink concentrations then is established using a cubic equation. Followed by, the coefficients obtained from the equation are employed to achieve the regenerated reflectance. This is carried out by establishing another spreadsheet which the number of inks can be selected to investigate the colour gamut. In addition, the application of matching between the gamut of original and the gamut of the selected inks is presented.

1.3 Content of the Thesis

An effort has been made to write up the thesis based on the study of optical properties of inkjet ink systems using the two-constant Kubelka-Munk theory. The content of the thesis is divided into 5 chapters. Chapter 1 is an introduction given objectives and scope of the research. Chapter 2 is dedicated to theoretical backgrounds, including the KM theory, Saunderson correction, the CIE system, the inkjet printing and the types of dye. In addition, the literature survey is addressed.

Chapter 3 describes the materials, the apparatus and the procedure of the experiment. Chapter 4 presents the results and discussion based on the experiments. Finally, the results are concluded in Chapter 5 along with suggestions and future work.