Study on the Influence of Primary ink of Water-based ink -jet

Jia-zhenSUN , Xian-fuWEI , Bei-qingHUANG , lingJia; Beijing Institute of Graphic Communication, Beijing, China

Abstract

The water-based ink contains no volatile organic solvents and makes little environmental pollution, so it will be used widely as one promising environment-protecting ink. In order to promote the printability of water-based ink and make it to be one better promotion and application as the environmental protecting print materials. So this paper adopted dispersion method of high speed grinding to get the primary ink of water-based ink, studying on the influence of primary ink of water-base ink. The result indicated that, the performance of primary ink of water-based ink prepared by high speed grinding was good. The factors which influenced dispersion of primary ink included pigment/resin ratios, types of dispersant. The factor which influenced the surface tension of primary ink is substrate wetting agent. Different defoamers in the water-based ink had different results. The defoamer A8 had great efficiency of defoaming.

Key words: *water-based ink; adhesion; low-energy surface*

Introduction

With the development of the computer technology, nanotechnology and superfine power technology are mature. The development of ink production and improvement of flame plating device are influenced. And the digital ink-jet printing technology is obtained comprehensive progress. Ink-jet printer has the good cost performance, so it is accepted by more and more user. As the main consumable items of ink-jet printer, ink-jet becomes the hot point which is studied by ink merchant and scholar. With the development of requirements about life quality and life environment, the green material is attached importance. The environment-protect ink production is required to satisfy the high-range production packaging. And it is becoming one pressure of ink industry, so the water-based ink-jet emerges because of demand[1- 2].

Water-based ink-jet has acquired considerable development. The selected colorant, vehicle and auxiliaries of ink have an effective function in the area of stability, water resistance, oxidative resistance and image definition. The particle size of water-based ink-jet is asked to be less than 500nm, and it is best to be less than 100nm. The ink is spurted to the printing material through the nozzle, the print speed and the resolve capability could be improved and the diametric of nozzle will be smaller[3]. This paper studies the dispersibility of the water-based ink-jet and discusses the factors to the dispersibility.

Experiments

Experimental materials

Pigment: Phthalo blue (Penglai chemical plant in Shandong Province);

Resin AZR (Tianjin ATOZ FINE Chemical Technology Co. Ltd);

Dispersing agent 710, 750, 760, wetting agent 245and defoamer 845, 810, 920 (Tego additive);

Solvent: deionized water

Equipment

GJ-2S style velocity mixing disperser (Haidatong corporation in Qingdao);

S3500 laser particle analyzer (America Beckman coulter .INC);

TA rheometer AR 2000(America TA I NC);

IGT printability tester (IGT F1)

Methods

Sampling Method: The resin, vehicle and auxiliaries are added in the primary ink, and make the ink samples by Grinding disperser:.

Viscosity measuring: TA rheometer measures the viscosity of samples.

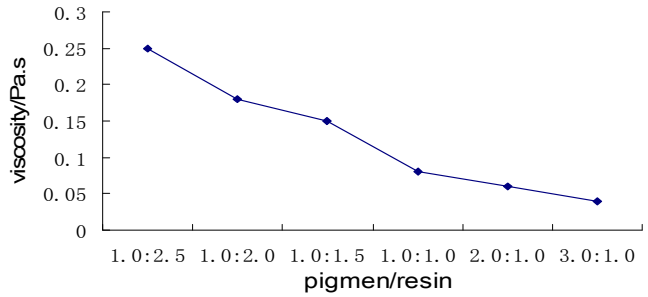
Dispersibility testing: Measuring sample with S3500 laser particle analyzer. The biggest size of 95% ink stand for the testing result, unite is □m.

Defoaming effect measuring: The foamex and ink sample are thrown in measuring cylinder, and it is stirred by high speed at the 2000r/min. And the foam volume is tested at 30s, 60s, 90s, 120s, 150s and 180s.

Results and Discussion

The influence of the pigment/resin to the property of primary ink

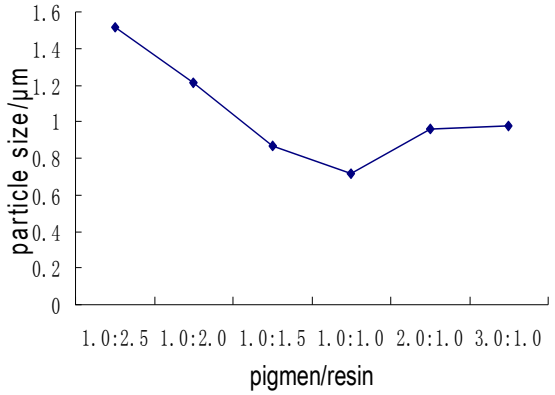
The content of pigment in the primary ink is fixed. Changing the pigment/resin, the water-based primary ink is made. Then the property like viscosity, particle size is tested to discuss the relations between the pigment/resin and property of primary ink. Viscosity of ink samples were tested by rheometer. The relations between the pigment/resin and viscosity of primary ink were shown in Fig 1.



Pig1. The influence of pigment/resin to the viscosity of primary ink

The Pig1 shows that with the promoting of pigment/resin, the viscosity of primary ink is decreasing. The viscosity of primary ink is mainly influenced by two factors. One is the viscosity of ink vehicle and the other is the applied force between the pigment and resin. In this study the ink vehicle is the same, so the viscosity of ink vehicle is the factor to the viscosity of primary ink. With the promoting of pigment/resin, the dispersion resin is decreasing and the solvent is increasing. So the viscosity of the ink vehicle is minishing, the viscosity of primary ink is decreasing.

Particle size of the samples is measured with S3500 laser particle analyzer. The relations between the pigment/resin and dispersity of primary ink were shown in Fig 2.

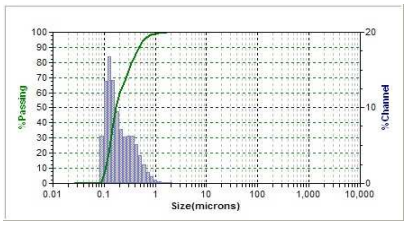


Pig2. The influence of pigment/resin to the dispersity of primary ink

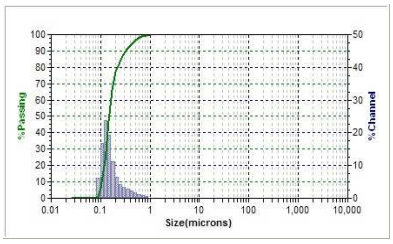
The Pig2 shows that with the promoting of pigment/resin, the dispersity of primary ink is becoming better and then turning worse. When the pigment/resin is 1.5:1, the particle size is smallest. Because the dispersing process is a shear flowing course, the effective shearing action is obtained when the dispersing ink is at the best flow point[4].The results of this study show that when the pigment/resin is 1.5:1, the viscosity of ink and the force between pigment and resin is appropriate. The status of ink is equal to be dispersed, the effect of dispersity is the best.

The influence of the dispersing agent to the dispersity of primary ink

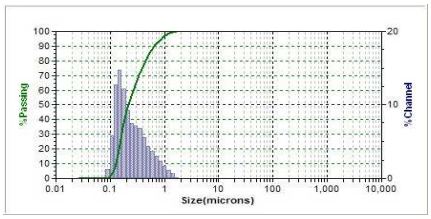
Generally speaking, particle dispersion needs the dispersing agent which can absorb, react and cover or envelope the surface of grain. So the dispersing agent is very important to the particle grain dispersion. In this study, the dispersing agents Tego 710,750,760 are selected according to the water-based system. The test results of particle size are shown as the pig3（a）、（b）、（c）.



(a)



(b)



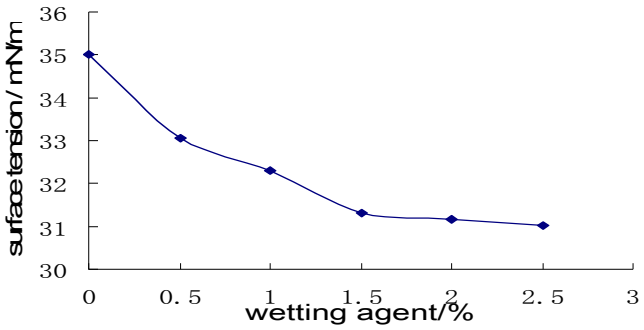
(c)

Pig3.The influence of the dispersing agent to the particle size of primary ink

Molecular structure of dispersing agent has two parts. One part is anchoring section which can absorb on the surface of pigment grain to prevent adsorptions. The other part is solvent chain which has favorable intermiscibility can form a thick sheath on the surface of pigment. The structures of the dispersing agent can influent the solution capability with dispersing medium and absorbability to particle surface. So the different dispersing agent has different dispersing effect to the dispersing system. In this study, three dispersing agents are added to the primary ink, the dispersing 750 can obtain better particle size.

The influence of the wetting agent to the surface tension of primary ink

Surface tension acts on the surface of liquid which is generated by the imbalanced molecular attraction. When the surface tension of ink is large, the ink droplet can be round easily. But the surface of nozzle can not be wetted easily when the surface of the water-based ink-jet is too large. And the wetting and permeate of printing stock and dryness of ink are also be influence. The drop is unsteady to be star spurting point and non-verbal visual is dirty to influent imaging quality when the surface tension of the water-based ink-jet is too low. So the surface tension of the water-based ink-jet should be controlled. Ink can not only spread on the substrates but also form fine droplet in the ink-jet process[5].Wetting agent as one surfactant can change the surface tension of the water-based ink-jet. The primary ink was added the wetting agent 245 and tested the surface tension. The test results are shown as the pig4.

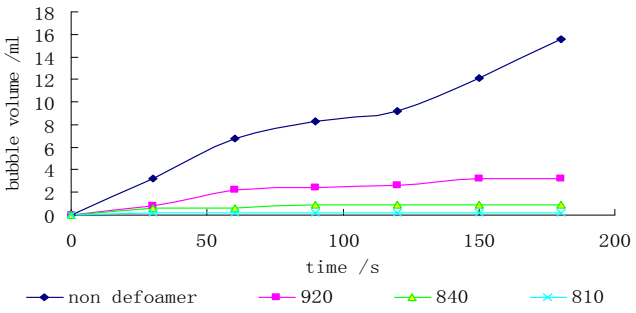


Pig4. The influence of the wetting agent to the surface tension of primary ink

In the pig4, the surface tension of primary ink is decreasing with the wetting agent increasing. The wetting agent can absorb on the surface of pigment and can reduce the surface energy between the dispersion medium and pigment. And then the dispersing system can be steady status and low the surface tension with the wetting agent. The test results shows that when the wetting agent is added less than 1.5%, the surface tension of ink is decreasing with the wetting agent increasing. When the wetting agent is added more than 1.5%, the density of wetting agent is the critical micelle concentration, the surface tension of ink is not changing obviously.

The defoaming effect of water-based ink of defoamer

The water is the main solvent of water-based system, the system with high surface tension forms bubble easily. So in this study the defoaming effect of water-based ink of defoamer is discussed. The different kinds of deforamers are selected, and the defoaming effect is tested. The tested results are shown in the pig5.



Pig5. The defoaming effect of water-based ink of defoamer

Generally speaking, the foam is two-phase foam or three-phase foam. The two-phase foam is formed by liquid membrane and gas, three-phase foam is constructed of liquid membrane, solider power and gas .In this study, the defoamer is the polyether modified siloxane. The test results in the pig5 shows that 845 has a bad defoaming effect, the result of 840 is better but the foam is increasing with time extent. The defoaming effect is best of 810, the volume of foam is smallest and the defoaming persistence is steady in the test time.

Conclusions

1. When the content of pigment is fixed in the primary ink, the pigment/resin is promoting and the viscosity of water-based plastic primary ink is increasing.
2. When the pigment/resin is 1.5:1, the effective shearing action is obtained and the particle size of primary ink is the smallest.
3. It is a certain influence of dispersing agent to the dispersity of primary ink. And the particle size is small and particle distribution is narrow, when the 750 dispersing agent is used in the primary ink.
4. The wetting agent can lower the surface tension with the wetting agent. When the wetting agent is added more than 1.5%, the surface tension of ink is not changing obviously.
5. The polyether modified siloxane defoamer has a certain influence to the defoaming effect of water-based ink. 810 has the best defoaming effect.

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