

The Effect of Surface Structure and Performance of Cotton Fabric on the Resolution of Ink-Jet Printing

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Abstract

Pure cotton knitted fabric is deeply loved by the people because of its good water absorption, breathability and comfort. Meanwhile, jet printing technology is a new printing method with broad development prospect. Therefore, in order to explore what kind of cotton knitted fabric can get good effect of inkjet printing, we measured the capillary effect hydrophilic, contact angle and glossiness of the 135 g/m², 140 g/m² and 160 g/m² in three different specifications of cotton knitted fabric, with seven different colors of jet printing, after the comparison of color characteristic values.

The results showed that when the amount of ink is 100%, the printing effect of 160 g/m² cotton knitted fabric is the best and when the amount of ink is 50%, the printing effect of 140 g/m² cotton knitted fabric is the best

Introduction

Knitted fabric from other fabrics have better moisture absorption, air permeability, flexibility, handle, can meet the requirements of people to the clothing wearing stick put oneself in comfortable, therefore widely used in underwear, sportswear, etc., are popular among people. Nowadays, the output of knitted fabric is almost the same as that of woven fabric. Therefore, the development of pure cotton knitted fabric printing products has a broad market prospect.

Up to now, many scholars have carried out in-depth research on printing technology in order to obtain high quality cotton knitted fabric products.

Materials and methods

Capillary effect

Three kinds of fabric were cut into 30cm*5cm (warp * weft) strips, two of which were used as samples. Sample bottom fixed weight about 3 g glass rod with a pin (made of fabric drape in glass rod under the action of gravity), above the glass rod on a horizontal line, perpendicular to the warp of the sample at the other end fixed on capillary effect machine cloth clip, adjust the horizontal level, make the horizontal line and the zero graduation of scale reading at the same level. Into the sink 0.5% potassium dichromate solution to the water, drop beam frame, make sample, horizontal rod zero and the water level three overlapping, start time, stay time after 30 min, measuring each sample liquid immediately higher level. If the height of the liquid rises is uneven, take the lowest point and record it (in cm), and take the average gross effect of the two samples as the gross effect value of the samples.

Moisture regain

Three pieces of fabric of the three different specifications to be tested were randomly sampled, which was controlled to about 10g as far as possible. The weight difference between samples should be as small as possible. Weigh the sample and

record its weight by serial number. It is wet weight. Then put the samples into the oven drying (temperature of 120 degrees Celsius), until they are constant weight test sample (every 10 min after each weighing, according to two consecutive weighing the weight of the difference is not more than 0.1%), records at this time, the weight of the dry weight. The serial Numbers of each fabric were recorded in sequence and the moisture regain was calculated

Contact angle

The syringe with a concentration of 50 l was fixed on the fixed seat and a certain amount of glycerine solution was absorbed. Cut the cloth sample into about 2cm*2cm (warp * weft) size and fix it on the glass slide. Pay attention to keeping the fabric surface smooth. Put the slide on the sample table, move the sample table and adjust the focal length until a clear image of the needle and fabric surface can be seen on the computer screen. When the droplet touches the fabric, press the ok button, and then click the automatic measurement. The degree of contact Angle between the left and right sides can be obtained respectively. Each fabric is measured three times and the final average is taken.

Glossiness

Press the switch of the gloss meter and calibrate the instrument with the standard whiteboard and blackboard. The cloth sample can be measured after calibration. Aim the instrument window at the cloth sample, press the measurement button, randomly select five positions on the cloth sample for measurement, and take the average value.

Results and discussion

Capillary effect

Capillary effect can be used to measure moisture absorption of fabrics.

All three fabrics have been starched before printing. As can be seen from figure 1, cotton knitted fabrics with a specification of 140g/m² have the worst capillary effect, that is, the best sizing situation.

Cotton knitted fabrics with specifications of 135g/m² and 160g/m² have little difference in gross efficiency.

The wool effect is too good, easy to cause the color of the printing light, so that the improvement of the dye ability is reduced, especially black.

After sizing, the fabric can absorb faster and better accommodate the ink sprayed on the fabric, greatly reducing the ink infiltration from the printing position to the surrounding, and achieving good printing effect.

But excessive size will change as the blocking agent between ink and fabric, prevent ink dye penetration to the inside fiber, permeability will be uneven, this will cause poor

fastness of printing part, designs for uneven color, serious when there will be "bottom" phenomenon happened ;

Assuming that the sizing conditions do not exceed the most suitable amount of sizing, the printing effect of pure cotton knitted fabric with the specification of 140g/m² should be the best, i.e. the highest resolution.

However, it cannot be ignored that when the knitted fabric is subjected to the downward force of the weight, a certain degree of hem will occur, causing the fabric to deform and making the gross efficiency inaccurate.

The drip method was tried, but the drop stretched over the fabric too fast for less than a second, so it could not be concluded by the drip method.

Moisture regain

Fiber absorbent and have all sorts of physical properties and appearance form of relationship, visible moisture absorption on the importance of the textile material, so is our water imbibition in testing the indicators of fiber, yarn and fabric should be considered an important indicator.

According to the experimental results and the data of correlation, it is found that the results of moisture regain test of the three fabrics are generally low.

As shown in Figure 2

Under the same conditions, the water absorption and moisture regain of the three cotton knitted fabrics of different specifications were ranked as 160g/m² > cotton knitted fabric 140g/m² > pure cotton knitted fabric 135g/m².

The water absorption of fabrics mainly depends on the moisture absorption capacity of raw materials and the structure of yarns and fabrics.

The fiber of three kinds of pure cotton knitted fabric is cellulose fiber, and the structure is all coil structure.

The difference in their ability to absorb water is due to the difference in weight per unit area of fabric, that is, the amount of fiber per unit area.

High moisture return rate and good water absorption of fiber per unit area;

Low moisture return rate and poor water absorption of fiber per unit area.

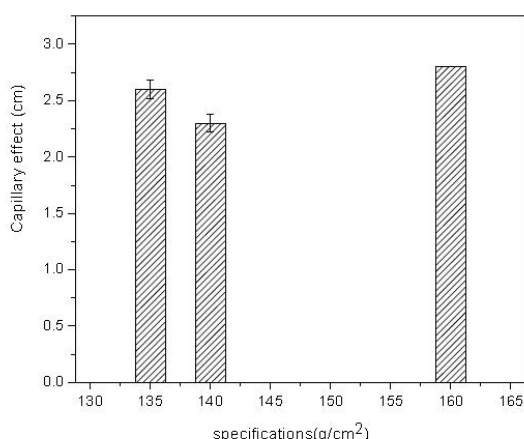


Figure 1. Capillary effect of 3 cotton knitted fabrics

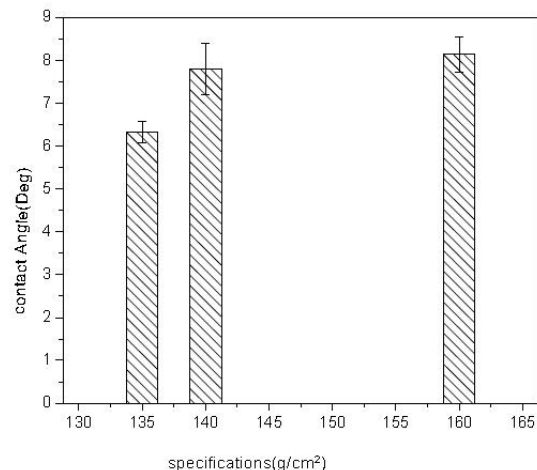


Figure 2. Contact angle of 3 cotton knitted fabrics

Glossiness

When measuring glossiness, high gloss surface (20 °), small Angle measurement data from the table, when the low Angle of three kinds of cloth sample glossiness were small and value is very small, so the switch to high Angle (60 °) of the three kinds of fabric to test glossiness, as you can see a star among the numerical difference, but the number is still small. Through referring to the literature, it is understood that this is mainly because of the coil structure of knitting. The bending of the fiber in the coil structure increases the diffuse reflection light, thus reducing the luster of the fabric surface

Color characteristic value

The L* value indicates lightness from 0 (black) to 100 (white).

Said red when a* is positive, negative, said green, b* said yellow when positive, negative, said negative, C* for the corresponding saturation, h° corresponding color.

Saturated colors have higher a* and b* coordinates, and higher C* values.

Since the L* value is not much different, within 10, we can use C* to compare the depth of the above seven colors.

According to the above-mentioned data, three kinds of pure cotton knitted fabric on seven are identical to the amount of ink printing ink C* value, from small to large order (that is, the color saturation from high to low) followed by orange, magenta, yellow, green, blue, black and dark.

For cyan with the highest viscosity, the color depth of both types of inks was 160 g/m² at the deepest, 140 g/m² at the second, and 135 g/m² at the lightest.

Magenta, orange and baolan are the deepest at 160 g/m², followed by 140 g/m², and 135 g/m².

When the amount of ink was 50%, the color saturation of 140 g/m² pure cotton knitted fabric was the highest, followed by 160g/m² pure cotton knitted fabric, and 135 g/m² pure cotton knitted fabric was the lightest.

When the amount of black ink was 100%, 160g/m² was the deepest, 140 g/m² was the second, 135g/m² was the shallowest, but 140 g/m² was the deepest when the amount of black ink was 50%, 135g/m² was the second, and 160g/m² was the shallowest.

Magenta orange, royal blue and black, in a low amount to ink, 140 g/m² of pure cotton knitted fabric printing effect is best, but the fabric gram weight low, before to ink quantity 100% fabric to saturated color, more than 160 g/m² of pure cotton knitted fabric printing effect more than 140 g/m², pure cotton knitted fabric, printing effect is best.

Yellow to 100% amount of ink in the deepest 140 g/m², 160 g/m², the most shallow, 135 g/m² to 50% amount of ink in the deepest 140 g/m², 135 g/m², the most shallow, 160 g/m² under the two amount to ink is 140 g/m², printing effect is best, on the ink quantity to rise to 100% before 135 g/m² saturated, so the 160 g/m² of the printing effect to ink is 100% when fabric is better than that of 135 g/m².

Dark to 100% amount of ink in the deepest 140 g/m², 135 g/m², the most shallow, 160 g/m² to 50% amount of ink in the deepest 160 g/m², 140 g/m², the most shallow, 135 g/m² to ink is high, 140 g/m² fabric printing effect is good, to the ink is low, 160 g/m² of fabric printing effect is good.

Table 1 glossiness of 3 kind of cotton knitted fabric

Specifications g/m ²)	135	140	160
20°	0.6	0.6	0.7
60°	1.7	1.8	2.1
80°	0.7	0.7	0.8

Table 2. Color characteristic value of 135g/m²

Color characteristic value	L*	a*	b*	C*	h°
Somber	65.18	-3.83	-4.06	6.04	237.4
azaleine	65.19	+20.48	-10.74	24.65	331.7
cyan	70.32	-12.93	-12.78	19.06	227.1
yellow	78.95	-4.14	22.23	22.36	99.83
orange	73.25	13.66	24.93	27.77	59.78
Borland	72.26	-2.94	-10.40	11.46	258.1
black	62.97	-2.77	-6.32	7.71	252.7

Table 3 Color characteristic value of 140g/m²

Color characteristic value	L*	a*	b*	C*	h°
Somber	62.31	-3.81	-4.23	6.26	238.3
azaleine	61.79	25.18	12.85	28.78	332.1
cyan	71.47	-13.64	13.56	19.91	227.2
yellow	78.38	-4.66	+26.21	26.39	99.20
orange	72.36	+17.15	+32.36	36.23	60.77
Borland	72.00	-3.07	-13.34	13.72	260.5
black	61.85	-2.87	-6.87	8.16	254.1

Table 4 Color characteristic value of 160g/m²

Color characteristic value	L*	a*	b*	C*	h°
Somber	61.00	-3.81	-4.11	5.94	237.0
azaleine	62.06	25.82	+13.38	30.52	332.9
cyan	71.76	-14.04	-13.87	20.21	226.9
yellow	82.32	-4.28	+26.88	25.50	78.79
orange	72.62	+17.48	+33.10	36.91	61.02
Borland	71.11	-3.18	-13.70	14.10	260.1
black	61.89	-3.01	-7.28	8.57	253.2

Conclusions

(1) under the printing conditions of 30V printing voltage, 30000Hz printing frequency and 1 PASS, printing with the same ink on the same fabric increases with the amount of ink given, and the printing effect first rises and then decreases.

(2) voltage 30 v in printing, printing 30000 hz frequency, 1 PASS printing conditions, printed on the same fabric, color is from deep to shallow orange, magenta, yellow, blue, sapphire blue, black, dark, and the viscosity of cyan, orange, magenta, and surface tension of the yellow ink printing color depth.

(3) the voltage 30 v in printing, printing frequency 30000 hz, 1 PASS printing conditions, to ink quantity was 100%, in the seven kinds of ink used for hydrophilic contact Angle gloss is one of the best 160 g/m², pure cotton knitted fabric printing effect is best, and give the ink amount was 50%, in the seven kinds of ink, Mao Xiao worst sizing best hydrophilic contact Angle is larger, 140 g/m² of pure cotton knitted fabric printing effect is best.

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