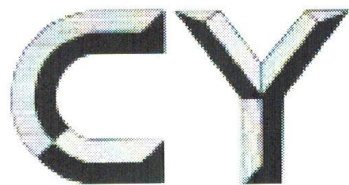


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**Screen printing — Application requirements and testing methods of
eco-friendly water-based printing paste**

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Foreword

This standard is prepared according to the drafting rules of GB/T 1.1-2009.

Please note that certain contents of this document may involve patents. The issuing agencies of this document do not bear the responsibility of identifying these patents.

This standard was proposed by and is under the jurisdiction of Subcommittee 2 on Screen Printing of National Technical Committee 170 on Printing of Standardization Administration of China (SAC/TC 170/SC2) .

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Screen printing — Application requirements and testing methods of eco-friendly water-based printing paste

1 Scope

This standard specifies the terms and definitions of eco-friendly water-based printing paste, the requirements of printing paste, printing process requirements, and the requirements of the finished products and the inspection methods.

This standard is applicable to the screen printing of cotton fiber weft knitted fabrics, screen printing of other fibers and structural fabrics can refer to use.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version is applicable to this document. For undated references, the latest edition (including all amendments) referred to applies.

GB/T 2912.1 Textiles-Determination of formaldehyde-Part 1:Free and hydrolyzed formaldehyde(water extraction method)

GB/T 3920 Textiles-Tests for colour fastness-Colour fastness to rubbing

GB/T 3922 Textiles-Tests for colour fastness-Colour fastness to perspiration

GB/T 3921—2008 Textiles -Tests for colour fastness -Colour fastness to washing with soap or soap and soda

GB/T 5713 Textiles-Tests for colour fastness-Colour fastness to water

GB/T 7568.2 Textiles-Tests for colour fastness-Standard adjacent fabrics-Part 2:Cotton and viscose

GB/T 7573 Textiles-Determination of pH of aqueous extract

GB/T 17593 Textiles - Determination of heavy metals

GB/T 18886 Textiles--Tests for fastness--Colour fastness to saliva

GB/T 20385 Textiles - Determination of organotin compounds

GB/T 20388 Textiles-Determination of the phthalate content-Tetrahydrofuran method

GB/T 23322 Textiles-Determination of surfactant-Alkylphenol ethoxylates

GB/T 28190 Textiles-Determination of dimethyl fumarate

GB/T 28189 Textiles-Determination of polycyclic aromatic hydrocarbons

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1

Water-based printing paste

With organic polymer as the basic material and water as the slurry material of dispersed phase, solid adhesive film with strong elasticity and continuous elasticity can be formed through screen printing on fiber textiles.

3.2

Surface Anti-stickness

After full drying and curing, the printing film has the ability to resist sticky surface.

3.3

Color fastness

The color of the textile printing film resists the resistance of various effects.

3.4

Washing fastness

The ability of printed adhesive film to withstand change after printing textile washing.

4 Technical requirements

4.1 Printing paste requirements

4.1.1 Environmental requirements

The environmental protection requirements for water-based printing paste are shown in Table 1.

Table 1 Environmental Requirements for Water-based Printing Paste

Item		Unit	Infant supplies	Direct contact with skin products	Non direct contact with skin products	Decorative materials
pH		—	4.0~7.5	4.0~7.5	4.0~9.0	4.0~9.0
formaldehyde	≤ free	mg/kg	20	75	300	300
extractable heavy metals	≤ antimony	mg/kg	30.0	30.0	30.0	—
	arsenic		0.2	1.0	1.0	1.0
	lead		0.2	1.0	1.0	1.0
	cadmium		0.1	0.1	0.1	0.1
	chromium		1.0	2.0	2.0	2.0
	chromium(hexavalent)		below detection limit ^b			
	cobalt		1.0	4.0	4.0	4.0
	copper		25.0	25.0	25.0	25.0
	nickel		1.0	4.0	4.0	4.0
	mercury		0.02	0.02	0.02	0.02

Table 1 (Continued)

Item	Unit	Infant supplies	Direct contact with skin products	Non direct contact with skin products	Decorative materials	
phthalatesa ≤	di-iso-nonylphthalate (DINP), di-n-octylphthalate (DNOP), di-isodecylphthalate (DIDP), butylbenzylphthalate (BBP), dibutylphthalate (DBP), di-isobutylphthalate (DIBP), di-n-hexylphthalate (DEHP), (total)	%	0.1	0.1	0.1	0.1
Organotin compound ≤	tributyltin compound (TBT)	mg/kg	0.5	1.0	1.0	1.0
	triphenyltin compound (TPHT)		0.5	1.0	1.0	1.0
	dibutyltin compound (DBT)		1.0	2.0	2.0	2.0
alkylphenol ethoxylates ≤	octaphenylPolyoxyethylene OP(EO)1-20, polyoxyethylene nonyl phenyl ether NP(EO)1-20 total	mg/kg	100	250	250	250
dimethyl fumarate (DMF) ≤	mg/kg	0.1				
polycyclic aromatic hydrocarbons (PAH) totala ≤	mg/kg	5	10	10	10	
benzoapyrene (BAP) a ≤	mg/kg	0.5	1.0	1.0	1.0	
^a : The list of specific substances is shown in Appendix A, Appendix B. ^b : The qualified limit value of chromium (hexavalent) is 0.5 mg/kg.						

4.1.2 Stability

From the date of production, the original packaging of the product is stored at a temperature of (5~35) °C, ventilated, dry and sunless environment for a year without any change in its appearance or performance.

4.1.3 Dispersibility

There is no visual white particles on the surface of the printing film.

4.2 Printing process requirements

4.2.1 Environmental requirements

4.2.1.1 Temperature: $25\text{ }^{\circ}\text{C}\pm 10\text{ }^{\circ}\text{C}$.

4.2.1.2 Relative humidity: $60\%\pm 10\%$.

4.2.1.3 Ventilation: good ventilation.

4.2.2 Screen requirements

4.2.2.1 Mesh: (40 ± 10) mesh / cm.

4.2.2.2 Screen tension: $\geq 18\text{ N/cm}^2$.

4.2.3 Operational requirements

Scratch-print more than 2 times, each time the surface of the film is dry.

4.2.4 Print post-processing requirements

After scraping and printing, it is fully dried and fixed.

4.3 Printing finished product requirements

4.3.1 Color fastness

The color fastness of the printing finished products is shown in Table 2.

Table 2 requirements for color fastness of printing finished products

The unit is level

Item		Infant supplies	Direct contact with skin products	Non direct contact with skin products	Decorative materials
Color fastness	Water resistance (discoloration, staining) \geq	3	3	3	3
	Acid perspiration (discoloration, staining)	3~4	3~4	3~4	3~4
	Alkali perspiration (discoloration, staining)	3~4	3~4	3~4	3~4
	Dry friction \geq	4	4	4	4
	Wet friction \geq	3	3	3	3
	Saliva resistance (discoloration, staining) \geq	4	—	—	—

4.3.2 Wash fastness

After the test, the printing film has no adhesion, discoloration, defect, shedding, cracking, etc.

4.3.3 Surface anti stickiness

After the test, the printing film has no breakage and color staining.

5 Testing method

5.1 Printing sample preparation

5.1.1 Sample preparation conditions

5.1.1.1 Standard cloth: GB/T 7568.2 provides standard cotton lining fabric, and in line with the requirements of environmental indicators in Table 1. When testing the environmental indicators in Table 1, first test the standard cloth according to the corresponding test methods in this standard, and then eliminate the influence of the standard cloth on the corresponding environmental indicators before making the printing samples.

5.1.1.2 Standard Screen: (40 ± 10) mesh / cm.

5.1.1.3 Standard test version: 200 mm × 200 mm field printing sample.

5.1.2 Printing steps

5.1.2.1 Non color printing sample preparation

Use Shore hardness HA 65 right angle knife plastic squeegee, scratch a total of 2 times, the first consecutive scraping 2 times, after the surface is dry, and then scraping 2 times, drying again, after 140 °C tunnel drying 2min, to achieve comprehensive drying and curing.

5.1.2.2 Tint (red) printing sample preparation

Add a bright red printing paste with a mass fraction of 5% in the mortar, and stir it evenly. Use Shore hardness HA 65 right angle knife plastic squeegee, scratch a total of 2 times, the first consecutive scraping 2 times, after the surface is dry, and then scraping 2 times, drying again, after 140 °C tunnel drying 2min, to achieve comprehensive drying and curing.

5.1.2.3 Tint (black) printing sample preparation

After the transparent glue and white glue are fully mixed according to the mass ratio of 4: 1, a mass fraction of 5% black coating color paste is added to the mixed slurry. Use Shore hardness HA 65 right angle knife plastic squeegee, scratch a total of 2 times, the first consecutive scraping 2 times, after the surface is dry, and then scraping 2 times, drying again, after 140 °C tunnel drying 2min, to achieve comprehensive drying and curing.

5.1.3 Sampling range

The printed sample should be sampled in the area of 200 mm × 200 mm printing film.

5.2 Determination of pH

The determination of pH value is made by 5.1.2.1 method, and is carried out according to GB/T 7573.

5.3 Determination of formaldehyde

The determination of formaldehyde is made by 5.1.2.1 method, and is carried out according to GB/T 2912.1.

5.4 Determination of extractable heavy metals

The determination of extractable heavy metals is made by 5.1.2.1 method, and is carried out according to GB/T 17593.

5.5 Determination of phthalates

The determination of phthalates is made by 5.1.2.1 method, and is carried out according to GB/T 20388.

5.6 Determination of organotin compounds

The determination of organotin compounds is made by 5.1.2.1 method, and is carried out according to GB/T 20385.

5.7 Determination of alkylphenol ethoxylates

The determination of alkylphenol ethoxylates is made by 5.1.2.1 method, and is carried out according to GB/T 23322.

5.8 Determination of dimethyl fumarate

The determination of dimethyl fumarate is made by 5.1.2.1 method, and is carried out according to GB/T 28190.

5.9 Determination of polycyclic aromatic hydrocarbons

The determination of polycyclic aromatic hydrocarbons is made by 5.1.2.1 method, and is carried out according to GB/T 28189.

5.10 Determination of colour fastness to water

The determination of colour fastness to water is made by 5.1.2.2 method, and is carried out according to GB/T 5713.

5.11 Determination of colour fastness to acid and alkali perspiration

The determination of colour fastness to acid and alkali perspiration is made by 5.1.2.2 method, and is carried out according to GB/T 3922.

5.12 Determination of colour fastness to dry and wet friction

The determination of colour fastness to dry and wet friction is made by 5.1.2.2 method, and is carried out according to GB/T 3920.

5.13 Determination of colour fastness to saliva

The determination of colour fastness to saliva is made by 5.1.2.2 method, and is carried out according to GB/T 18886.

5.14 Wash fastness

Prepare samples according to the method in 5.1.2.2 and wash them twice according to the conditions of 7.2 B (2) of GB/T 3921-2008 without interlining.

5.15 Surface anti-stickness

5.15.1 Sample preparation

Prepare two samples according to the method in 5.1.2.1 and 5.1.2.2.

5.15.2 Instruments and equipment

5.15.2.1 Constant temperature and humidity drying oven

5.15.2.2 Stainless steel frame: meet the requirements of GB/T 3922.

5.15.3 Test conditions

5.15.3.1 The temperature of the constant temperature and humidity test oven: (80 ± 2) °C.

5.15.3.2 Relative humidity: $(60 \pm 5)\%$.

5.15.4 Test steps

5.15.4.1 The two kinds of sample printing film are stacked face to face to form a combined sample.

5.15.4.2 With a stainless steel frame, the combined sample was tested, and it was subjected to 12.5 kPa, which was placed in the constant temperature and humidity test oven of 5.15.3, and placed 24 h consecutively.

5.15.4.3 Analysis result expression

Open the combination of samples, each paste the printing film can be separated and no damage, no staining that passed the test.

5.16 Dispersibility

5.16.1 Sample preparation

Test samples are prepared according to the method in 5.1.2.3.

5.16.2 Test steps

The sample is folded 180 °, the reciprocating friction rubbing against each other two times, and then observe the surface of the sample film.

Appendix A
(Normative appendix)

The table of the Chinese and English names of phthalates

Table A.1 The table of the Chinese and English names of phthalates

Serial number	Chinese name	English name
1	邻苯二甲酸二异壬酯(DINP)	Di-iso-nonylphthalate
2	邻苯二甲酸二正辛酯 (DNOP)	Di-n-octylphthalate
3	邻苯二甲酸二异癸酯(DIDP)	Di-isodecylphthalate
4	邻苯二甲酸丁苄酯(BBP)	Butylbenzylphthalate
5	邻苯二甲酸二丁酯(DBP)	Dibutylphthalate
6	邻苯二甲酸二异丁酯(DIBP)	Di-isobutylphthalate-
7	邻苯二甲酸二正己酯(DEHP)	Di-n-hexylphthalate

Appendix B
(Normative appendix)

The table of the Chinese and English names of polycyclic aromatic hydrocarbons (PAH)

Table B.1 The table of the Chinese and English names of polycyclic aromatic hydrocarbons (PAH)

Serial number	Chinese name	English name
1	芴	Acenaphthene
2	芴烯	Acenaphthylene
3	蒽	Anthracene
4	苯并(a)蒽	Benzo(a)anthracene
5	苯并(b)荧蒽	Benzo(b)fluoranthene
6	苯并芘	Benzo(e)pyrene
7	苯-(ghi)北(二萘嵌苯)	Benzo(ghi)perylene
8	苯并(k)荧蒽	Benzo(k)fluoranthene
9	二苯并(a,h)蒽	Dibenz(a,h)anthracene
10	荧	Fluoranthene
11	芴	Fluorene
12	茚苯(1,2,3-cd)芘	Indeno(1,2,3-cd)pyrene
13	萘	Naphthalene
14	菲	Phenanthrene
15	芘	Pyrene
16	屈	Chrysene

References

- [1] GB 18401—2010 National general safety technical code for textile products
 - [2] GB/T 18885—2009 Technical specifications of ecological textiles
 - [3] OEKO-TEX® Standard 100
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