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(54) **Cloth for ink-jet printing and ink-jet printing process.**

(57) The invention relates to a cloth for ink-jet printing deposited with a water-insoluble water-absorbing resin having a water absorption capability of 50 to 1,000 ml/g, and an ink-jet printing process comprising the steps of providing the printing cloth with a printing ink by an ink-jet process, plus heating and fixing, and cleaning.

The cloth for ink-jet printing of the invention can be printed at high reproducibility, with excellent sharpness and build-up of the printing image.

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The present invention relates to a cloth capable of obtaining a printing image of excellent sharpness and build-up by applying printing ink by an ink-jet process, and an ink-jet printing processing using the same cloth.

Recently, in the printing field, pattern printing by the ink-jet process has been developed. That is, in this method, the original pattern is read by the sensor, and is processed by computer and converted into an electric signal, and the printing solution containing dye is discharged from the ink-jet nozzle to print on the cloth. It was, however, a serious problem that a sharp and favorable printing image could not be obtained because, in the ink-jet printing process, blurring or running of ink occurs when the printing ink is applied on the cloth, and thus the resolution is lowered. A method is proposed, for example, to solve these problems, in which the cloth is pretreated with a compound substantially not dyeable with the ink to be used, selected from a group consisting of water soluble polymer, water soluble salts, and water insoluble inorganic fine powder; ink-jet printing is then performed (Japanese Patent Publication No. 31594/1988).

When printing, the ink and printing condition suitable for the type of fiber of the cloth used in printing must be adjusted carefully. In the above-mentioned proposed prior arts, however, it is very difficult to print with superior sharpness, build-up and reproducibility in ink-jet printing of various fibers.

It is hence a primary object of the invention to provide a cloth for ink-jet printing capable of printing with favorable reproducibility and excellent sharpness and build-up. It is another
object of the invention to introduce an ink-jet printing process providing excellent sharpness and build-up.

Those objects have been achieved by the surprising finding that the improved printing as mentioned above is possible by using a specific water-insoluble water-absorbing resin.

More specifically, the invention relates to a cloth for ink-jet printing, wherein 0.01 to 10 % by weight of a water-insoluble water-absorbing resin having a water absorption capability of 50 to 1,000 ml/g to purified water is deposited on said cloth; and an ink-jet printing process of cloth comprising the steps of depositing 0.01 to 10 wt.% of the the above mentioned water-insoluble water-absorbing resin to the cloth, applying printing ink by the ink-jet process, heating and fixing the printing ink, and washing and removing the water-insoluble water-absorbing resin.

According to the invention, the water-insoluble water-absorbing resin may be composed of ① resins obtainable by polymerizing, (a) starch or cellulose, (b) a water-soluble monomer having a carboxyl group or a sulfonic acid group and/or a monomer capable of becoming water-soluble through hydrolysis (hereinafter, designated as a water-soluble monomer) and (c) a crosslinking agent and subsequently carrying out, if necessary, hydrolysis (hereinafter, ① is designated as a starch or cellulose series crosslinking material).

Details of the components (a), (b) and (c) used for producing the water-insoluble water-absorbing resins noted above and the proportions of the components (a), (b) and (c), method of production and specific examples of the water-insoluble water-absorbing resins, are described in Japanese Patent Application Laid-Open No. 25886/1977 and Japanese Patent Publication No. 46199/1978, No. 46200/1978 and No. 21041/1980.

Examples of (a) include raw starches such as sweet potato starch, potato starch, wheat starch, corn starch, rice starch, and tapioca starch; processed starch such as oxidized starch, dialdehyde starch, alkyl etherized starch, oxy alkylated starch, amino ethyl etherized starch, and cyano ethyletherized starch; and celluloses such as natural cellulose, carboxymethyl cellulose, and cellulose ether.

Examples of (b) include monomers possessing a carboxy group such as (meth)acrylic acid and maleic anhydride; monomers possessing a carboxylate group such as sodium (meth)acrylate, sodium maleate, trimethylamine salt of (meth)acrylic acid, and triethanol amine salt of (meth)acrylic acid; monomers possessing a sulfonic acid group such as vinyl sulfonic acid, vinyl toluene sulfonic acid and sulfopropyl (meth)acrylate; and monomers possessing a sulfonate group such as sodium vinyl sulfonate, methyl amine salt of vinyl sulfonic acid, and sulfopropyl diethanol amine salt of (meth)acrylic acid.

Examples of (c) include polyols such as ethylene glycol and trimethylol propane; bisacrylamides such as N,N-methylene-bisacrylamide; multifunctional (meth)acrylic esters such as ethylene diglycol di(meth)-acrylate, polyethylene glycol di(meth)acrylate, and trimethylol propane tri(meth)acrylate; methylol (meth)-acrylamide, and glioxazal.

In the description herein, "(meth)acrylic-" means "acrylic-" or "methacrylic-".

Examples of the water-insoluble water-absorbing resin other than those noted above, are ② those obtainable by polymerizing the components (a) and (b), e.g., hydrolyzed product of starch-acrylonitrile graft copolymer or hydrolyzed product of cellulose-acrylonitrile graft copolymer (hereinafter, ② is designated as a starch- or cellulose-acrylonitrile graft copolymer); ③ crosslinked material of (a) (e.g., crosslinked carboxymethylcellulose); ④ a copolymer of the components (b) and (c) (e.g., partially hydrolyzed product of crosslinked polyacrylamide, crosslinked acrylic acid-acrylamide copolymer, crosslinked sulfonated polystyrene, saponified vinylester-unsaturated carboxylic acid copolymer disclosed in Japanese Patent Applica-

tion Laid-Open No. 14689/1977 and No. 27455/1977, crosslinked polyacrylic acid or salts thereof, crosslinked acrylic acid-acrylic acid ester copolymer, cross linked isobutylene-maleic acid anhydride copolymer and crosslinked carboxylic acid denaturated polyvinyl alcohol); and ⑤ self-crosslinking polymerization product of the component (b) (e.g., self-crosslinkable polyacrylic acid salts). These water-insoluble water-absorbing resins may be used alone or in combinations of two or more.

Among the above examples of water-insoluble water-absorbing resins, ① and some of ④ such as the partially hydrolyzed product of crosslinked polyacrylamide, crosslinked acrylic acid-acrylamide copolymer, crosslinked polyacrylic acid salts (e.g., alkali metal salts, ammonium salts, etc.), crosslinked acrylic acid-acrylic acid ester copolymer, crosslinked isobutylene-maleic acid anhydride copolymer and crosslinked carboxylic acid denaturated polyvinyl alcohol, are preferable.

The preferable water-insoluble water-absorbing resins above are those having a water absorption capability with respect to pure water of 50 to 1,000 ml/g, preferably 100 to 900 ml/g. The shape of the water-insoluble water-absorbing resin is not limited specifically, but powder- or granule-like particles (usually of 5 mm or less in size) are preferable.

The ink-jet process employed in the invention may be achieved by discharging the printing ink effectively from the nozzle, and applying on the cloth - which is the object of ink-jet printing - and its typical methods have been disclosed, for example, in I.E.E.E. Transactions on Industry Applications, Vol. 1A-13, No. 1; and Nikkei Electronics, April 19, 1976 and February 3, 1977.

As those typical systems, the following methods (1) to (3) are known. (1) is an Electrostatic attraction system: a method in which a ferroelectric field is applied between a nozzle and an accelerating electrode disposed several millimeters ahead thereof; ink is granulated and drawn out of the nozzle successively, and the information signal is given to deflecting electrodes to record when the drawn ink particles jump between deflecting electrodes.

(2) is an Ultrasonic vibration system: a method in which high pressure is applied to the ink by a small pump, the nozzle is vibrated mechanically by a quartz oscillator or the like, and small ink particles are forcibly jetted out. The jetted ink particles are electrically charged depending on the information signal when the ink particles are jetted out. The charged ink particles are deflected depending on the amount of charge when passing through deflecting electrode plates.

(3) is a Piezoresistive element system: a method in which piezoresistive elements are utilized, that is, the piezoresistive elements are provided with electric signals to cause mechanical displacement, and pressure is applied to ink to jet out from the nozzle.

These various ink-jet systems themselves are known arts and thus are not explained specifically herein, and these systems can be applied to the invention with proper discretion.

The cloth in the invention may be woven cloth, knitted cloth or nonwoven cloth, including carpet material. Fiber materials used in the cloth may be arbitrary synthetic fibers (e.g. polyester, polyamide, acrylic fiber), semisynthetic fibers (e.g. acetate, rayon), natural fibers (e.g. cotton, silk, wool), and their mixtures (e.g. blended woven fabric, twisted union fabric, knit/textile union fabric) and all other fiber materials.

The printing ink used in the invention must contain a dye applicable to the cloth, and examples of dyes include acid dye, direct dye, reactive dye, cationic dye, and disperse dye.

The dye composing the printing ink must be changed depending on the fiber material to be used. For example, in case of fiber material composing the cloth being polyester or acetate fiber, a disperse dye is used to compose the printing ink.

In the case of the cloth made of wool, silk, polyamide, cotton, rayon, and other materials printable by anionic dye, a direct dye, acid dye, reactive dye, and other anionic dyes are applicable. For materials such as acrylic fiber and cationic dyeable polyester fiber, cationic dyes are used.

Disperse dyes include azo, anthraquinone, nitrodiphenylamine, naphthal imide, naphthoquinone imide, and metine types. Practical examples of these dyes are listed in pages 725-816 of the New Dye Handbook (published by Maruzen).

Direct dyes include azo, stylbene, thiazole, dioxsazine, and phthalocyanine types. Practical examples of these dyes are listed in pages 317-396 of the same Handbook.

Acid dyes include azo, anthraquinone, triphenyl methane, and xanthine types. Practical examples of these dyes are listed in pages 393-526 of the same Handbook.

Reactive dyes include azo, anthraquinone, and phthalocyanine types. Practical examples of these dyes are listed in pages 881-934 of the same Handbook.

Cationic dyes include practical examples of dyes listed in pages 529-562 of the same Handbook.

The printing ink may be designed to suit the individual ink-jet systems, and from the viewpoint of environmental protection and blurring or running on the cloth, a water-based ink, such as aqueous solution

of dye and water disperse solution of dye may be preferably used.

The ink is blended with additives as required, such as property-regulating agents (for adjusting viscosity, surface tension, electric conductivity, pH, etc.), antimold agents, sterilizers, chelating agents, and ink drying inhibitors. The ink drying inhibitor acts to prevent clogging of the ink-jet nozzle with ink, of which examples include polyols such as ethylene glycol and glycerin, N-alkyl pyrrolidone such as N-methyl pyrrolidone and N-ethyl pyrrolidone, ether compounds such as methyl cellosolve, ethyl cellosolve, and methyl carbitol, formamide derivatives such as N-cyclohexyl formamide and N,N-dibutyl formamide, and aralkyl alcohol such as benzyl alcohol and 1-phenyl ethyl alcohol.

In an example of the method of applying a water-insoluble water-absorbing resin to a cloth, firstly, the water-insoluble water-absorbing resin is dispersed in water or hydrophilic organic solvent (e.g. methanol, isopropyl alcohol, ethylene glycol, propylene glycol, dimethylformamide), or a mixed solution of water and hydrophilic organic solvent, and a disperse solution is prepared. Then, in any one of the pad method, spray method, coating method and printing method, the cloth is treated in the disperse solution, and dried. Where an anti-explosive device is provided, a disperse solution may be prepared by using an aromatic organic solvent (e.g. toluene, xylene).

The depositing weight of the water-insoluble water-absorbing resin is 0.01 to 10 wt.% of the cloth, and preferably 0.1 to 5 wt.%. If less than 0.01%, the blurring preventive effect of the printing ink is small, and a sharp printing image is not obtained. If exceeding 10 wt.%, the blurring preventive effect is increased, but the build-up of the printing image is extremely impaired, and thus is not desirable. That is, the dye deposit rate on the cloth is greatly diminished, and is not economical. (The build-up refers to the quantity rate of dye-deposition in the printing process; that is, a degree of dye exhaustion.)

In a practical example of the ink-jet printing process of the invention, first a disperse solution composed of water-insoluble water-absorbing resin is applied to the cloth, and dried to obtain the cloth for ink-jet printing of the invention. On this printing cloth, a printing ink is applied by an ink-jet printing machine. Next, to heat the dye applied to the cloth to develop color, it is processed by steaming or dry heat. The heat fixing condition of the dye varies with the kind of dye and the kind of cloth, and it is treated for 10 to 30 minutes at 100 to 130 °C in the case of steaming, and 1 to 5 minutes at 180 to 210 °C in the case of dry heat. Finally, soaping or reduction cleaning is effected to remove the unbonded dye and water-insoluble water-absorbing resin.

In the invention, when printing ink is applied on the cloth bonded with the water-insoluble water-absorbing resin by the ink-jet process, it is possible to print with excellent sharpness, build-up and reproducibility; the reason for this is discussed below.

In printing, sharpness and build-up depend on how to apply the dye on the cloth abundantly and sharply, and prevent migration of dye when heating and fixing. Incidentally, in the printing ink of the ink-jet process, as mentioned above, the medium is mostly water, and is an aqueous solution of water-soluble dye or a water dispersion solution of fine dispersed dye. The key point is how to absorb the ink on the cloth promptly regardless of the ink volume.

When the cloth for ink-jet printing of the invention is used, when the ink deposits on the cloth for printing, the ink is mostly absorbed promptly without blurring. This is explained by the ink being entrapped within the cross linked high molecular meshes of the water-insoluble water-absorbing resin, and migration is prevented, thereby forming a sharp print. Besides, since the water-insoluble water-absorbing resin is poor in affinity for these dyes, if the dye entrapped in the high molecular meshes is heated and fixed, it is not diffused in the water-insoluble water-absorbing resin, and migrates only to the fibers having greater affinity. Therefore, a sharp printing image is obtained.

On the other hand, in the method of the prior art using a water-soluble high polymer or water-soluble salts, when the ink is similarly bonded, it dissolves these compounds, is absorbed while diffusing; that is, the ink is absorbed while blurring, so that a sharp printing image may not be obtained. Furthermore, in the prior art of using water-insoluble inorganic fine particles, the ink is contained in the gaps of particles by the capillary phenomenon to achieve an absorption state. However, because of water insolubility of the inorganic fine particles, the rate of absorption is slow, and the amount of absorption is limited, and much is not absorbed. Therefore, the printing image is not only poor in build-up but also low in sharpness.

This is why the method of applying printing ink by the ink-jet process on the printing cloth of the invention bonded with water-insoluble water-absorbing resin is excellent in sharpness and build-up, as compared with the conventional method of using water-soluble high molecular materials, water-soluble salts and water-insoluble inorganic fine particles.

The invention is further described below by referring to some of the preferred embodiments, but it must be noted that the invention is not limited to these embodiments alone. Please note: in the following description, % denotes wt.%.

(Definitions)

1. Diffusion ratio

In ink-jet printing, this refers to the ratio of the dot diameter of the printed image of ink on the cloth to the diameter of jumping ink drops. The less ink blurs, the smaller the ratio becomes.

2. Sharpness

Geometrical patterns (cross stripes) were printed by the ink-jet printing process, and the sharpness was observed by the naked eye.

(Criterion of evaluation)

A: Printed and dyed without any blurring, with sharp fine lines of patterns.
B: Printed and dyed without blurring, with favorable patterns.
C: Printed and dyed with slight blurring, with unclear fine lines of patterns.
D: Printed and dyed with blurring, with fine lines of patterns not expressed.

3. Saturation

By solid printing and dyeing by the ink-jet process, the saturation (*C) was measured, and the differential saturation (Δ*C) was calculated. The differential saturation denotes the difference in saturation between printed cloths in the case of dyeing cloth bonded with water-insoluble water-absorbing resin and the case of dyeing cloth that is not bonded. A smaller value means the differential saturation is smaller.

4. Build-up

The lightness (L value) of the printed cloth which was mentioned at the above item 3 was measured by spectrophotometer ("Multi Spectro MSC-2" manufactured by Suga Sikenki Co., Ltd.), and the color depth was measured. A smaller value denotes deeper printing.

Example 1

Preparing 1% disperse solution of starch series crosslinked-type water-insoluble water-absorbing resin "SANWET IM-1000 MPS" (manufactured by Sanyo Chemical Industries, Ltd.), polyester textured yarn woven fabric was padded (pickup 50%), dried for 2 minutes at 100 °C, and a cloth for ink-jet printing was produced. The cloth was printed by the ink-jet process under the following conditions.

Composition of ink for ink-jet process:

SUMIKARON BRILLIANT BLUE S-BL (disperse dye, Sumitomo Chemical Co., Ltd.)	8 (parts by weight)
N-methyl pyrrolidone	10
Ethylene glycol	15
Ion exchange water	67
Total	100 (parts by weight)

Viscosity (mPa.s(cps), 25 °C): 8
Surface tension (mN/m (dyne/cm), 25 °C): 58.2
pH: 7.8

Ink-jet printing: (1) Printing

1) Ink-jet process: Ink on demand system
2) Nozzle diameter: 60 μm
3) Voltage applied: 50 V

(2) Coloring (heat treatment, reduction cleaning)

1) Heat treatment: 180 °C × 2 min, fixing treatment
2) Reduction cleaning:

Hydrosulfite	1 (g/l)
NaOH	1 (g/l)
"IONET RK-15"	1 (g/l)

(dyeing auxiliaries, Sanyo Chemical Industries, Ltd.)
80 °C × 20 min treatment, washing in water, drying

Example 2

A cloth for ink jet printing was prepared by using crosslinked polyacrylic acid (salt) water-insoluble water-absorbing resin ("AQUARIC CA-ML" of NIPPON SHOKUBAI CO., LTD.) instead of starch series crosslinked-type water-insoluble water-absorbing resin as in Example 1. The same ink-jet printing test as in Example 1 was conducted.

Example 3

A cloth for ink-jet printing was prepared by using crosslinked polyacrylic acid (salt) water-insoluble water-absorbing resin ("SANWET IM-5000" of Sanyo Chemical Industries, Ltd.) instead of starch series crosslinked-type water-insoluble water-absorbing resin as in Example 1.

Comparative Examples 1 and 2

A cloth for ink-jet printing was prepared by using 1% aqueous solution of gum arabic (Comparative Example 1) and montmorillonite (Comparative Example 2) instead of starch series crosslinked-type water-insoluble water-absorbing resin as in Example 1. The same ink-jet printing test as in Example 1 was conducted.

In the cloths for ink-jet printing in Examples 1 to 3, and Comparative Examples 1 and 2, the diffusion ratio was measured, and the sharpness, saturation (*C) and build-up (L value) of the printed cloths were measured, of which results are shown in Table 1.

Table 1

	Diffusion ratio	Sharpness	Differential saturation (Δ*C)	Build-up (L value)
Example 1	2.3	A	-2.3	26.3
Example 2	2.1	A	-2.5	25.8
Example 3	2.2	A	-2.6	26.0
Comparative Example 1	3.5	B or C	-7.3	33.3
Comparative Example 2	3.8	B or C	-6.5	34.0

From the results of evaluation in Table 1, the cloths for ink-jet printing of the invention can provide ink-jet images excellent in diffusion ratio, sharpness, saturation, and build-up. By contrast, in Comparative Examples 1 and 2, the diffusion ratio and sharpness were slightly lower compared with Examples of the invention, and the saturation and build-up were also inferior.

Example 4

1% disperse solution of starch series crosslinked-type water-insoluble water-absorbing resin, "SANWET IM-100 MPS" (manufactured by Sanyo Chemical Industries, Ltd.) was prepared. A cotton broad #80 was padded (pickup 80%), and dried for 2 minutes at 105 °C, and a cloth for ink-jet printing was prepared. The cloth was printed by the ink-jet process under the following conditions.

Composition of ink for ink-jet process:

KAYACION SCARLET P-RN (reactive dye, Nippon Kayaku Co., Ltd.)	10 (parts by weight)
Urea	10
Sodium carbonate	2
Glycerin	15
Ion exchange water	63
Total	100 (parts by weight)

Viscosity (cps/25 °C): 10
Surface tension (dyne/cm, 25 °C): 55.3
pH: 10.2

Ink-jet printing:

(1) Printing
1) Ink-jet method: Ink on demand system
2) Nozzle diameter: 60 μm
3) Voltage applied: 50 V
(2) Coloring (superheated steam treatment, reduction cleaning)
1) Superheated steaming: 130 °C × 3 min
2) Soaping: Dyeing auxiliaries "Granup QF-105K"
(Sanyo Chemical Industries, Ltd.)
80 °C × 20 min treatment, washing in water, drying

Example 5

A cloth for ink-jet printing was prepared by using crosslinked isobutylene-maleic anhydride copolymer water-insoluble water-absorbing resin ("KIGEL 201K" of KURARAY CO., LTD.) instead of starch series crosslinked-type water-insoluble water-absorbing resin of Example 4. The same ink-jet printing test as in Example 4 was conducted.

Example 6

A cloth for ink-jet printing was prepared by using crosslinked carboxylic acid denatured polyvinyl alcohol water-insoluble water-absorbing resin ("IGETAL P", Sumitomo Chemical Company, Ltd.) instead of starch series crosslinked-type water-insoluble water-absorbing resin of Example 4. The same ink-jet printing test as in Example 4 was conducted.

Comparative Examples 3 and 4

A cloth for ink-jet printing was prepared by using 1% aqueous solution of polyvinyl alcohol ("PVA 117" of KURARAY CO., LTD.) (Comparative Example 3) and $CaCl_2$ (Comparative Example 4) instead of starch series crosslinked-type water-insoluble water-absorbing resin of Example 4. The same ink-jet printing test as in Example 4 was conducted.

In the cloths for ink-jet printing in Examples 4 to 6, and Comparative Examples 3 and 4, the diffusion ratio was measured, and the sharpness, saturation (*C) and build-up (L value) of the printed cloths were measured, of which results are shown in Table 2.

Table 2

	Diffusion ratio	Sharpness	Differential saturation (Δ*C)	Build-up (L value)
Example 4	2.4	A	-3.2	32.4
Example 5	2.5	A	-3.5	33.5
Example 6	2.3	A	-3.7	31.9
Comparative Example 3	3.6	B or C	-7.6	40.2
Comparative Example 4	3.7	C	-7.9	43.3

From the results of evaluation in Table 2, the cloths for ink-jet printing of the invention (Examples 4 to 6) can provide ink-jet images excellent in diffusion ratio, sharpness, saturation, and build-up. By contrast, in Comparative Examples 3 and 4, the diffusion ratio and sharpness were slightly lower compared with Examples of the invention, and the saturation and build-up were also inferior.

Example 7

1% disperse solution (a mixed solution of water/ethylene glycol = 7/3 (ratio by weight)) of the same water-insoluble water-absorbing resin as in Example 1 was sprayed on a polyester cut-pile tufting carpet-base material, and dried by an infrared ray lamp to produce a carpet-base material for ink-jet printing (the deposit of water-insoluble water-absorbing resin: 0.3 wt.%). The carpet-base material was printed by the ink-jet process under the same conditions as in Example 1.

The obtained ink-jet printed carpet-base material was of high quality and had a differential saturation of -2.2, a build-up (L value) of 25.0, and sharpness of rank A.

By using the cloth for ink-jet printing of the invention, it is possible to print by the ink-jet process and achieve excellent sharpness, build-up and reproducibility. Accordingly, by the printing method of the invention, printed goods as valuable as the high grade printed goods of conventional roller printing or screen printing can be obtained.

Claims

1. A cloth for ink-jet printing, wherein 0.01 to 10 wt.% of a water-insoluble water-absorbing resin having a water absorption capability of 50 to 1,000 ml/g to purified water is deposited on the cloth.

2. The cloth according to
claim 1, wherein the water-insoluble water-absorbing resin has a water absorption capability of 100 to 900 ml/g to purified water.

3. The cloth according to claim 1 or 2,
wherein the water-insoluble water-absorbing resin is at least one selected from the group consisting of:
a water-insoluble water-absorbing resin obtained by polymerizing, as essential components, starch or cellulose (a), a monomer (b) selected from a monomer having a carboxyl group or sulfonic acid group and monomer made soluble in water by hydrolysis, and a crosslinking agent (c), or a water-insoluble water-absorbing resin obtained by further hydrolyzation; a partial hydrolyzate of crosslinked polyacrylamide; cross linked acrylic acid-acrylamide copolymer; crosslinked polyacrylic acid salt; crosslinked acrylic acid-acrylate copolymer; crosslinked isobutylene-maleic anhydride copolymer; and crosslinked carboxylic acid denatured polyvinylalcohol.

4. The cloth according to any of claims 1 to 3,
wherein the deposition weight of the water-insoluble water-absorbing resin is 0.1 to 5 wt.% of the cloth.

5. A cloth for ink-jet printing according to any one of claims 1 to 4, wherein the cloth is a base material for carpet.

6. An ink-jet printing process of cloth comprising the steps of preparing a cloth on which 0.01 to 10 wt.% of a water-insoluble water-absorbing resin having a water absorption capability of 50 to 1,000 ml/g is

deposited, applying printing ink to the cloth by the ink-jet method, heating and fixing the printing ink, and washing and removing the water-insoluble water-absorbing resin.

7. The process according to claim 6, wherein the water-insoluble water-absorbing resin has a water absorption capability of 100 to 900 ml/g to purified water.

8. The process according to claim 6 or 7,
wherein the water-insoluble water-absorbing resin is at least one selected from:
a water-insoluble water-absorbing resin obtained by polymerizing, as essential components, starch or cellulose (a), a monomer (b) selected from a monomer having a carboxyl group or sulfonic acid group and monomer made soluble in water by hydrolysis, and a crosslinking agent (c), or a water-insoluble water-absorbing resin obtained by further hydrolyzation; a partial hydrolyzate of crosslinked polyacrylamide; crosslinked acrylic acid-acrylamide copolymer; crosslinked polyacrylic acid salt; crosslinked acrylic acid-acrylate copolymer; cross linked isobutylene-maleic anhydride copolymer; and crosslinked carboxylic acid denatured polyvinylalcohol.

9. The process according to any of claims 6 to 8, wherein the deposition weight of the water-insoluble water-absorbing resin is 0.1 to 5 wt.% of the cloth.

10. The process according to any of claims 6 to 9,
wherein the printing ink is a water-based ink comprising an aqueous solution of dye or a water disperse solution of dye.

11. The process according to any of claims 6 to 10,
wherein the heat fixing process of the printing ink is steaming at 100 to 130 °C for 10 to 30 min., or dry heat treatment at 180 to 210 °C for 1 to 5 min.

12. The process according to any one of claims 6 to 11, wherein the cloth is a base material for carpet.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 11 0102

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	DATABASE WPI Week 8517, Derwent Publications Ltd., London, GB; AN 85-101549 & JP-A-60 046 290 (TEIJIN KK) * abstract * ---	1,6	D06P1/00
E	DATABASE WPI Week 9333, Derwent Publications Ltd., London, GB; AN 93-262179 & JP-A-05 179 577 (SANYO CHEM IND LTD) * abstract * -----	1,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

D06P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 October 1993	DELZANT, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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