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(54) **TRANSFER PRINTING METHOD**

(57) The object is to provide a transfer textile printing method that satisfies general versatility, simplicity, fixing property, color development property and fineness.

The object is achieved by a transfer textile printing method comprising
a step (1) of preparing a transfer paper,
a step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper,
a step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other and heating and pressurizing,
a step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other, and
a step (5) of removing the printed transfer paper from the textile printing medium,
wherein the transfer textile printing method comprises the step (3), the step (4), and the step (5) in this order.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a transfer textile printing method for forming a pattern on a textile printing medium such as a fabric using a printed transfer paper.

BACKGROUND ART

[0002] As a method for forming a pattern on a fabric, a transfer textile printing method is known in which the surface of a printed transfer paper having a pattern formed thereon with sublimation printing ink made of sublimation dye and the surface to be printed of a textile printing medium such as a fabric are heated facing each other to transfer the pattern to the textile printing medium (see, for example, Patent Document 1). The pattern of the printed transfer paper is formed by a printing method such as a gravure printing method, a screen printing method, an electrophotographic printing method, and an inkjet printing method. Since the degree of freedom of ink used is relatively high, the pattern is often formed by an inkjet printing method.

[0003] There is known a direct textile printing method in which a pattern is directly formed on a textile printing medium by an inkjet printing method or the like (see, for example, Patent Document 2).

[0004] The textile printing inks of the direct textile printing method include dye inks and pigment inks. In textile printing using a dye ink, since there are compounds of coloring materials corresponding to various colors, it is possible to form a pattern excellent in color development and color tone on a textile printing medium. However, the dye ink may be insufficiently fixed to the textile printing medium. Furthermore, the fineness of the pattern may be reduced due to the insufficient fixing. Accordingly, in order to supplement fixing, dye ink requires complicated post-processing such as fixing processing on a textile printing medium having a pattern formed thereon. On the other hand, the pigment ink is superior to the dye ink in terms of light resistance and water resistance, although it is inferior in color development and color tone as compared with the dye ink. In addition, the direct textile printing method using a pigment ink is superior in fixing to a textile printing medium than a dye ink, and therefore, complicated post-processing for the textile printing medium is not required.

[0005] For these reasons, a direct textile printing method using a pigment ink is attracting attention.

[0006] However, it is difficult for the textile printing medium to directly accept the dye ink or pigment ink suitably. Therefore, the direct textile printing method often requires pre-treatment of the textile printing medium in advance in order to improve the receiving ability of the textile printing medium with respect to dye ink or pigment ink. For this reason, there are disadvantages such as the pre-treatment time, cost, and change in texture of the textile printing medium.

PRIOR ART DOCUMENTS

Patent Documents

[0007]

Patent Document 1: Japanese Patent Application Kokai Publication No. 2015-124324 (unexamined, published Japanese patent application)
Patent Document 2: Japanese Patent Application Kokai Publication No. 2004-67807(unexamined, published Japanese patent application)

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0008] There is a transfer textile printing method in which a printed transfer paper having a pattern formed thereon using a sublimation printing ink is brought into close contact with a textile printing medium and heat-treated to transfer the ink from the printed transfer paper to the textile printing medium. However, the textile printing medium that can be printed with the sublimation printing ink is limited to the one made of polyester fiber, and the one made of other fibers such as cotton and nylon cannot be printed.

[0009] There is a transfer textile printing method in which a printed transfer paper having a pattern formed thereon using a disperse dye ink which is a dye poorly soluble in water and generally contains the dye in a state of fine particles dispersion with a dispersant is brought into close contact with a textile printing medium and heat-treated to transfer the ink from the printed transfer paper to the textile printing medium. However, textile printing media that can be printed with

disperse dye ink are almost limited to those made of hydrophobic fibers such as polyester, acetate, and triacetate.

[0010] The present inventors have focused on pigment inks that are excellent in fixing to various textile printing media, and based on the transfer textile printing method that allows the textile printing media to easily accept the ink, the present inventors have studied a transfer textile printing method that satisfies the color development and fineness of the pattern formed on the textile printing medium, and have arrive at the invention.

[0011] An object of the present invention is to provide a transfer textile printing method having the following items using a pigment ink.

[0012] The textile printing medium is not limited to polyester (general versatility)
No need for pre-treatment of a textile printing medium (simplicity)
The pattern formed on a textile printing medium is sufficiently fixed (fixing property)
The pattern formed on a textile printing medium has sufficient color development (color development property)
The pattern formed on a textile printing medium is sufficiently fine (fineness)

Means for Solving the Problems

[0013] As a result of extensive studies to solve the above problems, the present inventors have accomplished the object of the present invention by the following.

[1] A transfer textile printing method comprising

a step (1) of preparing a transfer paper,
a step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper,
a step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other and heating and pressurizing,
a step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other, and
a step (5) of removing the printed transfer paper from the textile printing medium,

wherein the transfer textile printing method comprises the step (3), the step (4), and the step (5) in this order.

[2] The transfer textile printing method according to [1], further comprising a step (6) of washing the textile printing medium with water after the step (5).

Effect of the invention

[0014] According to the present invention, it is possible to provide a transfer textile printing method having general versatility, simplicity, fixing property, color development property and fineness.

MODE FOR CARRYING OUT THE INVENTION

[0015] The present invention will be described below in detail.

[0016] The present invention is a transfer textile printing method comprising

a step (1) of preparing a transfer paper,
a step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper,
a step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other and heating and pressurizing,
a step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other, and
a step (5) of removing the printed transfer paper from the textile printing medium,

wherein the transfer textile printing method comprises the step (3), the step (4), and the step (5) in this order.

[0017] In the present invention, the term "transfer paper" means a paper in a blank state before a pattern to be transferred is printed, which is used for a transfer textile printing method. The term "printed transfer paper" means a paper on which a pattern to be transferred to a textile printing medium has been printed with respect to the transfer paper.

[0018] The transfer paper is not particularly limited as long as it can print the pattern to be transferred. The transfer paper may be either a non-coated paper that does not have a coating layer for manufacturing cost reduction or a coated paper that has a coating layer for receiving ink well on a paper substrate. As the non-coated paper and the coated paper, various printing papers used for a normal printing method such as an offset printing method, a gravure printing method,

a screen printing method, an electrophotographic printing method, and an inkjet printing method can be used.

[0019] The step (1) of preparing a transfer paper is obtaining a transfer paper by producing a non-coated paper or a coated paper by a conventionally known method, or obtaining a transfer paper by obtaining commercially available various printing paper of a coated paper or a non-coated paper.

[0020] The non-coated paper is a papermaking paper obtained by producing a paper stock containing at least one pulp selected from chemical pulp such as LBKP (Leaf Bleached Kraft Pulp) and NBKP (Needle Bleached Kraft Pulp), mechanical pulp such as GP (Groundwood Pulp), PGW (Pressure Ground Wood pulp), RMP (Refiner Mechanical Pulp), TMP (Thermo Mechanical Pulp), CTMP (ChemiThermoMechanical Pulp), CMP (Chemi Mechanical Pulp) and CGP (Chemi Groundwood Pulp), and waste paper pulp such as DIP (DeInked Pulp), various fillers such as calcium carbonate, talc, clay and kaolin, and various additives such as a sizing agent, a fixing agent, a retention aid, a cationizing agent and a paper strengthening agent as required into a paper. Further, the non-coated paper includes woodfree paper which has been subjected to calendering processing, surface sizing with starch, polyvinyl alcohol or the like, or surface treatment or the like on a papermaking paper. Further, the non-coated paper includes woodfree paper which has been subjected to calendering processing after subjected to surface sizing or surface treatment.

[0021] Paper making is carried out by adjusting a paper stock to acidic, neutral or alkaline and using a conventionally known papermaking machine. Examples of the papermaking machine may include a fourdrinier papermaking machine, a twin wire papermaking machine, a combination papermaking machine, a cylindrical papermaking machine, a Yankee papermaking machine and the like.

[0022] In the paper stock, one or two or more of other additives selected from a pigment dispersant, a thickener, a fluidity improving agent, a defoamer, an antifoamer, a releasing agent, a foaming agent, a penetrating agent, a colored dye, a colored pigment, an optical brightener, an ultraviolet light absorber, an antioxidant, a preservative, a fungicide, an insolubilizer, an wet paper strengthening agent, a dry paper strengthening agent and the like can be blended appropriately as long as the desired effect of the present invention is not impaired.

[0023] The coated paper has, for example, a coating layer on at least one side of the base paper. The coating layer can be provided on the base paper by applying and drying each coating layer-coating composition on the base paper.

[0024] The method of providing a coating layer on a base paper is not particularly limited. For example, an applying method and a drying method using a coating apparatus and a drying apparatus conventionally known in the field of papermaking can be mentioned. Examples of the conventionally known coating apparatus may include a size press, a gate roll coater, a film transfer coater, a blade coater, a rod coater, an air knife coater, a comma coater, a gravure coater, a bar coater, an E bar coater, a curtain coater, and the like. Examples of the drying apparatus may include a hot air dryer such as a straight tunnel dryer, an arch dryer, an air loop dryer and a sine curve air float dryer, an infrared heating dryer, a dryer using microwave, and the like.

[0025] The base paper is a papermaking paper obtained by producing a paper stock containing at least one pulp selected from chemical pulp such as LBKP (Leaf Bleached Kraft Pulp) and NBKP (Needle Bleached Kraft Pulp), mechanical pulp such as GP (Groundwood Pulp), PGW (Pressure Ground Wood pulp), RMP (Refiner Mechanical Pulp), TMP (Thermo Mechanical Pulp), CTMP (ChemiThermoMechanical Pulp), CMP (Chemi Mechanical Pulp) and CGP (Chemi Groundwood Pulp), and waste paper pulp such as DIP (DeInked Pulp), various fillers such as calcium carbonate, talc, clay and kaolin, and various additives such as a sizing agent, a fixing agent, a retention aid, a cationizing agent and a paper strengthening agent as required into a paper. Further, the base paper includes woodfree paper which has been subjected to calendering processing, surface sizing with starch, polyvinyl alcohol or the like, or surface treatment or the like on a papermaking paper. Further, the base paper includes woodfree paper which has been subjected to calendering processing after subjected to surface sizing or surface treatment.

[0026] Paper making is carried out by adjusting a paper stock to acidic, neutral or alkaline and using a conventionally known papermaking machine. Examples of the papermaking machine may include a fourdrinier papermaking machine, a twin wire papermaking machine, a combination papermaking machine, a cylindrical papermaking machine, a Yankee papermaking machine and the like.

[0027] In the paper stock, one or two or more of other additives selected from a pigment dispersant, a thickener, a fluidity improving agent, a defoamer, an antifoamer, a releasing agent, a foaming agent, a penetrating agent, a colored dye, a colored pigment, an optical brightener, an ultraviolet light absorber, an antioxidant, a preservative, a fungicide, an insolubilizer, an wet paper strengthening agent, a dry paper strengthening agent and the like can be blended appropriately as long as the desired effect of the present invention is not impaired. In the case of coated paper having a coating layer, for example, if printing is possible by an inkjet printing method, a resin sheet support can be used instead of the base paper.

[0028] The coating layer is not particularly limited. The coating layer is preferably a coating layer containing a resin binder and, if necessary, a conventionally known white pigment and/or various additives in the coated paper field. Examples of the additives may include a dispersant, a fixing agent, a thickener, a fluidity improving agent, a defoamer, a releasing agent, a foaming agent, a penetrating agent, a colored pigment, a colored dye, an optical brightener, an ultraviolet light absorbing agent, an antioxidant, a preservative, fungicide and the like. Further, the coating layer can

contain various auxiliaries conventionally known in a transfer textile printing method. The auxiliaries are added to optimize various physical properties of the coating layer-coating composition or to improve the dyeability of the pigment ink to be transferred. Examples of the auxiliaries may include various surfactants, a humectant, a wetting agent, a pH adjusting agent, an alkaline agent, a deep coloring agent, a deaerator, a reducing inhibitor and the like.

[0029] Examples of the resin binder may include starch and various modified starches, cellulose derivatives such as carboxymethyl cellulose and hydroxyethyl cellulose, natural polymer resin such as casein, gelatin, soybean protein, pullulan, gum arabic, karaya gum and albumin or a derivative thereof, polyvinyl pyrrolidone, polyvinyl alcohol and various modified polyvinyl alcohols, polyacrylamide, polyethyleneimine, polypropylene glycol, polyethylene glycol, maleic acid type resin, acrylic type resin, methacrylate-butadiene type copolymer resin, a styrene-butadiene type copolymer resin, ethylene-vinyl acetate type copolymer resin, or a functional group-modified copolymer resins of these various copolymers with monomers containing a functional group such as carboxy group, a thermosetting synthetic resin such as a melamine resin and an urea resin, a polyurethane type resin, an unsaturated polyester resin, polyvinyl butyral, alkyd resin latex, and the like.

[0030] Examples of the white pigment may include inorganic pigments such as calcium carbonate, kaolin, talc, satin white, lithopone, titanium oxide, zinc oxide, silica, alumina, aluminum hydroxide, activated clay and diatomaceous earth, and organic pigments such as plastic pigments.

[0031] The step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper is printing a pattern on the transfer paper by at least one printing method selected from the group consisting of a gravure printing method, a screen printing method, an inkjet printing method, and the like using a pigment ink, to produce a printed transfer paper having a pattern formed thereon to be transferred to a textile printing medium. As a method for printing a pattern on a transfer paper, an inkjet printing method is preferable because the image quality and the degree of freedom of ink used are relatively high.

[0032] The pigment ink is an ink whose coloring material is a pigment. The pigment as the coloring material is generally in a dispersed state with respect to the solvent of the pigment ink. The pigment ink of the present invention can contain a conventionally known pigment dispersant, a resin, and various auxiliary agents such as a penetrating agent, a humectant, a thickener, a pH adjusting agent, an antioxidant and a reducing agent as necessary, in addition to the pigment as the coloring material, and various solvents such as water and alcohol.

[0033] A pigment coated with a resin can be used for the pigment as the coloring material. The resin is preferably a resin containing a monomer having at least an anionic group such as acrylic acid or methacrylic acid. The method of obtaining the pigment coated with a resin is, for example, as follows. A pigment is dispersed in an aqueous solution in which a resin is dissolved in the presence of a basic compound to obtain a dispersion. From the dispersion, a resin is deposited on the pigment surface using ion exchange means or the like. A pigment ink composed of a pigment coated with a resin is preferable because of excellent dispersibility of the pigment in the ink and excellent fixing property to a textile printing medium.

[0034] The pigment as the coloring material can be further roughly classified into an inorganic colored pigment and an organic colored pigment. Any of these may be used as the coloring material. The pigment as the coloring material is registered as "C.I. Pigment" in a database such as Color Index International. General examples of the pigment as the coloring material may include carbon black, metal oxide, metal hydroxide, metal sulfide, ferrocyanide, metal chloride, and the like. Further, examples of the organic colored pigment may include azo pigments, phthalocyanine pigments, quinacridone pigments, isoindolinone pigments, dioxazine pigments, perylene pigments, perinone pigments, thioindigo pigments, anthraquinone pigments, and quinophthalone pigments.

[0035] Examples of pigments of four primary colors (black, cyan, magenta, yellow) that are generally used in the inkjet printing method may include C.I. PigmentBlack7 etc. as a black ink, C.I. PigmentBlue1, C.I. PigmentBlue2, C.I. PigmentBlue15:3, C.I. PigmentBlue16, etc. as a cyan ink, C.I. PigmentRed5, C.I. PigmentRed48:2, C.I. PigmentRed57:1, C.I. PigmentRed112, C.I. PigmentRed122, C.I. PigmentViolet19, etc. as a magenta ink, C.I. PigmentYellow1, C.I. PigmentYellow3, C.I. PigmentYellow13, C.I. PigmentYellow74, C.I. PigmentYellow83, C.I. PigmentYellow128, etc. as a yellow ink.

[0036] Sublimation printing inks composed of sublimable dyes and disperse dye inks composed of disperse dyes corresponding to "C.I. Disperse" in the database such as Color Index International do not correspond to the pigment inks of the present invention.

[0037] The pigment as the coloring material preferably has an average particle diameter of 50 nm or more and 300 nm or less from the viewpoint of fineness. The pigment dispersant is a dispersant generally used for preparing a dispersion, for example, a polymer dispersant or a surfactant. Resins may include, for example, acrylic type resins, styrene-acrylic type copolymer resins, fluorene type resins, polyurethane type resins, polyolefin type resins, rosin-modified resins, terpene type resins, polyester type resins, polyamide type resins, epoxy type resins, vinyl chloride type resins, vinyl chloride-vinyl acetate type copolymer resins, ethylene-vinyl acetate type copolymer resins, and the like.

[0038] The step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other, and heating and pressurizing is bringing the surface on which the ink is adhered of the printed transfer paper

having the pattern formed thereon and the surface to be printed of the textile printing medium into close contact with each other and heating and pressurizing in the above-mentioned contact state.

[0039] The method of heating and pressurizing is not particularly limited as long as it is a condition that allows the pigment as the coloring material of the pigment ink to be transferred from the printed transfer paper to the textile printing medium by bringing them into close contact with each other. In the case of the following heat press method, the pressure is preferably 1 kg/cm^2 or more and 12 kg/cm^2 or less, and more preferably 5 kg/cm^2 or more and 10 kg/cm^2 or less. In the case of the roll nip method, the linear pressure is preferably 10 kg/cm or more and 150 kg/cm or less, and more preferably 20 kg/cm or more and 70 kg/cm or less. This is because the transfer of the pigment ink can be achieved without damaging the textile printing medium. The heating is preferably performed at a temperature of 105°C or higher and 220°C or lower, more preferably 120°C or higher and 200°C or lower. This is because the transfer of the pigment ink can be achieved without damaging the textile printing medium. The heating and pressurizing time is preferably 0.05 seconds or longer and 15 seconds or shorter, and more preferably 0.2 seconds or longer and 10 seconds or shorter. This is because the transfer of the pigment ink can be achieved without damaging the textile printing medium.

[0040] More preferably, the heating is performed at a temperature of 105°C or higher and 220°C or lower, and the heating and pressurizing time is 0.05 second or longer and 15 seconds or shorter. Further preferably, the heating is performed at a temperature of 120°C or higher and 200°C or lower, and the heating and pressurizing time is 0.2 seconds or longer and 10 seconds or shorter.

[0041] The close contact can be achieved by, for example, a heat press method such as a flatbed heat press or a roll nip method such as a super calender or soft calender. Heat can be adjusted by pressing temperature or roll temperature. The pressurization can be adjusted by pressing pressure or nip pressure.

[0042] The step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other is heating the printed transfer paper and the textile printing medium in close contact with each other without pressurizing.

[0043] Examples of the heat treatment method may include a heat press method, a heat roll set method, a steam method, a thermofix method, etc. under a non-pressurized condition including light pressing that is not generally called pressurization. Examples of the heat source for the heat treatment may include an infrared lamp, a high-temperature steam, and a metal heater. The temperature of the heat treatment may be any temperature at which the pigment which is the coloring material of the pigment ink is fixed to the textile printing medium without damaging the textile printing medium. An example of the temperature of the heat treatment is preferably 105°C or higher and 220°C or lower, and more preferably 120°C or higher and 200°C or lower from the viewpoint of hardly damaging the textile printing medium. An example of the time of the heat treatment is preferably 10 seconds or longer and 300 seconds or shorter, and more preferably 30 seconds or longer 180 seconds or shorter.

[0044] More preferably, the temperature of the heat treatment is 105°C or higher and 220°C or lower, and the time of the heat treatment is 10 seconds or longer and 300 seconds or shorter. Further preferably, the temperature of the heat treatment is 120°C or higher and 200°C or lower, and the time of the heat treatment is 30 seconds or longer and 180 seconds or shorter.

[0045] The step (4) can also be achieved by a method of stopping the pressurization while carrying out the heating in the step (3). For example, in the case of a heat press method, such a method is a method of heating a printed transfer paper and a textile printing medium in a close contact state without pressurizing, including pressing lightly to the extent that it cannot be generally called pressurization, and in the case of a roll nip method, such a method is a method of bringing the printed transfer paper and the textile printing medium that are in close contact with each other and a heat roll into contact with each other without applying a nip pressure. In the roll nip method, it is understood that the minimum nip pressure necessary for product conveyance is "no pressurization".

[0046] The heat treatment in the step (4) may be performed at the same temperature as the step (3) or a different temperature. A preferable temperature and time are as follows. In the step (3), the heating is performed at a temperature of 105°C or higher and 220°C or lower, and the heating and pressurizing time is 0.05 second or longer and 15 seconds or shorter, and in the step (4), the temperature of the heat treatment is 105°C or higher and 220°C or lower, and the time of the heat treatment is 10 seconds or longer and 300 seconds or shorter. A more preferable temperature and time are as follows. In the step (3), the heating is performed at a temperature of 120°C or higher and 200°C or lower, and the heating and pressurizing time is 0.2 seconds or longer and 10 seconds or shorter, and in the step (4), the temperature of the heat treatment is 120°C or higher and 200°C or lower, and the time of the heat treatment is 30 seconds or longer and 180 seconds or shorter. Preferably, the step (3) and the step (4) are performed at the same temperature. This is because the fixing is uniform in the pattern formed on the textile printing medium.

[0047] The step (5) of removing the printed transfer paper from the textile printing medium is physically peeling the printed transfer paper from the textile printing medium. The removal method is a conventionally known method and is not particularly limited.

[0048] The transfer textile printing method of the present invention has the step (3), the step (4) and the step (5) in this order. That is, it is sufficient that the step (4) is executed after the step (3) and the step (5) is executed after the step

(4). As long as the effects of the present invention are not impaired, other processing may be performed in the middle of each step.

[0049] The transfer textile printing method of the present invention preferably has a step (6) of washing the textile printing medium with water after the step (5). By the step (6), unnecessary pigment ink components are removed from the textile printing medium, and as a result, the fixing property or fineness is improved. The method of washing with water is a conventionally known method and is not particularly limited.

[0050] By transferring the pigment ink from the printed transfer paper to the textile printing medium, a pattern can be formed on the textile printing medium without being limited to polyester. Further, the pre-treatment of the textile printing medium is not necessary, and the process can be simplified. It is physically difficult to transfer the pigment ink from the printed transfer paper to the textile printing medium. However, by having the step (3) and the step (4) of the present invention, and the step (5) after the step (4), it was possible to transfer the pigment ink from the printed transfer paper to the textile printing medium while having color development property and fineness.

[0051] In the present invention, the textile printing medium is not particularly limited to fibers. Examples of fibers may include plant fibers such as cotton and linen, animal fibers such as silk, wool, alpaca, angola, cashmere and mohair, regenerated fibers such as rayon, cupra and polynosic, semi-synthetic fibers such as acetate, triacetate and promix, synthetic fibers such as nylon, polyester, acrylic, polyvinyl chloride and polyurethane. As a configuration of the fiber material, there can be mentioned single, blended, mixed fiber or interwoven fabric such as woven fabric, knitted fabric and nonwoven fabric. Furthermore, these configurations may be combined.

EXAMPLES

[0052] Hereinafter, the present invention will be described in more detail by examples. It should be noted that the present invention is not limited to these examples. Here, "part by mass" and "% by mass" each represent "parts by mass" and "% by mass" of a dry solid content or a substantial component amount. A coating amount of a coating layer represents a dry solid content.

<Step (1) of preparing a transfer paper>

(Base paper)

[0053] 10 parts by mass of calcium carbonate as a filler, 1.2 parts by mass of amphoteric starch, 0.8 part by mass of aluminum sulfate and 0.1 parts by mass of alkyl ketene dimer type sizing agent were added to a pulp slurry containing 100 parts by mass of LBKP having a freeness degree of 380 ml csf to form a paper stock, which was made into raw paper using a fourdrinier papermaking machine. Oxidized starch was attached to both sides of the raw paper with a size press device at 1.5 g/m^2 per side, and machine calendering was performed to prepare a base paper with a basis weight of 80 g/m^2.

<Coating layer-coating composition >

[0054] 75 parts by mass of carboxymethylcellulose (Cellogen® 6A, manufactured by DKS Co. Ltd.) and 15 parts by mass of silica (Mizukasil® P527, manufactured by Mizusawa Industrial Chemicals, Ltd.) were dissolved and dispersed in water, and 10 parts by mass of urethane dispersion (Hydran® WLS201: manufactured by DIC Corporation) was further added, and the coating composition concentration was adjusted to 13% by mass to obtain a coating layer-coating composition.

(Transfer paper)

[0055] The coating layer-coating composition was applied on one side of the base paper with an air knife coater so as to make the coating amount 5 g/m^2, and dried in a hot air dryer, to finally obtain a roll-shape transfer paper and sheet-shape transfer paper.

<Step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper >

[0056] Using an inkjet printer (VJ-1628TD, manufactured by Mutoh Industries Ltd.) with pigment inks or dye inks set, the evaluation patterns were printed with pigment inks (cyan, magenta, yellow, black) or dye inks (cyan, magenta, yellow, black) on the roll-shape or sheet-shape transfer paper to finally obtain a roll-shape or sheet-shape printed transfer paper.

[0057] For the pigment ink, LYOSPERSE ink manufactured by Huntsman Corporation was used.

[0058] For dye ink 1, EA ink manufactured by KIWA Chemical Industry Co., Ltd. was used as an acidic ink for nylon

dyeing, and for dye ink 2, NOVACLON MI ink manufactured by Huntsman Corporation was used as a reaction ink for cotton dyeing.

<Step (3) of bringing the printed transfer paper and the textile printing medium into close contact with each other and heating and pressurizing >

[0059] Polyester cloth, cotton cloth, and nylon cloth that were not pretreated were used as a textile printing medium. The printed surface of the printed transfer paper and the textile printing medium were brought into contact, and brought into close contact with each other while heating and pressurizing in the following manner. In P1, a roll-shaped printed transfer paper was used, and in P2, a sheet-shaped printed transfer paper was used.

P1: Roll nip method (temperature, pressure and time are shown in Table 1)
P2: Heat press method (temperature, pressure and time are shown in Table 1)

<Step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other >

[0060] After the step (3), a heat treatment was performed by the following method while the printed transfer paper and the textile printing medium remain in close contact with each other.

H1: Heat in contact with heat roll
H2: Heat with a heat press

[0061] The heating temperature and time are shown in Table 1.
[0062] In addition, the dye ink was subjected to a steaming process.

<Step (5) of removing the printed transfer paper from the textile printing medium >

[0063] After the heat treatment, the printed transfer paper was peeled off from the textile printing medium. No post-treatment related to fixing was performed on the obtained textile printing medium.

<Step (6) of washing the textile printing medium with water>

[0064] The textile printing medium from which the printed transfer paper has been removed in the step (5) was washed with running water. The presence or absence of water washing is shown in Table 1.
[0065] The following items were evaluated for the textile printed medium having the pattern formed thereon.

<Fixing property>

[0066] The textile printed medium having the pattern formed thereon was washed five times in the standard mode of a fully automatic washing machine. No detergent was used. Before and after washing, the pattern formed on the textile printing medium was visually evaluated with respect to the color fading change before and after washing according to the following criteria. In the present invention, if the evaluation is 2, 3 or 4, the textile printing medium is judged to have fixing property.

4: No color fading is observed, which is good.
3: No noticeable color fading is observed, which is generally good.
2: Color fading is slightly observed, which is lower limit of practical use.
1: Color fading is observed, which is bad.

<Color development property>

[0067] In the textile printing medium, the color density of the solid image portions of four colors (black, cyan, magenta, yellow) was measured using an optical densitometer (X-rite® 530, available from Sakata Inx Eng. Co., Ltd.), and the color density values of the four colors were totaled. The color development property was judged according to the following criteria. In the present invention, if the evaluation is 2, 3 or 4, the textile printing medium is judged to have color development property.

4: Total value is 4.0 or more
3: Total value is 3.5 or more and less than 4.0
2: Total value is 3.0 or more and less than 3.5
1: Total value is less than 3.0

<Fineness>

[0068] The pattern formed on the textile printing medium was visually evaluated with respect to fineness according to the following criteria. In the present invention, if the evaluation is 3 or 4, the textile printing medium is judged to have fineness.

4: The outline of the pattern is very clear, which is a good level.
3: The outline of the pattern is clear, which is generally good level.
2: The outline of the pattern is almost clear, which is practically usable level.
1: The outline of the pattern is not clear, which is practically unusable level.

[0069] Evaluation results are shown in Table 1.

[Table 1]

[0070]

Table 1

	Ink	Textile printing medium	Step (3)				Step (4)			Step (6)	Fixing property	Color development property	Pattern fineness
			Contact method	Temperature (°C)	Pressure	Time (s)	Heat treatment method	Heat temperature (°C)	Treatment time (S)	Presence or absence			
Example 1	Pigment ink	Polyester cloth	P1	180	70 kg/cm	0.5	H1	120	60	Yes	3	2	3
Example 2	Pigment ink	Polyester cloth	P1	180	70 kg/cm	0.5	H1	180	60	Yes	3	3	3
Example 3	Pigment Ink	Polyester cloth	P1	180	70 kg/cm	0.5	H1	200	60	Yes	4	3	4
Example 4	Pigment ink	Polyester cloth	P2	200	10 kg/cm^2	10	H2	200	3D	Yes	3	3	3
Example 5	Pigment ink	Polyester cloth	P2	200	10 kg/cm^2	10	H2	200	60	Yes	3	3	3
Example 6	Pigment ink	Polyester cloth	P2	200	10 kg/cm^2	10	H2	200	180	Yes	3	3	3
Example 7	Pigment ink	Polyester cloth	P2	200	10 kg/cm2	10	H2	200	60	No	2	3	3
Example 8	Pigment ink	Nylon cloth	P1	180	70 kg/cm	0.5	H1	120	60	Yes	3	2	3
Example 9	Pigment ink	Nylon cloth	P1	180	70 kg/cm	0.5	H1	180	60	Yes	4	4	3
Example 10	Pigment ink	Nylon cloth	P1	180	70 kg/cm	0.5	H1	200	60	Yes	3	4	4
Example 11	Pigment ink	Nylon cloth	P2	200	10 kg/cm^2	10	H2	200	30	Yes	3	3	3
Example 12	Pigment ink	Nylon cloth	P2	200	10 kg/cm^2	10	H2	200	60	Yes	3	4	3
Example 13	Pigment ink	Nylon cloth	P2	200	10 kg/cm^2	10	H2	200	180	Yes	3	4	3

(continued)

	Ink	Textile printing medium	Step (3)				Step (4)			Step (6)	Fixing property	Color development property	Pattern fineness
			Contact method	Temperature (°C)	Pressure	Time (s)	Heat treatment method	Heat temperature (°C)	Treatment time (S)	Presence or absence			
Example 14	Pigment Ink	Nylon cloth	P2	200	10 kg/cm^2	10	H2	200	60	No	2	4	3
Example 15	Pigment ink	Cotton cloth	P1	180	70 kg/cm	0.5	H1	120	60	Yes	3	2	3
Example 16	Pigment Ink	Cotton cloth	P1	180	70 kg/cm	0.5	H1	180	60	Yes	4	4	4
Example 17	Pigment ink	Cotton cloth	P1	180	70 kg/cm	0.5	H1	200	60	Yes	3	4	4
Example 18	Pigment ink	Cotton cloth	P2	200	10 kg/cm^2	10	H2	200	30	Yes	4	3	4
Example 19	Pigment ink	Cotton cloth	P2	200	10 kg/cm^2	10	H2	200	60	Yes	3	4	4
Example 20	Pigment ink	Cotton cloth	P2	200	10 kg/cm^2	10	H2	200	180	Yes	3	4	4
Example 21	Pigment ink	Cotton cloth	P2	200	10 kg/cm^2	10	H2	200	60	No	2	4	3
Example 22	Pigment ink	Polyester cloth	P1	105	70 kg/cm	0.5	H1	120	60	Yes	2	2	3
Example 23	Pigment Ink	Polyester cloth	P1	120	70 kg/cm	0.5	H1	120	60	Yes	3	2	3
Example 24	Pigment ink	Polyester cloth	P1	120	70 kg/cm	0.5	H1	105	60	Yes	2	2	3
Example 25	Pigment ink	Polyester cloth	P2	200	10 kg/cm^2	10	H2	200	10	Yes	2	2	3
Example 26	Pigment ink	Nylon cloth	P2	220	10 kg/cm^2	10	H2	200	180	Yes	3	3	3

(continued)

	Ink	Textile printing medium	Step (3)				Step (4)			Step (6)	Fixing property	Color development property	Pattern fineness
			Contact method	Temperature (°C)	Pressure	Time (s)	Heat treatment method	Heat temperature (°C)	Treatment time (S)	Presence or absence			
Example 27	Pigment ink	Nylon cloth	P1	180	70 kg/cm	0.05	H1	180	60	Yes	3	2	3
Example 28	Pigment ink	Polyester cloth	P1	180	70 kg/cm	0.2	H1	200	60	Yes	4	3	4
Example 29	Pigment ink	Polyester cloth	P1	180	70 kg/cm	0.2	H1	220	60	Yes	4	3	4
Example 30	Pigment ink	Polyester cloth	P2	200	10 kg/cm^2	10	H2	200	200	Yes	3	3	3
Example 31	Pigment ink	Cotton cloth	P2	200	10 kg/cm^2	15	H2	200	180	Yes	3	4	3
Comparative Example 1	Pigment ink	Polyester cloth	P1	180	70 kg/cm	0.5	-	-	-	No	2	1	1
Comparative Example 2	Pigment ink	Nylon cloth	P1	180	70 kg/cm	0.5	-	-	-	No	2	1	1
Comparative Example 3	Pigment ink	Cotton cloth	P1	180	70 kg/cm	0.5	-	-	-	No	1	1	1
Comparative Example 4	Pigment ink	Polyester cloth	P1	180	0 kg/cm	0.5	H1	200	60	No	1	1	1
Comparative Example 5	Pigment ink	Nylon cloth	P1	180	0 kg/cm	0.5	H1	200	60	No	1	2	1
Comparative Example 6	Pigment ink	Cotton cloth	P1	180	0 kg/cm	0.5	H1	200	60	No	1	2	2
Comparative Example 7	Dye ink 1	Nylon cloth	P1	180	70 kg/cm	0.5	H1	200	60	No	1	3	1
Comparative Example 8	Dye ink 2	Cotton cloth	P1	180	70 kg/cm	0.5	H1	200	60	No	2	3	2

[0071] From the results in Table 1, it can be seen that Examples 1 to 31 corresponding to the transfer textile printing method of the present invention have general versatility, simplicity, fixing property, color development property and fineness. It can be seen that Comparative Examples 1 to 8 which do not correspond to the transfer textile printing method of the present invention cannot satisfy at least one of these effects.

[0072] Further, mainly from the comparison between Example 5, Example 12 and Example 19, and Example 7, Example 14 and Example 21, it can be seen that it is preferable to have the step (6) of washing the textile printing medium with water after the step (5) of removing the printed transfer paper from the textile printing medium.

[0073] Also, mainly from the comparison between Examples 1, 13, 22, 23 and 26 and the comparison between Examples 9, 20, 27 and 31, it can be seen that the temperature in the step (3) is preferably 120°C or higher and 200°C or lower, and the heating and pressurizing time is preferably 0.2 seconds or longer and 10 seconds or shorter.

[0074] Also mainly from the comparison between Examples 3, 23, 24 and 29, and the comparison between Examples 4, 6, 25 and 30, and since a slight discoloration was observed locally in the textile printing medium in Examples 29 and 30 although it is at a level where there is no problem in practical use, it can be seen that the heat treatment temperature in the step (4) is preferably 120°C or higher and 200°C or lower, and the heat treatment time is preferably 30 seconds or longer and 180 seconds or shorter.

Claims

1. A transfer textile printing method comprising

a step (1) of preparing a transfer paper,
a step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper,
a step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other and heating and pressurizing,
a step (4) of performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other, and
a step (5) of removing the printed transfer paper from the textile printing medium,

wherein the transfer textile printing method comprises the step (3), the step (4), and the step (5) in this order.

2. A transfer textile printing method comprising

a step (1) of preparing a transfer paper,
a step (2) of forming a pattern using a pigment ink on the transfer paper to obtain a printed transfer paper,
a step (3) of bringing the printed transfer paper and a textile printing medium into close contact with each other and heating and pressurizing,
a step (4) of releasing the pressurization, and performing a heat treatment without pressurizing while the printed transfer paper and the textile printing medium remain in close contact with each other, and
a step (5) of removing the printed transfer paper from the textile printing medium,

wherein the step (4) is executed after the step (3), and the step (5) is executed after the step (4).

3. The transfer textile printing method according to claim 1 or 2, further comprising a step (6) of washing the textile printing medium with water after the step (5).

4. The transfer textile printing method according to any one of claims 1 to 3, wherein in the step (3), the heating is performed at a temperature of 120°C or higher and 200°C or lower, and the heating and pressurizing time is 0.2 seconds or longer and 10 seconds or shorter.

5. The transfer textile printing method according to any one of claims 1 to 3, wherein in the step (4), the heat treatment temperature is 120°C or higher and 200°C or lower, and the heat treatment time is 30 seconds or longer and 180 seconds or shorter.

6. The transfer textile printing method according to any one of claims 1 to 3, wherein in the step (3), the heating is performed at a temperature of 120°C or higher and 200°C or lower, and the heating and pressurizing time is 0.2 seconds or longer and 10 seconds or shorter, and in the step (4), the heat treatment temperature is 120°C or higher and 200°C or lower, and the heat treatment time is 30 seconds or longer and 180 seconds or shorter.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/014975

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. D06P5/26(2006.01)i, D06P5/20(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. D06P5/26, D06P5/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 52-049385 A (LEWIS, Edward Joseph, RATTEE, Ian Durham) 20 April 1977, claims 19, 21, examples 1-5 & GB 1561330 A (claims 20-21, 23, examples 1-5) & US 4351871 A & DE 2645640 A & FR 2327356 A	1-6
X	JP 43-014865 B1 (FUKUI SEIREN KAKO CO., LTD.) 22 June 1968, claim 1, page 1, right column, line 21 to page 2, left column, line 23, example 2 (Family: none)	1-6
X	JP 50-108012 A (MATSUI SHIKISO CHEMICAL CO., LTD.) 26 August 1975, claim 1, page 3, lower left column, first line from the bottom to lower right column, line 12 (Family: none)	1-6

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Patent documents cited in the description

- JP 2015124324 A **[0007]**
- JP 2004067807 A **[0007]**