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(54) **HEAT-SENSITIVE RECORDING BODY**

(57) An object of the present invention is to provide a heat-sensitive recording medium superior in transparency. The heat-sensitive recording medium of the present invention is characterized by being a heat-sensitive recording medium including a thermal layer containing a fatty-acid-based wax. The fatty-acid-based wax is pre-

ferably a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax. The fatty-acid-based wax is preferably a solubilized fatty-acid-based wax. The solubilized fatty-acid-based wax preferably contains a solubilizer.

Description

Technical Field

5 **[0001]** The present invention relates to a heat-sensitive recording medium.

Background Art

10 **[0002]** Heat-sensitive recording media give recording images by developing color through chemical reaction due to heating by a thermal head or the like, and are used in a wide variety of applications including not only facsimiles, ticket vending machines, and recording media for scientific measuring machines, but also heat-sensitive recording labels for POS systems in retail stores and receipt paper.

15 **[0003]** In particular, in using a heat-sensitive recording medium as a label for food containers like lunch boxes or a food-packaging film, use of an opaque heat-sensitive recording medium causes a problem of the invisibility of contents, and hence a heat-sensitive recording medium superior in transparency has been demanded for good visibility of contents.

20 **[0004]** For example, a heat-sensitive recording medium whose heat-sensitive recording layer contains a dispersant having a carboxyl group and a crosslinking agent containing epichlorohydrin-modified polyamide-polyamine resin or an organic compound containing an oxazoline group as a main component has been proposed as a heat-sensitive recording medium superior in transparency, and it has been disclosed that use of a material having a small particle diameter results in more enhanced transparency (e.g., see Patent Literature 1).

Citation List

Patent Literature

25 **[0005]** Patent Literature 1: International Publication No. WO 2021/106076

Summary of Invention

Technical Problem

[0006] However, examination for a heat-sensitive recording medium superior in transparency is said to be still insufficient, and there is room for further consideration.

35 **[0007]** Accordingly, an object of the present invention is to provide a heat-sensitive recording medium superior in transparency.

Solution to Problem

40 **[0008]** The present inventors have diligently examined to solve the problem, and found that a heat-sensitive recording medium superior in transparency is successfully provided through inclusion of a fatty-acid-based wax in a thermal layer. The present invention has been completed on the basis of this finding.

[0009] Specifically, the present invention provides a heat-sensitive recording medium including a thermal layer containing a fatty-acid-based wax. Having the configuration in which the thermal layer contains a fatty-acid-based wax, the heat-sensitive recording medium is superior in transparency.

45 **[0010]** The fatty-acid-based wax is preferably a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax. With this configuration, more enhanced transparency is successfully achieved.

[0011] The fatty-acid-based wax is preferably a solubilized fatty-acid-based wax. With this configuration, more enhanced transparency is successfully achieved.

50 **[0012]** The solubilized fatty-acid-based wax preferably contains a solubilizer. With this configuration, more enhanced transparency is successfully achieved.

[0013] The thermal layer preferably contains a surfactant and/or a solvent. With this configuration, more enhanced transparency is successfully achieved.

[0014] The thermal layer preferably further contains a wax differing from the fatty-acid-based wax and having an average particle diameter of 1 μm or less. With this configuration, more enhanced transparency is successfully achieved.

55 **[0015]** The content of the fatty-acid-based wax is preferably in the range of 0.1% by mass to 5% by mass, based on a dry mass of the thermal layer. With this configuration, more enhanced transparency is successfully achieved.

[0016] In addition, the present invention provides a method for producing a heat-sensitive recording medium, the method including the steps of:

preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax; and
 forming a thermal layer by applying and drying the coating material for a thermal layer. Heat-sensitive recording media produced by this method are superior in transparency.

Advantageous Effect of Invention

[0017] The present invention can provide a heat-sensitive recording medium superior in transparency.

Brief Description of Drawing

[0018] [Figure 1] Figure 1 is a schematic cross-sectional view illustrating an embodiment of the heat-sensitive recording medium of the present invention.

Description of Embodiments

[Heat-sensitive recording medium]

[0019] The heat-sensitive recording medium of the present invention is a heat-sensitive recording medium including a thermal layer containing a fatty-acid-based wax.

[0020] The heat-sensitive recording medium of the present invention may include a substrate, and may include an anchor layer. In the case that the heat-sensitive recording medium of the present invention includes a substrate and an anchor layer, the heat-sensitive recording medium of the present invention preferably includes the substrate, the anchor layer, and the thermal layer in this order. The heat-sensitive recording medium of the present invention may include a layer other than those layers. Examples of the layer other than those layers include a back coat layer, an intermediate layer, and a top coat layer.

[0021] The following describes an embodiment of the heat-sensitive recording medium of the present invention in detail on the basis of a drawing, but the present invention is not limited to embodiments shown in the following.

[0022] Figure 1 is a schematic cross-sectional view illustrating an embodiment of the heat-sensitive recording medium of the present invention.

[0023] As illustrated in Figure 1, the heat-sensitive recording medium 1 of the present embodiment includes a substrate 2, an anchor layer 3, and a thermal layer 4 in this order.

(Substrate)

[0024] In the present embodiment, the substrate 2 functions as a support for the heat-sensitive recording medium 1. For example, a transparent synthetic resin film or the like can be used as the substrate 2. Examples of the transparent synthetic resin film include a polypropylene film, a polyethylene terephthalate film, a polystyrene film, and a polycarbonate film. The transparent synthetic resin film may be a biaxially oriented film, or a heat-sealable film. The substrate 2 may be monolayered or multilayered. The thickness of the substrate 2 is, for example, preferably 5 μm to 150 μm , and more preferably 10 μm to 100 μm . The thickness within the range is preferred because of superiority in coatability and transparency. Among the substrates shown above, a biaxially oriented polypropylene (OPP) film and a heat-sealable polyethylene terephthalate (HS-PET) film can be preferably used.

(Anchor layer)

[0025] In the present embodiment, the anchor layer 3 functions as a layer to increase the adhesion between the substrate 2 and the thermal layer 4. Any material may be used for forming the anchor layer 3 without limitation, and a binder can be used as the only component. The anchor layer 3 may contain an additional component, and may contain, for example, a pigment or the like. Here, the anchor layer does not need to be provided, if not needed.

[0026] The binder contained in the anchor layer 3 is not limited, and examples thereof include modified styrene-acryl resin, acrylic emulsion, styrene-acryl copolymer, modified styrene-butadiene latex, styrene-butadiene copolymer (SBR), acryl-butadiene-styrene copolymer, vinyl acetate resin, vinyl acetate-acrylic acid copolymer, and polyurethane resin. Here, the term acryl means acrylic acid (salt) or an acrylic acid ester, and the term acrylic acid (salt) means acrylic acid or an acrylic acid salt.

[0027] The binder is preferably one or more selected from the group consisting of modified styrene-acryl resin, acrylic emulsion, styrene-acryl copolymer, acryl-butadiene-styrene copolymer, and vinyl acetate-acrylic acid copolymer, and more preferably one or more selected from the group consisting of modified styrene-acryl resin and acrylic emulsion. In

particular, if the modified styrene-acryl resin is used, modified styrene-acrylic acid (salt) resin is preferred. One of those binders alone or a combination of two or more thereof can be used.

[0028] The salt for the acrylic acid salt is not limited, and examples thereof include an ammonium salt such as a salt with ammonia; alkanolamine salts such as triethanolamine, diethanolamine, and monoethanolamine salts; alkylamine salts such as a methylamine salt, an ethylamine salt, a diethylamine salt, and a triethylamine salt; polyamine salts such as a diethyleneamine salt and a diethylenetriamine salt; alkali metal salts such as lithium, sodium, and potassium salts; alkaline earth metal salts such as magnesium and calcium salts; and polyvalent metal salts such as zinc and iron salts. Among those, the ammonium salt is particularly preferred. One of those salts alone or a combination of two or more thereof can be used.

[0029] As a binder other than those shown above, watersoluble polymer may be used, such as polyvinyl alcohol, starch and derivatives thereof, cellulose derivatives such as methoxycellulose, hydroxyethylcellulose, carboxymethylcellulose, methylcellulose, and ethylcellulose, sodium polyacrylate, polyvinylpyrrolidone, acrylamide-acrylic acid ester copolymer, acrylamide-acrylic acid ester-methacrylic acid terpolymer, an alkali salt of styrene-maleic anhydride copolymer, an alkali salt of isobutylene-maleic anhydride copolymer, polyacrylamide, sodium alginate, gelatin, and casein. One of those binders alone or a combination of two or more thereof can be used.

[0030] The content of the binder is preferably 10% by mass or more, more preferably 20% by mass or more, further preferably 50% by mass or more, further preferably 70% by mass or more, further preferably 80% by mass or more, and particularly preferably 90% by mass or more to 100% by mass of the dry mass of the anchor layer 3. The content of the binder may be substantially 100% by mass to 100% by mass of the dry mass of the anchor layer 3. The content of the binder within the range is preferred for more increased adhesion between the substrate 2 and the thermal layer 4.

[0031] Herein, the term "dry mass" means the mass of nonvolatile components (solid contents) given by drying a coating material or a raw material thereof to remove solvents (volatile components) such as water contained therein.

[0032] The coating amount (dry mass) for the anchor layer 3 is, for example, preferably 0.3 g/m² to 5.0 g/m², and more preferably 0.5 g/m² to 2.0 g/m².

[0033] The thickness of the anchor layer 3 is, for example, preferably 0.3 μm to 5.0 μm, and more preferably 0.5 μm to 2.0 μm.

[0034] The coating amount and thickness of the anchor layer 3 in the present embodiment within those ranges are preferred because more enhanced adhesion is given between the substrate 2 and the thermal layer 4 as a tendency.

[0035] In the case that the anchor layer 3 is provided in the present embodiment, a material fitting with the type of the substrate 2 can be selected for the anchor layer 3. In the case that a polypropylene film is used as the substrate 2, for example, the anchor layer 3 preferably contains, as a binder, modified styrene-acryl resin, more preferably contains modified styrene-acrylic acid (salt) resin, and more preferably contains modified styrene-acrylic acid (ammonium salt) resin. For enhanced transparency and imparting functionality, a biaxially oriented polypropylene (OPP) film is particularly preferred as the polypropylene film.

[0036] In the case that a polyethylene terephthalate film is used as the substrate 2, the anchor layer 3 preferably contains acrylic emulsion as a binder. For example, a material commercially available under the name "AQUENCE EPIX BC AD81B" (manufactured by Henkel Japan Ltd.) can be used as the acrylic emulsion. For enhanced transparency and imparting functionality, a heat-sealable polyethylene terephthalate (HS-PET) film is particularly preferred as the polyethylene terephthalate film. The combination of the substrate 2 and the anchor layer 3 is preferred because, as a tendency, more enhanced adhesion is given between the substrate 2 and the thermal layer 4 and more enhanced transparency is imparted to the heat-sensitive recording medium 1.

(Thermal layer)

[0037] In the present embodiment, the thermal layer 4 functions as a layer that develops color through heating. The thermal layer 4 at least contains a fatty-acid-based wax.

[0038] Use of materials having small average particle diameters is preferred in order to impart an enhanced degree of transparency to the heat-sensitive recording medium 1. The diffuse reflection of light caused by particles is reduced by the use of materials having small average particle diameters, and hence the heat-sensitive recording medium 1 is allowed to have enhanced transparency as a tendency.

[0039] Herein, the term average particle diameter refers to a particle diameter at which a cumulative value of 50% is reached in particle size distribution as determined by a laser diffraction-scattering method (D50, median diameter). Measurement of average particle diameter by the laser diffraction-scattering method can be performed, for example, by using "MT3300EX-II", which is a product name, manufactured by MicrotracBEL Corp. Hereinafter, the term "average particle diameter" refers to median diameter determined by that method.

[0040] The fatty-acid-based wax has a function to impart enhanced transparency to the heat-sensitive recording medium. Specifically, the fatty-acid-based wax is expected to permeate through gaps among particles of other components to fill the gaps in forming the thermal layer 4, thereby reducing the diffuse reflection of light in the gaps, and as a result

imparting more enhanced transparency to the heat-sensitive recording medium. Examples of the fatty-acid-based wax include fatty acids, fatty acid salts, fatty acid amides, and fatty acid esters. One of these fatty-acid-based waxes alone or a combination of two or more thereof can be used.

[0041] Examples of the fatty acids include higher fatty acids having 10 to 22 carbon atoms. Examples of the higher fatty acids having 10 to 22 carbon atoms include higher saturated fatty acids having 10 to 22 carbon atoms such as capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, arachidic acid, and behenic acid; and higher unsaturated fatty acids having 10 to 22 carbon atoms such as palmitoleic acid, oleic acid, elaidic acid, linoleic acid, and linolenic acid. These fatty acids may have a substituent. Examples of the substituent include a hydroxy group.

[0042] Examples of the fatty acid salts include salts given by neutralizing any of those fatty acids. Examples of the salts include alkali metal salts such as lithium, sodium, and potassium salts; alkaline earth metal salts such as magnesium and calcium salts; and polyvalent metal salts such as zinc and iron salts. Specific examples of the fatty acid salts include sodium stearate, potassium stearate, magnesium stearate, calcium stearate, zinc stearate, iron stearate, sodium oleate, potassium oleate, magnesium oleate, calcium oleate, zinc oleate, and iron oleate.

[0043] Examples of the fatty acid amides include amidation reaction products between any of those fatty acids and an ammonium or amine. Examples of the amine include diamines such as ethylenediamine and hexamethylenediamine. Specific examples of the fatty acid amides include capramide, lauramide, myristamide, palmitamide, stearamide, arachidamide, behenamide, palmitoleamide, oleamide, elaidamide, linoleamide, linolenamide, N,N'-ethylenebis(stearamide), and N,N'-hexamethylenebis(stearamide).

[0044] Examples of the fatty acid esters include esterification products between any of those fatty acids and a monohydric and/or polyhydric alcohol. Examples of the monohydric and/or polyhydric alcohol include monohydric alcohols such as ethanol and propanol; and polyhydric alcohols such as propylene glycol, glycerin, and sorbitol.

[0045] In the present embodiment, the fatty-acid-based wax is preferably a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax, and more preferably a solubilized fatty-acid-based wax. The term solubilized fatty-acid-based wax herein means being soluble in the thermal layer or a coating material for the thermal layer. Use of the solubilized fatty-acid-based wax and/or emulsified fatty-acid-based wax allows the heat-sensitive recording medium to have enhanced transparency as a tendency. In particular, being soluble in the thermal layer or a coating material for the thermal layer, the solubilized fatty-acid-based wax allows the heat-sensitive recording medium to have enhanced transparency as a tendency.

[0046] The solubilized fatty-acid-based wax may be soluble in the thermal layer or a coating material for the thermal layer by the presence of the fatty-acid-based wax alone, or soluble in the thermal layer or a coating material for the thermal layer by a configuration in which the fatty-acid-based wax contains a solubilizer to form a mixture of the two. Examples of the solubilizer include surfactants, solvents, and liquid media to be used for a coating material for the thermal layer. Examples of the liquid media for a coating material for the thermal layer include organic solvents and water, and water is preferred. In the case that the solubilized fatty-acid-based wax contains any of the liquid media to be used for a coating material for the thermal layer, the solubilized fatty-acid-based wax may contain part of the liquid medium or the whole of the liquid medium. For handleability and easiness in solubilization, the solubilized fatty-acid-based wax preferably contains a fatty-acid-based wax and a solubilizer. The solubilizer is preferably one or more selected from the group consisting of surfactants, solvents, and liquid media to be used for a coating material for the thermal layer. The solubilizer preferably contains a surfactant and/or solvent and part of a liquid medium for a coating material for the thermal layer, and it is also preferable that the solubilizer contain a surfactant and/or solvent and be free of a liquid medium for a coating material for the thermal layer.

[0047] The emulsified fatty-acid-based wax is such a compound that the fatty-acid-based wax undergoes self-emulsification, and may be singly dispersive in a liquid medium for a coating material for the thermal layer to become emulsified, or dispersive in a liquid medium for a coating material for the thermal layer by the action of a surfactant or the like to become emulsified. Herein, the term emulsified fatty-acid-based wax means a fatty-acid-based wax that stably forms an emulsion. Furthermore, the phrase stably forming an emulsion means, for example, being capable of maintaining an emulsion state without the appearance of change in state such as separation or precipitation of components after leaving at normal temperature and normal pressure for 24 hours.

[0048] In the present embodiment, the thermal layer 4 may contain an additional component other than the fatty-acid-based wax, and may contain, for example, a dye, a developer, a filler, a binder, a dispersant, a crosslinking agent, a wax differing from the fatty-acid-based wax (additional wax), a surfactant, or a solvent. Especially, the thermal layer 4 preferably contains a surfactant and/or solvent. The surfactant is not limited, and any component having a function to enhance the solubility of the fatty-acid-based wax may be used. Examples of the surfactant include anionic surfactants, nonionic surfactants, cationic surfactants, and amphoteric surfactants. One of these surfactants alone or a combination of two or more thereof can be used.

[0049] Examples of the anionic surfactants include alkylbenzenesulfonic acid and/or salts thereof, alkylsulfonic acid and/or salts thereof, alkylsulfate and/or salts thereof, and alkyl ether sulfate and/or salts thereof. Examples of the alkyl group of the anionic surfactants include alkyl groups having 10 to 22 carbon atoms. Examples of the alkyl groups include saturated hydrocarbon groups and unsaturated hydrocarbon groups. The alkyl groups may have a substituent. Examples

of the substituent include a hydroxy group. Examples of the salts include ammonium salts such as salts with ammonia; alkanolamine salts such as triethanolamine salts; alkali metal salts such as lithium, sodium, and potassium salts; alkaline earth metal salts such as magnesium and calcium salts; and polyvalent metal salts such as zinc and iron salts.

[0050] Examples of the nonionic surfactants include polyoxyethylene alkyl ether, polyoxypropylene alkyl ether, polyoxyalkylene alkyl ether, polyoxyethylene alkyl ester, polyoxyethylene polyoxypropylene glycol, sorbitan alkyl ester, polyoxyethylenesorbitan alkyl ester, glycerin alkyl ester, polyoxyethylene glycerin alkyl ester, and polyoxyethylene hydrogenated castor oil. Examples of the alkyl group of the nonionic surfactants include, but are not limited to, alkyl groups having 10 to 22 carbon atoms. Examples of the alkyl groups include saturated hydrocarbon groups and unsaturated hydrocarbon groups. The alkyl groups may have a substituent. Examples of the substituent include a hydroxy group.

[0051] The solvent is not limited, and any component having a function to enhance the solubility of the fatty-acid-based wax may be used. Examples of the solvent include glycol ethers such as diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, and diethylene glycol monobutyl ether; glycols such as ethylene glycol, diethylene glycol, triethylene glycol, and propylene glycol; ethers such as diisopropyl ether, ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, and 1,4-dioxane; alcohols such as methanol, ethanol, n-propanol, isopropanol, 2-ethylhexanol, and benzyl alcohol; and amines such as monoethanolamine, diethanolamine, and triethanolamine. Among them, the solvent is preferably one or more selected from the group consisting of glycol ethers, glycols, ethers, and alcohols, more preferably one or more selected from the group consisting of glycol ethers and glycols, and further preferably any of the glycol ethers, for handleability and solubilizing the fatty-acid-based wax. In the case that the solvent is any of the glycol ethers, diethylene glycol monobutyl ether is particularly preferred among them. One of those solvents alone or a combination of two or more thereof can be used.

[0052] Herein, any compound that corresponds to a fatty-acid-based wax and can further correspond to an additional component such as a surfactant and a solvent is classified only as a fatty-acid-based wax, and not classified as an additional component. Any compound that does not correspond to a fatty-acid-based wax and corresponds to a surfactant and a solvent is classified only as a surfactant, and not classified as a solvent.

[0053] The average particle diameter of the fatty-acid-based wax is preferably 1.0 μm or less. The average particle diameter of the fatty-acid-based wax within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0054] The content of the fatty-acid-based wax is preferably 0.1% by mass or more, more preferably 0.5% by mass or more, and further preferably 1% by mass or more to 100% by mass of the dry mass of the thermal layer 4. The content of the fatty-acid-based wax is preferably 5% by mass or less, more preferably 4% by mass or less, and further preferably 3% by mass or less to 100% by mass of the dry mass of the thermal layer 4. The content of the fatty-acid-based wax within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0055] Herein, in the case that the fatty-acid-based wax contains a solubilizer, the phrase "the content of the fatty-acid-based wax" means a content as the total of the dry mass of the fatty-acid-based wax and the dry mass of the solubilizer. In the case that the fatty-acid-based wax is emulsified and contains a surfactant, the phrase means a content as the dry mass of the emulsion with the surfactant.

[0056] In the present embodiment, the thermal layer 4 preferably contains a wax differing from the fatty-acid-based wax (additional wax) for imparting more enhanced long-term water resistance to the heat-sensitive recording medium 1. For example, polystyrene, polyethylene, or paraffin can be used as the wax differing from the fatty-acid-based wax. Especially, the wax differing from the fatty-acid-based wax is preferably one or more selected from the group consisting of polystyrene and polyethylene, and more preferably polystyrene for imparting more enhanced long-term water resistance and transparency to the heat-sensitive recording medium 1. One of those waxes alone or a combination of two or more thereof can be used.

[0057] The average particle diameter of the wax differing from the fatty-acid-based wax is preferably 0.1 μm or more. The average particle diameter of the wax differing from the fatty-acid-based wax is preferably 1.0 μm or less, more preferably 0.6 μm or less, further preferably 0.55 μm or less, further preferably 0.4 μm or less, and particularly preferably 0.3 μm or less. The average particle diameter of the wax differing from the fatty-acid-based wax within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0058] The content of the wax differing from the fatty-acid-based wax is preferably 0.1% by mass or more, more preferably 0.5% by mass or more, and further preferably 1% by mass or more to 100% by mass of the dry mass of the thermal layer 4. The content of the wax differing from the fatty-acid-based wax is preferably 5% by mass or less, more preferably 4% by mass or less, and further preferably 3% by mass or less to 100% by mass of the dry mass of the thermal layer 4. The content of the wax differing from the fatty-acid-based wax within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0059] In the present embodiment, the thermal layer 4 preferably contains, for example, one to five waxes, more preferably contains one or two waxes, and further preferably contains two waxes. In the case that two waxes are used,

containing a combination of one fatty-acid-based wax and one polystyrene is particularly preferred.

[0060] The ratio of the dry mass of the wax differing from the fatty-acid-based wax as the dry mass of the fatty-acid-based wax is taken as 1 (dry mass of wax other than fatty-acid-based wax / dry mass of fatty-acid-based wax) is preferably 0.1 or more, and more preferably 0.5 or more. The ratio of the dry mass of the wax differing from the fatty-acid-based wax as the dry mass of the fatty-acid-based wax is taken as 1 (dry mass of wax other than fatty-acid-based wax / dry mass of fatty-acid-based wax) is preferably 10 or less, more preferably 5 or less, and further preferably 2 or less. The ratio of the dry mass of the wax differing from the fatty-acid-based wax as the dry mass of the fatty-acid-based wax is taken as 1 (dry mass of wax other than fatty-acid-based wax / dry mass of fatty-acid-based wax) is particularly preferably 1. The ratio of the dry mass of the wax differing from the fatty-acid-based wax to the dry mass of the fatty-acid-based wax within the range is preferred because more enhanced transparency and long-term water resistance are imparted to the heat-sensitive recording medium 1 as a tendency.

[0061] The content of the whole of the waxes is preferably 0.2% by mass or more, more preferably 1% by mass or more, and further preferably 1.5% by mass or more to 100% by mass of the dry mass of the thermal layer 4. The content of the whole of the waxes is preferably 10% by mass or less, more preferably 8% by mass or less, and further preferably 5% by mass or less to 100% by mass of the dry mass of the thermal layer 4. The content of the whole of the waxes within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0062] Applicable as the dye are, for example, 3-dibutylamino-6-methyl-7-anilino-fluoran, 3-(N-isobutyl-N-ethyl)amino-6-methyl-7-anilino-fluoran, 3-(N-isopentyl-N-ethyl)amino-6-methyl-7-o-chloroanilino-fluoran, 3-(N-ethyl-N-p-toluidino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-isopentyl)amino-6-methyl-7-anilino-fluoran, 3-(N-ethoxypropyl-N-ethyl)amino-6-methyl-7-anilino-fluoran, 3-(N-cyclohexyl-N-methyl)amino-6-methyl-7-anilino-fluoran, 3-(N-methyl-N-n-propyl)amino-6-methyl-7-anilino-fluoran, 3-diethylamino-6-methyl-7-p-toluidino-fluoran, 3-diethylamino-6-methyl-7-anilino-fluoran, 3-diethylamino-6-methyl-8-methylfluoran, 3-diethylamino-7-(m-trifluoromethyl-anilino)fluoran, 3-diethylamino-7-(o-chloroanilino)fluoran, 3-diethylamino-7-chloro-fluoran, 3-dibutylamino-6-methyl-7-bromo-fluoran, 3-dibutylamino-7-(o-chloroanilino)fluoran, 3-dipentylamino-6-methyl-7-anilino-fluoran, 3-dimethylamino-5-methyl-7-methylfluoran, 3-pyrrolidino-6-methyl-7-anilino-fluoran, and crystal violet lactone. One of these dyes alone or a combination of two or more thereof can be used.

[0063] The average particle diameter of the dye is, for example, preferably 0.1 μm to 1.0 μm , more preferably 0.1 μm to 0.6 μm , further preferably 0.1 μm to 0.55 μm , further preferably 0.1 μm to 0.4 μm , and particularly preferably 0.1 μm to 0.3 μm . The average particle diameter of the dye within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0064] The content of the dye is preferably in the range of 5% by mass to 50% by mass, more preferably in the range of 8% by mass to 35% by mass, and further preferably in the range of 10% by mass to 25% by mass, based on the dry mass of the thermal layer 4.

[0065] Applicable as the developer are, for example, 4-hydroxyphenyl (4'-n-propoxyphenyl)sulfone, 3-[(3-phenylureido)phenyl]-4-methylbenzenesulfonate, N,N-di-[3-(p-toluenesulfonyloxy)phenyl]urea, 1,1-bis(p-hydroxyphenyl)cyclohexane, 1,1-bis(p-hydroxyphenyl)propane, 2,2-bis(p-hydroxyphenyl)propane, 2,2-bis(p-hydroxyphenyl)butane, 1,1-bis(4-hydroxyphenyl)-1-phenylethane, 2,2'-methylenebis(4-chlorophenol), 2,2-bis(4-hydroxyphenyl)-4-methylpentane, 2,4'-dihydroxydiphenyl sulfone, 4,4'-dihydroxydiphenyl sulfone, 4-hydroxy-4'-isopropoxydiphenylsulfone, 4-hydroxy-4'-methyl-diphenyl sulfone, 4-hydroxyphenyl-4'-benzyloxyphenyl sulfone, 4-hydroxy-4'-allyloxydiphenyl sulfone, bis(3-allyl-4-hydroxyphenyl) sulfone, poly(4-hydroxybenzoic acid), benzyl 4-hydroxybenzoate, 2,4-bis(phenylsulfonyl)phenol, α -{4-[(4-hydroxyphenyl)sulfonyl]phenyl}- ω -hydroxypoly (degree of polymerization: $n = 1$ to 7) (oxyethyleneoxyethyleneoxy-p-phenylenesulfonyl-p-phenylene) 2,2-bis[(4-methyl-3-phenoxy-carbonylaminophenyl)urea]diphenylsulfone, 3,5-bis(α -methylbenzyl)salicylic acid, bis[zinc 4-(n-octyloxycarbonylamino)salicylate], 4,4'-bis(p-trisulfonylaminocarbonylamino)diphenylmethane, 4-hydroxybenzenesulfonanilide, 2'-(3-phenylureido)benzenesulfonanilide, N-(2-hydroxyphenyl)-2-[(4-hydroxyphenyl)thio]acetamide, N-(4-hydroxyphenyl)-2-[(4-hydroxyphenyl)thio]acetamide, 4-[[4-[4-[4-(1-methylethoxy)phenyl]sulfonylphenoxy]butoxy]phenyl]sulfonyl]phenol, 4-tert-butylphenol-formaldehyde polycondensation products, N-(p-toluenesulfonyl) N'-(3-p-toluenesulfonyloxyphenyl)urea, and 1-phenyl-3-(4-methylphenylsulfonyl)urea. One of these developers alone or a combination of two or more thereof can be used.

[0066] The average particle diameter of the developer is, for example, preferably 0.1 μm to 1.0 μm , more preferably 0.1 μm to 0.6 μm , further preferably 0.1 μm to 0.55 μm , further preferably 0.1 μm to 0.4 μm , and particularly preferably 0.1 μm to 0.3 μm . The average particle diameter of the developer within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0067] The content of the developer is preferably in the range of 20% by mass to 70% by mass, more preferably in the range of 25% by mass to 60% by mass, and further preferably in the range of 30% by mass to 50% by mass, based on the dry mass of the thermal layer 4.

[0068] Applicable as the filler are, for example, kaolin, calcined kaolin, aluminum hydroxide, magnesium hydroxide, aluminum oxide, magnesium oxide, aluminum silicate, calcium carbonate, magnesium carbonate, titanium oxide, barium sulfate, silica gel, activated clay, talc, clay, diatomaceous earth, white carbon, zinc oxide, silicon oxide, colloidal silica,

polystyrene resin particles, urea-formalin resin particles, and polyolefin resin particles. One of these fillers alone or a combination of two or more thereof can be used.

[0069] The average particle diameter of the filler is, for example, preferably 0.1 μm to 1.0 μm , more preferably 0.1 μm to 0.6 μm , further preferably 0.1 μm to 0.55 μm , further preferably 0.1 μm to 0.4 μm , and particularly preferably 0.1 μm to 0.3 μm . The average particle diameter of the filler within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0070] The content of the filler is preferably in the range of 0.1% by mass to 30% by mass, more preferably in the range of 1% by mass to 20% by mass, and further preferably in the range of 5% by mass to 15% by mass, based on the dry mass of the thermal layer 4.

[0071] Applicable as the binder are, for example, styrene-butadiene copolymer (SBR), polyvinyl alcohol, modified polyvinyl alcohol, starch, casein, gelatin, polyamide, polyacrylamide, modified polyacrylamide, hydroxyethylcellulose, methylcellulose, carboxymethylcellulose, hydroxypropylcellulose, polyvinyl acetate, polyacrylic acid ester, styrene-maleic anhydride copolymer, isobutylene-maleic anhydride copolymer, diisobutylene-maleic anhydride copolymer, vinyl acetate-maleic anhydride copolymer, methylvinyl-maleic anhydride copolymer, isopropylene-maleic anhydride copolymer, styrene-butadiene copolymer, polyvinyl chloride, polyvinylidene chloride, vinyl chloride-vinyl acetate copolymer, polyurethane, polystyrene, polyvinylpyrrolidone, acrylic acid ester, acrylonitrile, and methyl vinyl ether. One of these binders alone or a combination of two or more thereof can be used.

[0072] The content of the binder is preferably in the range of 5% by mass to 50% by mass, more preferably in the range of 10% by mass to 40% by mass, and further preferably in the range of 20% by mass to 30% by mass, based on the dry mass of the thermal layer 4.

[0073] The dispersant is preferably a dispersant having a carboxyl group. Applicable as the dispersant having a carboxyl group are, for example, styrene-acryl polymer such as styrene-acrylic acid (salt) polymer and styrene-acrylic acid ester polymer, styrene-maleic acid (salt) resin, and styrene-maleic acid ester resin. Among them, styrene-acryl polymer is preferred, styrene-acrylic acid (salt) polymer is more preferred, and styrene-acrylic acid (ammonium salt) polymer is further preferred. One of those dispersants alone or a combination of two or more thereof can be used.

[0074] The salt for the acrylic acid salt contained in the dispersant having the carboxyl group is not limited, and examples thereof include an ammonium salt such as a salt with ammonia; alkanolamine salts such as triethanolamine, diethanolamine, and monoethanolamine salts; alkylamine salts such as a methylamine salt, an ethylamine salt, a diethylamine salt, and a triethylamine salt; polyamine salts such as a diethyleneamine salt and a diethylenetriamine salt; alkali metal salts such as lithium, sodium, and potassium salts; alkaline earth metal salts such as magnesium and calcium salts; and polyvalent metal salts such as zinc and iron salts. Among them, the ammonium salt is particularly preferred.

[0075] The content of the dispersant is preferably in the range of 5% by mass to 30% by mass, more preferably in the range of 7% by mass to 18% by mass, and further preferably in the range of 10% by mass to 15% by mass, based on the dry mass of the thermal layer 4.

[0076] Applicable as the crosslinking agent are, for example, epichlorohydrin-modified polyamide-polyamine resin and organic compounds containing an oxazoline group. One of these crosslinking agents alone or a combination of two or more thereof can be used.

[0077] The content of the crosslinking agent is preferably in the range of 0.1% by mass to 10% by mass, more preferably in the range of 0.3% by mass to 5% by mass, and further preferably in the range of 0.5% by mass to 2% by mass, based on the dry mass of the thermal layer 4.

[0078] In the case that a dispersant having a carboxyl group is used as the dispersant and epichlorohydrin-modified polyamide-polyamine resin is used as the crosslinking agent, the azetidinium ring (AZR) in the epichlorohydrin-modified polyamide-polyamine resin as the crosslinking agent and the carboxyl group of the dispersant react together to form a cross-linked structure in the thermal layer 4, and the cross-linked structure is expected to result in enhanced film formation in the thermal layer 4, filling gaps contained in the thermal layer 4. As a result, the thermal layer 4 comes to have more enhanced transparency, allowing the heat-sensitive recording medium 1 to have much superior transparency.

[0079] In the case that a dispersant having a carboxyl group is used as the dispersant and an organic compound containing an oxazoline group is used as the crosslinking agent, the oxazoline group of the organic compound containing an oxazoline group as the crosslinking agent and the carboxyl group of the dispersant react together to form a cross-linked structure in the thermal layer 4, and the cross-linked structure is expected to result in enhanced film formation in the thermal layer 4, filling gaps contained in the thermal layer 4. As a result, the thermal layer 4 comes to have more enhanced transparency, allowing the heat-sensitive recording medium 1 to have much superior transparency.

[0080] The coating amount (dry mass) for the thermal layer 4 is, for example, preferably 0.5 g/m^2 to 10.0 g/m^2 , more preferably 1.0 g/m^2 to 8.0 g/m^2 , further preferably 2.0 g/m^2 to 6.0 g/m^2 , further preferably 3.0 g/m^2 to 6.0 g/m^2 , further preferably 3.5 g/m^2 to 5.5 g/m^2 , further preferably 4.0 g/m^2 to 5.0 g/m^2 , and particularly preferably 4.5 g/m^2 . The coating amount within the range is preferred because more enhanced transparency is imparted to the heat-sensitive recording medium 1 as a tendency.

[0081] The thickness of the thermal layer 4 is, for example, preferably 2 μm to 6 μm , and more preferably 3 μm to 5 μm .

[0082] Having the configuration, the heat-sensitive recording medium 1 in the present embodiment is superior in transparency.

[0083] The haze value of the heat-sensitive recording medium 1 in the present embodiment, as measured for a laminate in which the two end faces are the substrate 2 and the thermal layer 4 by a method described in Examples, is preferably 40% or less, more preferably 38% or less, and further preferably 37% or less. The haze value of the laminate in which the two end faces are the substrate 2 and the thermal layer 4 within the range is preferred because of much superior transparency results.

[Method for producing heat-sensitive recording medium]

[0084] The method of the present invention for producing a heat-sensitive recording medium is not limited. For example, the production can be such that a coating material for a thermal layer is prepared by dispersing components to be contained in the thermal layer in a liquid medium such as water by a known or conventional method, and the resulting coating material is subsequently applied by a known or conventional method, and then dried by a known or conventional method.

(Preparation step)

[0085] In the preparation step, all components may be dispersed in advance in the same liquid medium to prepare the coating material for a thermal layer. Alternatively, a color former and developer reactive with each other, which have been prepared as separate dispersions, may be mixed together to form the coating material for a thermal layer. In this case, other components may be added to any one of the dispersion containing the dye and the dispersion containing the developer, or both of them. Examples of methods for preparing the coating material include, but are not limited to, disintegration treatment with stirring, ultrasonication, a ball mill, a bead mill, a sand mill, a high-pressure homogenizer, or the like. One of these methods alone or a combination of two or more thereof can be used.

[0086] The method of the present invention for producing a heat-sensitive recording medium preferably includes a step of preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax for giving a heat-sensitive recording medium having more enhanced transparency. Especially, inclusion of a step of preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax is more preferred. Microparticulation or solubilization of the fatty-acid-based wax into an emulsified state is expected to result in more enhanced permeation of the fatty-acid-based wax through gaps among particles of other components to fill the gaps to a higher degree, reducing the diffuse reflection of light in the gaps and as a result giving a heat-sensitive recording medium having more enhanced transparency.

[0087] The solubilized fatty-acid-based wax can be obtained in any manner without limitation, for example, by adding a solubilizer to a fatty-acid-based wax and mixing the resultant. For the solubilizer, all the contents shown in the section [Heat-sensitive recording medium] can be referred to. Examples of methods for the mixing include, but are not limited to, disintegration treatment with stirring, ultrasonication, a ball mill, a bead mill, a sand mill, a high-pressure homogenizer, or the like. One of these methods alone or a combination of two or more thereof can be used.

[0088] The solubilized fatty-acid-based wax is preferably in the form of transparent liquid. For example, a solubilized fatty-acid-based wax in the form of transparent liquid can be prepared by mixing the fatty-acid-based wax and the solubilizer. Such a solubilized fatty-acid-based wax can exhibit more enhanced permeation through a thermal layer or a coating material for a thermal layer, hence successfully giving a heat-sensitive recording medium having more enhanced transparency. In addition, in contrast to an emulsion in which a wax is present as particles in a medium, such a solubilized fatty-acid-based wax has no wax existing as particles, and hence more enhanced transparency can be imparted to the heat-sensitive recording medium.

(Coating step)

[0089] Examples of methods for applying the thus-obtained coating material for a thermal layer in the coating step include a method of directly applying onto a substrate and a method of applying onto a release liner or the like and then transferring onto a substrate. Examples of coating methods include, but are not limited to, air knife coating, Varibar blade coating, pure blade coating, rod blade coating, short-dwell coating, curtain coating, die coating, and gravure coating. One of these methods alone or a combination of two or more thereof can be used.

(Drying step)

[0090] Examples of methods for drying the thus-applied coating material include, but are not limited to, drying by heating, drying at normal temperature, and vacuum drying. A thermal layer can be formed by drying the applied coating material by

any of the methods. One of those methods alone or a combination of two or more thereof can be used.

[0091] In the case that the heat-sensitive recording medium of the present invention includes an additional layer differing from the thermal layer, the above contents can be referred to for a method for forming the additional layer. For example, the heat-sensitive recording medium 1 including the substrate 2, the anchor layer 3, and the thermal layer 4 in this order as illustrated in Figure 1 can be produced by such a production method that the anchor layer 3 is formed on the substrate 2 and the thermal layer 4 is then formed on the anchor layer 3. A coating material for the anchor layer may be prepared by such a method that all components to be contained in the anchor layer 3 are dispersed in advance in the same liquid medium, and, in the case that components reactive with each other are contained, the coating material may be prepared by preparing each component as separate dispersions and mixing them together. Examples of methods for the preparation include, but are not limited to, disintegration treatment with stirring, ultrasonication, a ball mill, a bead mill, a sand mill, a high-pressure homogenizer, or the like. One of these methods alone or a combination of two or more thereof can be used. Examples of methods for applying the thus-obtained coating material for the anchor layer onto the substrate 2 include a method of directly applying onto the substrate 2. Examples of methods for applying the coating material for the anchor layer include, but are not limited to, air knife coating, Varibar blade coating, pure blade coating, rod blade coating, short-dwell coating, curtain coating, die coating, and gravure coating. One of these methods alone or a combination of two or more thereof can be used. The anchor layer 3 can be subsequently formed on the substrate 2 by drying the thus-applied coating material for the anchor layer. Examples of methods for the drying include drying by heating, drying at normal temperature, and vacuum drying. One of these methods alone or a combination of two or more thereof can be used. The heat-sensitive recording medium 1 illustrated in Figure 1 can be subsequently obtained by forming the thermal layer 4 on the anchor layer 3 through the same procedure as described above.

[0092] In the method of the present invention for producing a heat-sensitive recording medium, the layers may be formed by multi-layer simultaneous coating with a curtain coater or the like, or individually, sequentially formed. Some of the layers may be formed by simultaneous coating with the other layers individually, sequentially formed.

Examples

[0093] The following describes the present invention in more detail by showing examples, but the present invention is not limited by those examples, and limited only by the description in Claims.

[0094] A heat-sensitive recording medium was produced by laminating an anchor layer and a thermal layer in this order on the upper side of a substrate through the following steps.

(Example 1)

(Production of heat-sensitive recording medium)

<Anchor layer>

[0095] A coating material for an anchor layer was prepared by adding water to a modified styrene-acrylic acid (ammonium salt) resin (manufactured by BASF Japan Ltd., product name: JONCRYL PDX7430) to give a dry mass of 10% by mass. The coating material for an anchor layer was applied onto a biaxially oriented polypropylene (OPP) film (thickness: 40 μm) as a substrate, and then dried to form an anchor layer with a coating amount of 0.5 to 2.0 g/m^2 as dry mass and a thickness of 0.5 to 2 μm .

<Thermal layer>

[0096] A coating material for a thermal layer with a dry mass of 23% by mass was prepared in such a manner that the dry mass of each material to be blended satisfied the composition shown in Table 1 with use of water as a liquid medium, applied onto the anchor layer, and then dried at 50°C to form a thermal layer with a coating amount of 4.0 g/m^2 as dry mass; thus, the production of a heat-sensitive recording medium in Example 1 was completed. The numerical values for materials to be blended in Table 1 show ratios of mass after drying (dry mass). If a material to be blended (e.g., a fatty-acid-based wax) contains a surfactant or solvent, the numerical value for the material to be blended in Table 1 shows a mass ratio with inclusion of the surfactant or solvent on being dried.

[0097] For a wax 1 as a material to be blended, a solubilized fatty-acid-based wax (manufactured by Nissin Kagaku Kenkyusho Co., Ltd., product name: R-053D) was used. The wax 1 contained a fatty-acid-based wax as a main component, contained an anionic surfactant and polyoxyethylene alkyl ether as surfactants, and contained water as a liquid medium. The wax 1 was readily soluble in water. 3-Dibutylamino-6-methyl-7-anilino-fluoran having an average particle diameter of 0.15 μm was used as a dye, 4-hydroxyphenyl (4'-n-propoxyphenyl)sulfone (manufactured by Mitsubishi Chemical Corporation, product name: Tomirac KN) having an average particle diameter of 0.15 μm was used

as a developer, kaolin having an average particle diameter of 0.4 μm was used as a filler, SBR having a glass transition temperature, T_g , of -3°C was used as a binder, styrene-acrylic acid (ammonium salt) polymer was used as a dispersant, and epichlorohydrin-modified polyamide-polyamine resin was used as a crosslinking agent.

(Example 2)

[0098] A heat-sensitive recording medium in Example 2 was produced in the same manner as in Example 1 except that, for the thermal layer, a wax 5 (a polystyrene wax having an average particle diameter of 0.2 μm) was further used as a wax differing from the fatty-acid-based wax and the blend ratios were adjusted in such a manner that the dry mass of each material to be blended satisfied the composition shown in Table 1.

(Example 3)

[0099] A heat-sensitive recording medium in Example 3 was produced in the same manner as in Example 2 except that, for the thermal layer, the wax 1 was changed to an emulsified fatty-acid-based wax (manufactured by Chukyo Yushi Co., Ltd., product name: HYMICRON L-271) as a wax 2. The wax 2 contained a fatty acid amide in a dry mass of 20% by mass to 30% by mass as a main component, contained triethanolamine in a dry mass of less than 1.0% by mass as a solvent, and contained water as a liquid medium. The wax 2 was dispersible in water. The average particle diameter of microparticles contained in an emulsion of the wax 2 was determined to be 0.87 μm .

(Example 4)

[0100] A heat-sensitive recording medium in Example 4 was produced in the same manner as in Example 2 except that, for the thermal layer, the wax 1 was changed to an emulsified fatty-acid-based wax (manufactured by Nissin Kagaku Kenkyusho Co., Ltd., product name: New Wax E-50) as a wax 3. The wax 3 contained a fatty-acid-based wax as a main component, contained solid paraffin in a dry mass of 10% by mass to 20% by mass as an additional component, and contained water as a liquid medium. The wax 3 was dispersible in water. The average particle diameter of microparticles contained in an emulsion of the wax 3 was determined to be 0.18 μm .

(Example 5)

[0101] A heat-sensitive recording medium in Example 5 was produced in the same manner as in Example 2 except that, for the thermal layer, the wax 1 was changed to a solubilized fatty-acid-based wax as a wax 4. The wax 4 was prepared by adding 3 g of diethylene glycol monobutyl ether as a solvent to 1 g of solid contents given by warming the wax 3, an emulsified fatty-acid-based wax (manufactured by Nissin Kagaku Kenkyusho Co., Ltd., product name: New Wax E-50), at 50°C to distill off water therein, and used as a solubilized fatty-acid-based wax. The diethylene glycol monobutyl ether in Example 5 is regarded as a solvent to solubilize the fatty-acid-based wax, and hence the numerical value for the wax 4 in Example 5 in Table 5 shows the ratio of dry mass with inclusion of the diethylene glycol monobutyl ether.

[0102] The wax 1 and the wax 4 were in the form of transparent liquid.

[0103] (Comparative Example 1)

[0104] A heat-sensitive recording medium in Comparative Example 1 was produced in the same manner as in Example 2 except that, for the thermal layer, the wax 1 was changed to a wax 6 and the wax 5 was changed to a wax 7. The wax 6 used was a polyethylene wax having an average particle diameter of 1.3 μm , and the wax 7 used was paraffin having a melting point of 46°C and an average particle diameter of 0.3 μm .

[0105] Thus, the heat-sensitive recording media in Examples 1 to 5 and Comparative Example 1 were produced by the methods described above, and used for the following haze value measurement.

(Haze value measurement)

[0106] In haze value measurement, the haze value of each heat-sensitive recording medium (a laminate in which the two end faces are a substrate and a thermal layer) produced as described above was measured from the thermal layer side using a haze meter (manufactured by NIPPON DENSHOKU INDUSTRIES CO., LTD., product name: NDH7000). The haze values obtained for the heat-sensitive recording media produced in the examples and comparative example are shown in Table 1.

[0107] The measurement was conducted by a method in accordance with JIS K7136: 2000.

[Table 1]

[0108]

Table 1

		Example 1	Example 2	Example 3	Example 4	Example 5	Comparative Example 1
	Dye	13.6%	13.6%	13.6%	13.6%	13.6%	13.6%
	Developer	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%
	Filler	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
	Binder	26.0%	26.0%	26.0%	26.0%	26.0%	26.0%
	Wax 1 (solubilized fatty-acid-based wax)	3.0%	1.5%	-	-	-	-
	Wax 2 (emulsified fatty-acid-based wax)	-	-	1.5%	-	-	-
	Wax 3 (emulsified fatty-acid-based wax)	-	-	-	1.5%	-	-
	Wax 4 (solubilized fatty-acid-based wax)	-	-	-		1.5%	-
	Wax 5 (polystyrene wax, average particle diameter: 0.2 μm)	-	1.5%	1.5%	1.5%	1.5%	-
	Wax 6 (polyethylene wax, average particle diameter: 1.3 μm)	-	-	-	-	-	1.5%
	Wax 7 (paraffin wax, average particle diameter: 0.3 μm)	-	-	-	-	-	1.5%
	Dispersant	12.2%	12.2%	12.2%	12.2%	12.2%	12.2%
	Crosslinking agent	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	Total (%)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Haze value (%)	34.50	35.14	37.93	38.11	37.37	44.54

[0109] Table 1 gave the following findings.

[0110] The heat-sensitive recording media in Examples 1 to 5, in each of which a fatty-acid-based wax was contained as a wax in the thermal layer, had smaller haze values than the heat-sensitive recording medium in Comparative Example 1, in which no fatty-acid-based wax was contained; thus, it was found that heat-sensitive recording media having enhanced transparency are given as a tendency by the use of a fatty-acid-based wax as the wax. Furthermore, the heat-sensitive recording medium in Example 5, which was obtained with the wax 4, a solubilized fatty-acid-based wax given by solubilizing the wax 3 with a solvent, exhibited a smaller haze value than the heat-sensitive recording medium in Example 4, which was obtained with the wax 3, an emulsified fatty-acid-based wax; thus, enhanced transparency was found. Although the detailed mechanism of action for the enhancement of transparency due to the use of a fatty-acid-based wax after being solubilized is unclear, it is expected that the solubilization of the wax 3, which existed as particles of visually discernable size, resulted in more enhanced permeation through gaps among particles of materials to be blended.

[0111] As a summary of the above, the configuration of the present invention and variations thereof are added in the following.

[Supplement 1] A heat-sensitive recording medium comprising a thermal layer containing a fatty-acid-based wax.

[Supplement 2] The heat-sensitive recording medium according to supplement 1, wherein the fatty-acid-based wax is a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax.

[Supplement 3] The heat-sensitive recording medium according to any one of supplements 1 and 2, wherein the fatty-acid-based wax is a solubilized fatty-acid-based wax.

[Supplement 4] The heat-sensitive recording medium according to any one of supplements 2 and 3, wherein the solubilized fatty-acid-based wax contains a solubilizer.

[Supplement 5] The heat-sensitive recording medium according to any one of supplements 1 to 4, wherein the solubilized fatty-acid-based wax is in a form of transparent liquid.

[Supplement 6] The heat-sensitive recording medium according to any one of supplements 1 to 5, wherein the thermal layer contains a surfactant and/or a solvent.

[Supplement 7] The heat-sensitive recording medium according to any one of supplements 1 to 6, wherein the thermal layer further contains a wax differing from the fatty-acid-based wax and having an average particle diameter of 1 μm or less.

[Supplement 8] The heat-sensitive recording medium according to supplement 7, wherein the wax differing from the fatty-acid-based wax is any one or more of polystyrene, polyethylene, and paraffin.

[Supplement 9] The heat-sensitive recording medium according to any one of supplements 1 to 8, having a content of the fatty-acid-based wax in the range of 0.1% by mass to 5% by mass, based on a dry mass of the thermal layer.

[Supplement 10] A method for producing the heat-sensitive recording medium according to any one of supplements 1 to 9, the method comprising the steps of: preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax; and forming a thermal layer by applying and drying the coating material for a thermal layer.

[Supplement 11] A method for producing the heat-sensitive recording medium according to any one of supplements 1 to 9, the method comprising the steps of: preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax in a form of transparent liquid; and forming a thermal layer by applying and drying the coating material for a thermal layer.

Industrial Applicability

[0112] The heat-sensitive recording medium of the present invention is superior in transparency, and hence applicable particularly preferably to applications for which the visibility of contents is required, such as labels for food containers like lunch boxes and food-packaging films.

Reference Signs List

[0113]

- 1 heat-sensitive recording medium
- 2 substrate
- 3 anchor layer
- 4 thermal layer

Claims

1. A heat-sensitive recording medium comprising a thermal layer containing a fatty-acid-based wax.
2. The heat-sensitive recording medium according to claim 1, wherein the fatty-acid-based wax is a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax.
3. The heat-sensitive recording medium according to claim 1, wherein the fatty-acid-based wax is a solubilized fatty-acid-based wax.
4. The heat-sensitive recording medium according to claim 3, wherein the solubilized fatty-acid-based wax contains a solubilizer.

5. The heat-sensitive recording medium according to any one of claims 1 to 4, wherein the thermal layer contains a surfactant and/or a solvent.

6. The heat-sensitive recording medium according to any one of claims 1 to 4, wherein the thermal layer further contains a wax differing from the fatty-acid-based wax and having an average particle diameter of 1 μm or less.

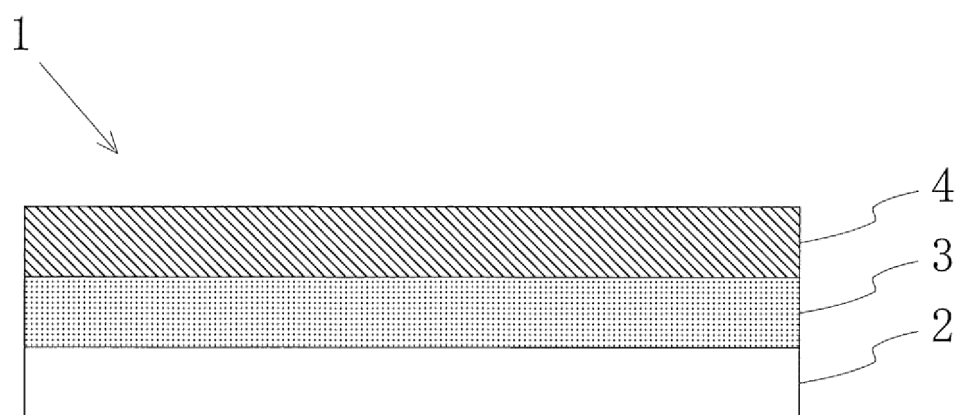
7. The heat-sensitive recording medium according to any one of claims 1 to 4, having a content of the fatty-acid-based wax in the range of 0.1% by mass to 5% by mass, based on a dry mass of the thermal layer.

8. A method for producing the heat-sensitive recording medium according to any one of claims 1 to 4, the method comprising the steps of:

preparing a coating material for a thermal layer by using a solubilized fatty-acid-based wax and/or an emulsified fatty-acid-based wax; and

forming a thermal layer by applying and drying the coating material for a thermal layer.

[Fig. 1]



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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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 1971-2024
Registered utility model specifications of Japan 1996-2024
Published registered utility model applications of Japan 1994-2024

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 2015-182327 A (NIPPON PAPER INDUSTRIES CO., LTD.) 22 October 2015 (2015-10-22) paragraphs [0007], [0043]-[0057]	1-5, 7, 8
X	JP 2013-86402 A (OJI HOLDINGS CORPORATION) 13 May 2013 (2013-05-13) paragraphs [0048]-[0074]	1-8
X	JP 2008-100392 A (OJI PAPER CO., LTD.) 01 May 2008 (2008-05-01) paragraphs [0015]-[0021], [0092]-[0116]	1-8
X	JP 2006-264123 A (MITSUBISHI PAPER MILLS LTD.) 05 October 2006 (2006-10-05) paragraphs [0028], [0067]-[0108]	1-5, 7, 8
X	JP 8-156406 A (RICOH COMPANY, LTD.) 18 June 1996 (1996-06-18) paragraphs [0020]-[0021], [0024]-[0032]	1-8
X	JP 6-305242 A (NEW OJI PAPER CO., LTD.) 01 November 1994 (1994-11-01) paragraphs [0011], [0021], [0025]-[0044]	1-5, 7, 8

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search

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Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/017006

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2-1364 A (KANZAKI PAPER MFG CO., LTD.) 05 January 1990 (1990-01-05) p. 6, lower left column to p. 7, lower right column	1-5, 7, 8
X	JP 9-39405 A (OJI PAPER CO., LTD.) 10 February 1997 (1997-02-10) paragraphs [0019]-[0034]	1-5, 7, 8

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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JP 2015-182327 A	22 October 2015	(Family: none)	
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JP 2006-264123 A	05 October 2006	(Family: none)	
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JP 2-1364 A	05 January 1990	US 5017545 A column 6, line 30 to column 9, line 24 EP 0345755 A2	
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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