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## (54) Diffusion transfer heat processable photosensitive material.

(57) A diffusion transfer heat-processable photosensitive material comprises a dye-providing material represented by the following Formula (I) :

Formula (I) $[A\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-Dye}$

wherein A represents a 1,3-S-N- or 1,3-S-N- compound residue ; $J_1$ represents a divalent group ; $J_2$ represents a divalent, trivalent, tetravalent or pentavalent group ; $X_1$ and $X_2$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O- ; a, b, d and e independently represent 0 or 1 ; c represents an integer of 1 to 4 ; and Dye represents a residue of an indoaniline cyan dye prepared from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative.

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## FIELD OF THE INVENTION

The present invention relates to a diffusion transfer heat-processable photosensitive material, and particularly to a diffusion transfer heat-processable photosensitive material wherein the density of a cyan dye image has been improved.

## BACKGROUND OF THE INVENTION

Heat development wherein heating is used in a development step is conventional. Heat development for obtaining black-and-white images and color images are known. In addition, a transfer heat-processable photosensitive material wherein an image obtained through heat development is transferred from a photosensitive material to an image receiving layer is also well-known.

A heat-processable photosensitive material ordinarily comprises a support and provided thereon, a binder, a photosensitive silver halide emulsion, a reducing agent, and optionally, a dye-providing material, an organic silver salt and various photographic additives. In addition, with regard to a transfer heat-processable photosensitive material, the above-mentioned photosensitive material may have an image receiving layer capable of receiving silver or dyes, or a separate image receiving material having an image receiving layer capable of receiving silver or dyes is used in combination with the photosensitive material.

Among heat-processable photosensitive materials, when a color image is obtained, a dye-providing material forming or releasing a dye on heat development is ordinarily used. In such a color heat-processable photosensitive material, a method to form or release a diffusible dye on heat development and to diffuse and transfer the dye to a dye image receiving material is preferably used from the viewpoint of image sharpness and preservability of a dye image.

As a dye-providing material used for the above-mentioned diffusion transfer heat development, various materials have so far been known. In many cases, utilization of dye-providing materials of the type of a wet type diffusion transfer system (so-called an instant photography) has been attempted. The above-mentioned dye-providing materials are generally divided into a type wherein diffusible dyes are released in accordance with the development of silver halide and a type wherein diffusible dyes are released in reverse accordance with the development of silver halide.

One of the latter type is a dye-providing material releasing a diffusible dye on reaction with a silver ion of silver halide or an organic silver compound unused on development or a soluble silver ion complex derived from silver particles thereof.

Examples applying this type of dye-providing material to the wet type diffusion transfer system are disclosed in U.S. Patent Nos. 4,362,806, 3,719,489 and 4,375,507. In addition, examples applying this dye-providing material to the diffusion transfer heat development are disclosed in Japanese Patent Publication Open to Public Inspection (hereinafter referred to as Japanese Patent O.P.I. Publication) No. 180548/1984.

A weak point which these dye-providing materials is that it is necessary to subject them to photographic development for a relatively long time and at high temperature for obtaining a sufficient dye density, in other words, that the sufficient dye density cannot be obtained for a relatively short time and at low temperature. Especially in the case of a cyan dye image, it has been found that this weak point appears noticeably.

## SUMMARY OF THE INVENTION

The present invention has been attempted in view of the above-mentioned problems. A first object of the present invention is to provide a diffusion transfer heat-processable photosensitive material containing a cyan dye-providing material which provides a low fog and a sufficient maximum density for a relatively short time and at a low temperature.

A second object of the present invention is to provide a diffusion transfer heat-processable photosensitive material providing an excellent image stability due to heat development and containing a cyan dye-providing material which provides visible absorption spectral necessary for faithful color reproducibility and sharp color images.

## DETAILED DESCRIPTION OF THE INVENTION

The above-mentioned objects of the present invention have been attained by a diffusion transfer heat-processable photosensitive material comprising a support and provided thereon a hydrophilic binder, a photosensitive silver halide and a dye-providing material wherein the dye-providing material is a compound represented by the following Formula (I):

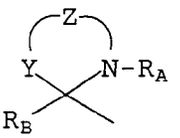
Formula (I) $[A\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-Dye}$

wherein A represents a 1,3-S-N- or 1,3-Se-N- compound residue releasing $[\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-Dye}$ on cleavage reaction at a high temperature in the presence of a silver ion or a soluble silver complex ; $J_1$ represents a divalent linkage group; $J_2$ represents a divalent to pentavalent linkage group; $X_1$ and $X_2$ independently represent a divalent linkage group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-; a, b, d and e independently represent 0 or 1; c represents an integer of 1 through 4; and Dye represents an indoaniline cyan dye residue produced from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative.

Hereunder, the present invention will be explained in detail.

In the above-mentioned Formula (I), the 1,3-S-N or 1,3-Se-N- compound residue on cleavage reaction at high temperature in the presence of a silver ion or a soluble silver complex represented by A is preferably a cyclic 1,3-S-N- or 1,3-Se-N- compound residue represented by the following Formula (II) :

Formula (II)




wherein $R_A$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group, an acyl group or a sulfonyl group.

An alkyl group represented by $R_A$ includes a straight-chained or branched alkyl group such as methyl, ethyl, i-propyl, t-butyl, dodecyl or 1-hexylnonyl.

A cyclohexyl group includes, for example, a cyclopropyl group, a cyclohexyl group, a bicyclo[2.2.1]heptyl group and an adamantyl group.

An aryl group includes, for example, a phenyl group, a 1-naphthyl group and a 9-anthranyl group.

A heterocyclic group includes, for example, a 2-tetrahydrofuryl group, a 2-thienyl group, a 4-imidazolyl group and a 2-pyridyl group.

An acyl groups includes, for example, a carbonyl group (for example, an alkylcarbonyl group such as an acetyl group or a trifluoro acetylpyvaloyl group and an arylcarbonyl group such as a benzoyl group, a pentafluorobenzoyl group or a 3,5-di-t-butyl-4-hydroxybenzoyl group), an oxycarbonyl group (for example, an alkoxy carbonyl group such as a methoxycarbonyl group, a cyclohexyloxycarbonyl group or a dodecyloxycarbonyl group), an aryloxycarbonyl group such as a phenoxycarbonyl group, a 2,4-di-t-amylphenoxycarbonyl group or a 1-naphtyloxycarbonyl group, a heterocyclic oxy carbonyl group such as a 2-pyridyloxy carbonyl group and a 1-phenyl pyrazolyl-5-oxycarbonyl group, a carbamoyl group (for example, an alkyl carbamoyl group such as a dimethylcarbamoyl group or a 4-(2,4-di-t-amylphenoxy)butylaminocarbonyl group and an arylcarbamoyl group such as a phenyl carbamoyl group or a 1-naphthylcarbamoyl group).

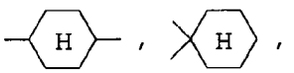
The sulfonyl group represented by $R_A$ includes a sulfonyl group (for example, an alkylsulfonyl group such as a methanesulfonyl group or a trifluoromethanesulfonyl group and an arylsulfonyl group such as p-toluenesulfonyl group or a sulfamoyl group (for example, an alkylsulfonyl group such as a dimethylsulfamoyl group or 4-(2,4-di-t-amylphenoxy)butylaminosulfonyl group or an arylsulfonyl group such as a phenylsulfamoyl group).

Each group represented by $R_A$ may have a substituent. The substituent includes, for example, an alkyl, cycloalkyl, aryl, heterocyclic, acyl or sulfonyl group as described in the above $R_A$. In addition, an alkyl group substituted with a halogen atom (for example, a trifluoromethyl group), a halogen atom (for example, chlorine and bromine), a cyan group, a nitro group, an alkenyl group (for example, 2-propylene and oleyl), a hydroxyl group, an alkoxy group (for example, a methoxy group and a 2-ethoxyethoxy group), an aryloxy group (for example, a phenoxy group, a 2,4-di-t-amylphenoxy group and a 4-(4-hydroxyphenylsulfonyl)phenoxy group), a heterocyclicoxy group (for example, a 4-pyridyloxy group and a 2-hexahydropyranyloxy group), a carbonyloxy group (for example, an alkylcarbonyloxy group such as an acetyloxy group, a trifluoroacetyloxy group and a pyvaloyloxy group and an aryloxy group such as a benzoyloxy group and a pentafluorobenzoyloxy group), an urethane group (for example, an alkylurethane group such as an N,N-dimethylurethane group and an arylurethane group such as an N-(p-cyanophenyl)urethane, a sulfonyloxy group (for example, an alkylsulfonyloxy group such as a methanesulfonyloxy group, a trifluoromethanesulfonyloxy and a dodecanesulfonyloxy group and an arylsulfonyloxy group such as an alkylsulfonyloxy group, a benzenesulfonyloxy group and a p-toluenesulfonyloxy group), amino groups (for example, an alkylamino group such as a dimethylamino group, a cyclohexylamino group and a dodecylamino group and an aryl amino group such as an anilino group and a p-t-

octylanilino group), a sulfonylamino group (for example, an alkylsulfonylamino group such as a methanesulfonylamino group, a heptafluoropropanesulfonylamino group and a hexadecylsulfonylamino group and an arylsulfonylamino group such as a p-toluenesulfonyl group and a pentafluorobenzenesulfonylamino group), a sulfamoylamino group (for example, an alkylsulfamoylamino group such as an N,N-dimethylsulfamoylamino group and an arylsulfamoylamino group such as an N-phenylsulfamoylamino group), an acylamino group (for example, an alkylcarbonylamino group such as an acetylamino group, a myrystoilamino group and an arylcarbonylamino group and an arylcarbonylamio group such as a benzoylamino group), an ureido group (for example, an alkylureido group such as an N,N-dimethylaminoureido group and an arylureido group such as an N-phenylureido group and an N-(p-cyanophenyl)ureido group), an alkylthio group (for example, a methylthio group and a t-octylthio group), an arylthio group (for example, a phenylthio group) and a heterocyclicthio group (for example, a 1-phenyltetrazol-5-thio goup and a 5-methyl-1,3,4-oxadiazole-2-thio group) are cited.

$R_A$ is preferably an alkyl group or an aryl group.

$R_B$ represents an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group or a group represented by $-(J_1')_{a'}-(X_1')_{b'}-(J_2')_{d'}-(X_2')_{e'}-Dye'$, wherein $J_1'$ and $J_2'$ represent independently a divalent group selected from the group consisting of $-CH_2-$, $-CH(CH_3)-$, $-CH_2(CH_2)_nCH_2-$ wherein n represent an integer of 0 to 10,



-CH=CH-, -C≡C-, phenylene or naphthylene, $X_1'$ and $X_2'$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-, a', b', d' and e' independently represent 0 or 1, and Dye' represents a residue of an indoaniline cyan dye prepared from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative. Dye' preferably represents a residue represented by Formula (III) described later.

The alkyl, cycloalkyl, aryl and heterocyclic group represented by $R_B$ include the same alkyl, cycloalkyl, aryl and heterocyclic group as those represented by the above $R_A$. In addition, each group represented by $R_B$ can have a substituent. The substituent includes those for an cycloalkyl group, aryl group and heterocyclic group each represented by $R_A$.

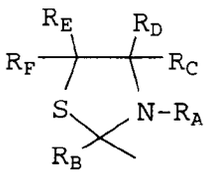
$R_B$ is preferably a hydrogen atom.

Y represents a sulfur atom or a selenium atom. Z represents a nonmetallic atomic group necessary to form a 5- to 7-membered ring. Examples thereof include a ethylene group, a trimethylene group and a 1,2-phenylene group.

Y is preferably a sulfur atom. Z is preferably a nonmetallic atomic group necessary to form a 5-membered ring.

In Formula (I), A is more preferably a thiazolydinyl group represented by the following Formula (IV):

Formula (IV)



In Formula (IV), $R_A$ and $R_B$ independently represent the same group as $R_A$ and $R_B$ as those described in the above-mentioned Formula (II).

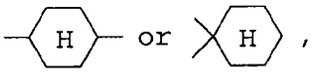
$R_C$, $R_D$, $R_E$ and $R_F$ independently represent a hydrogen atom, an alkyl group, an aryl group, a heterocyclic group, a carboxyl group, an acyl group, a sulfonyl group or a sulfo group.

The alkyl, aryl, heterocyclic, acyl and sulfonyl group independently represented by $R_C$, $R_D$, $R_E$ and $R_F$ include the same groups as those represented by $R_A$ in the above-mentioned Formula (II). In addition, the alkyl, cycloalkyl, aryl, heterocyclic, acyl and sulfonyl group represented by $R_B$ can have a substituent. Examples of the substituent include the same group as the substituent for each group represented by $R_A$ in the above-mentioned Formula (II).

$R_C$, $R_D$, $R_E$ and $R_F$ independently represent a hydrogen atom, an alkyl group, an aryl group and an acyl group preferably. The more preferable are an hydrogen atom and an alkyl group.

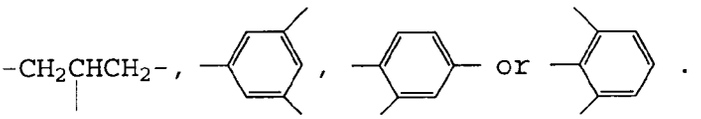
In Formula (I), $J_1$ represents a divalent linkage group including an alkylene group such as $-CH_2-$, $-CH(CH_3)-$

or $-CH_2(CH_2)_nCH_2-$ wherein n represent an integer of 0 to 10, a cycloalkylene group such as



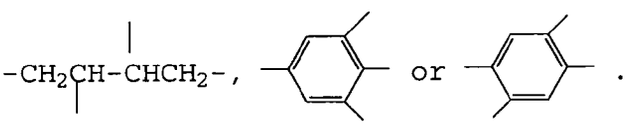
an alkenylene group such as -CH=CH-, an alkinylene group such as -C≡C- or an arylene group such as o-, m- or p-phenylene or naphthylene.

$J_2$ represents a divalent through pentavalent linkage group, and preferably represents a divalent or trivalent linkage group. The divalent linkage group of $J_2$ includes the same groups as $J_1$ above. The trivalent group of $J_2$ includes $>CHCH_2-$,

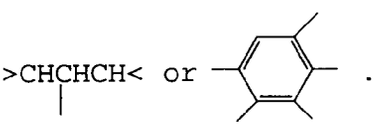


The tetravalent group of $J_2$ includes

>CH-CH<,



The pentavalent group of $J_2$ includes

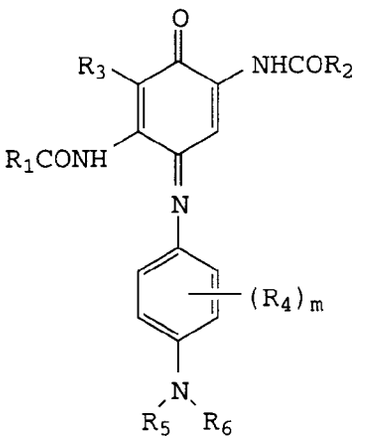


In Formula (I), $X_1$ and $X_2$ independently represent a divalent linkage group selected from -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO- and -O-. Preferably, $X_1$ and $X_2$ independently represent a divalent linkage group selected from -CONH-, $-SO_2NH-$, -NHCO- and $-NHSO_2-$.

In Formula (I) a, b, d and e independently represent 0 or 1, and c represents an integer of 1 through 4, preferably 1 or 2 and more preferably 2.

In Formula (I), Dye represents an indoaniline cyan dye residue produced from a 2,5-diaminophenol derivative and a p-phenylenediamine derivative. Preferably, a dye residue represented by the following Formula (III):

Formula (III)



In Formula (III), $R_1$ represents an alkyl group, a cycloalkyl group or an aryl group. The examples thereof include the same groups as those represented by $R_A$ in the above-mentioned Formula (II). Each group represented by $R_1$ can have a substituent. The substituent includes the same groups as the substituent for the alkyl, cycloalkyl and aryl group represented by $R_A$.

$R_2$ represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group. Practically, the same groups as ones represented by $R_A$ in the above-mentioned Formula (II). In addition, each group represented by $R_2$ may have a substituent. The substituent includes the same group as those cited as the substituent for the alkyl, cycloalkyl, aryl and heterocyclic group each represented by $R_A$.

$R_3$ represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group.

The alkyl group represented by $R_3$ includes, for example, the same group as the alkyl group represented by $R_A$ in the above-mentioned Formula (II). The alkoxy group includes, for example, a methoxy group, a 2-ethoxyethoxy group and an i-propoxy group. The alkyl and alkoxy group may have a substituent. The substituent includes the same group as those cited as the substituent for the alkyl group represented by $R_A$ in Formula (II). $R_1$ and $R_3$ may combine to form a cyclic structure, each other. $R_3$ is preferably a hydrogen atom or an alkyl group, and especially preferably a hydrogen atom.

$R_4$ represents an acylamino group or an alkoxy group. m represents an integer of 0 through 4. The alkyl and alkoxy group represented by $R_4$ include the same group as the alkyl and alkoxy group represented by $R_3$, respectively.

The acylamino group includes an alkylcarbonylamino group such as an acetylamino group and a myrystoylamino group and an arylcarbonylamino group such as a benzoylamino group.

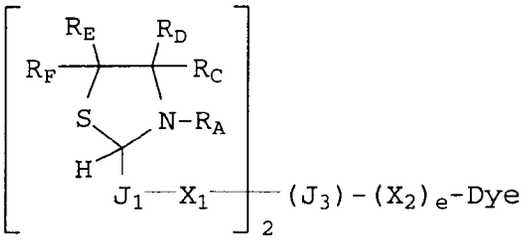
Each group represented by $R_4$ may have a substituent. The substituent includes the same group cited as the substituent for the alkyl group represented by $R_A$ in Formula (II).

$R_5$ and $R_6$ independently represent an alkyl group, a cycloalkyl group or an aryl group, provided that $R_5$ and $R_5$ combine each other to form a ring. The alkyl, cycloalkyl or aryl group represented by $R_5$ and $R_6$ include, for example, the same group as that of $R_A$ in the aforementioned Formula (II). The group represented by $R_5$ and $R_6$ may have a substituent. The substituent includes the same group as the substituent of the alkyl cycloalkyl or aryl group represented by $R_A$.

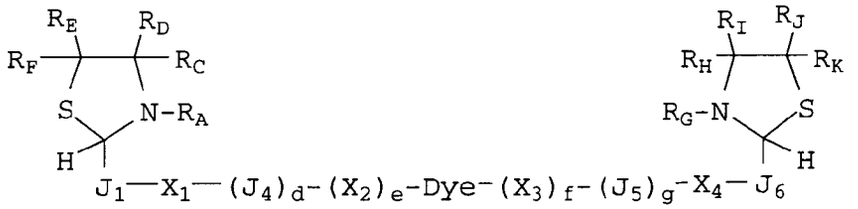
The group represented by the above-mentioned Formula (III) is linked with a group represented by $[A\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-}$ through at least one of $R_1$ through $R_5$.

Among the dye-providing material represented by Formula (I), dye-providing materials represented by the following Formula (V) or (VI) are preferable.

Formula (V)



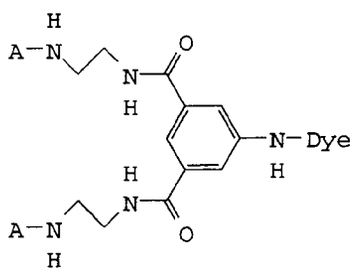
Formula (VI)

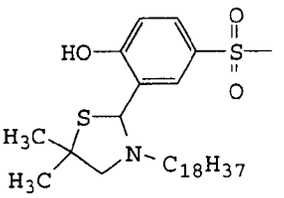
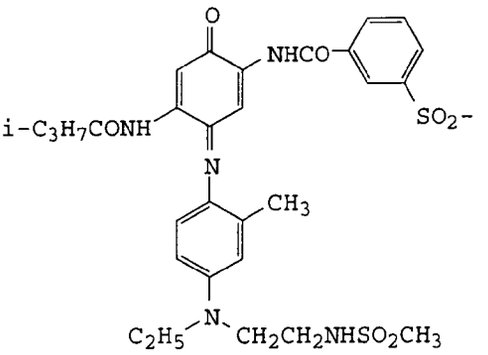
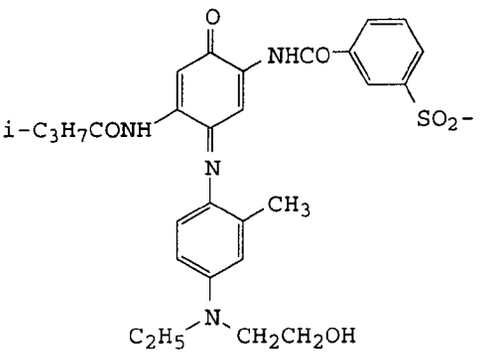
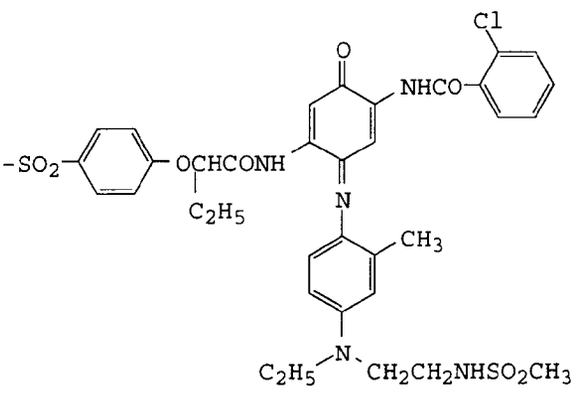


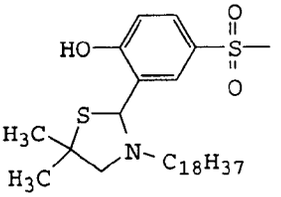
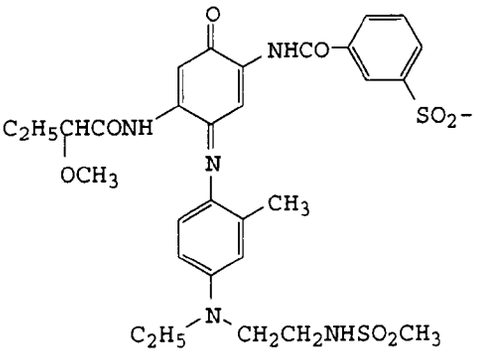
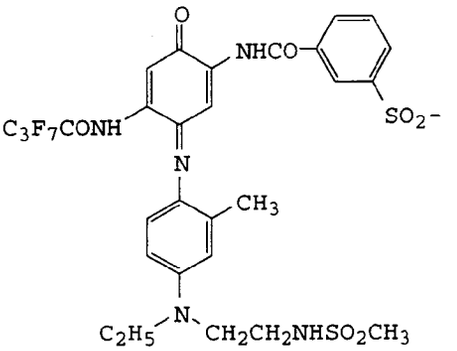
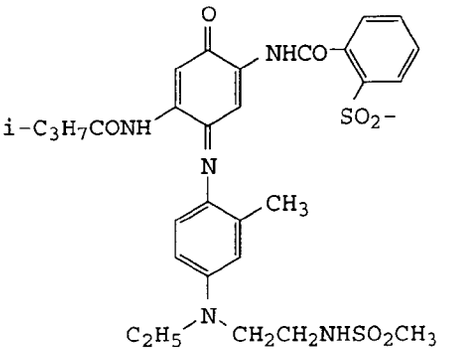
In Formula (V), $R_A$, $R_C$, $R_D$, $R_E$ and $R_F$ represent the same group as $R_A$, $R_C$, $R_D$, $R_E$ and $R_F$ in the above-mentioned Formula (IV), respectively. $J_1$, $X_1$ and $X_2$ represents the same group as $J_1$, $X_1$ and $X_2$ in the above-mentioned Formula (I), respectively. $J_3$ represents a trivalent linkage group, and e represents 0 or 1. Dye represents the same as the dye residue represented by the above-mentioned Formula (III).

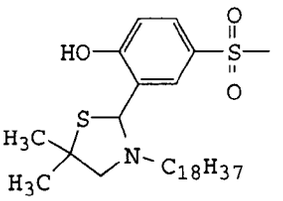
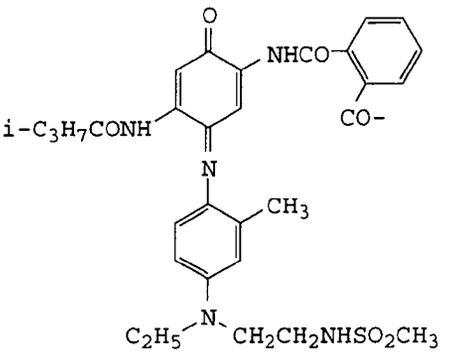
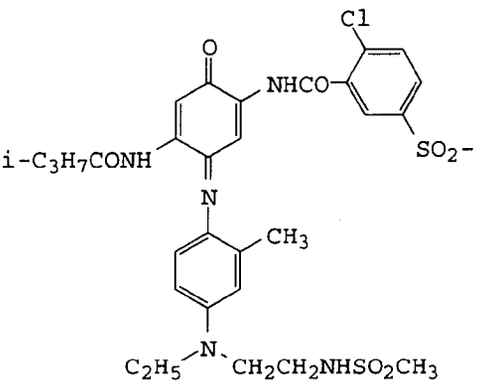
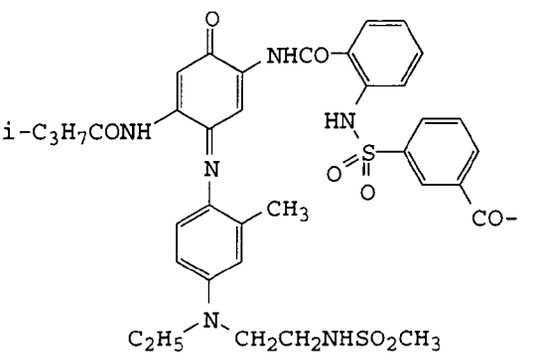
In Formula (VI), $R_A$ and $R_G$ respectively represent the same group as $R_A$ in the above-mentioned Formula (IV). $R_C$, $R_D$, $R_E$ and $R_F$ and $R_H$, $R_I$, $R_J$ and $R_K$ represent the same group as $R_C$, $R_D$, $R_E$ and $R_F$ in Formula (VI), respectively. $J_1$, $J_4$, $J_5$ and $J_6$ independently represent a divalent linkage group. $X_1$ and $X_2$ and $X_3$ and $X_4$ represent the same group as $X_1$ and $X_2$ in the above-mentioned Formula (I), respectively, and d, e, f and g represents 0 or 1. Dye is the same as the dye residue represented by the above-mentioned Formula (III).

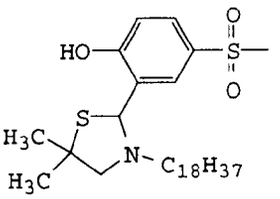
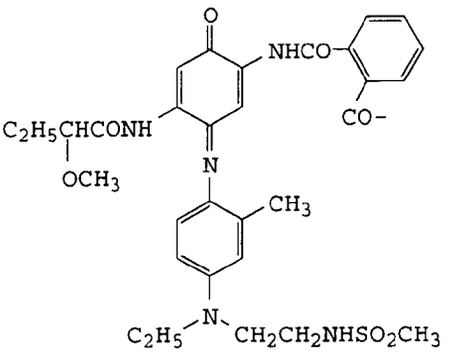
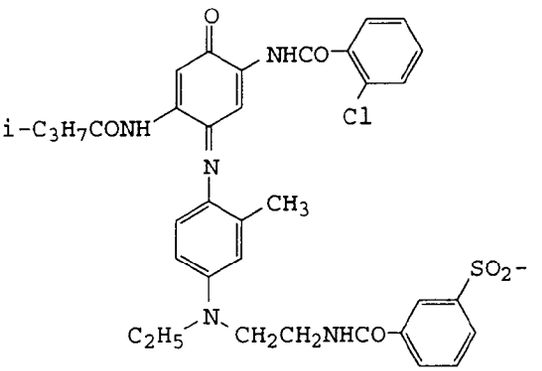
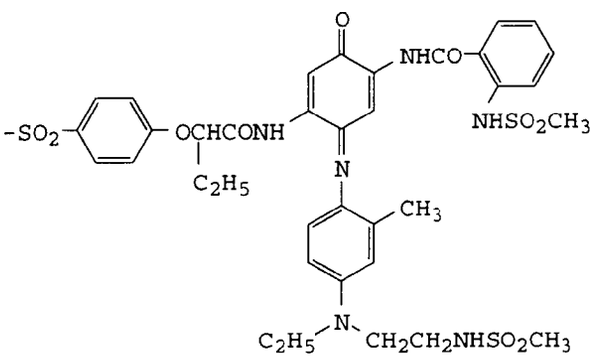
Next, typical examples of the dye-providing material represented by Formula (I) used in the present invention will be shown below. However, the present invention is not limited thereto.

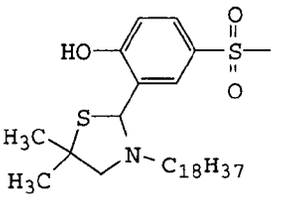
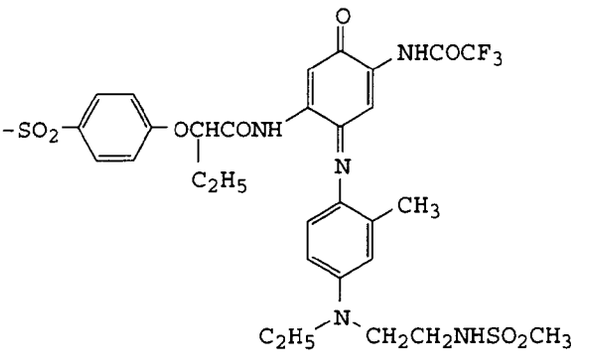
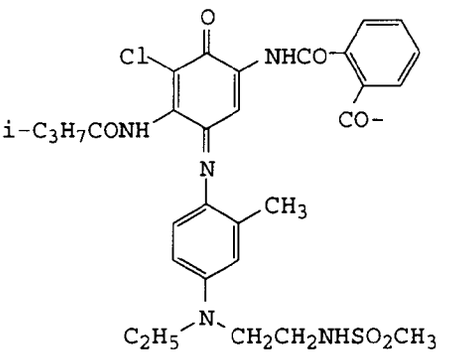
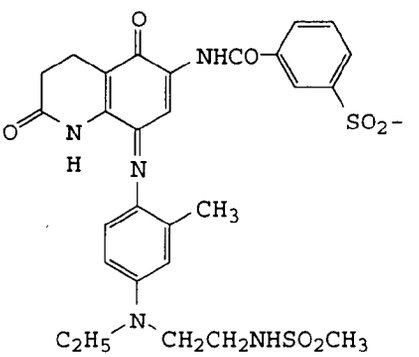


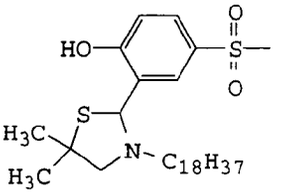
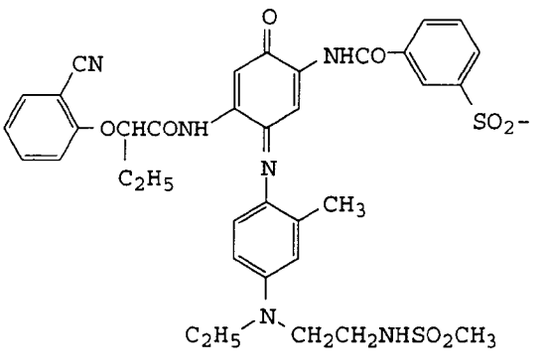
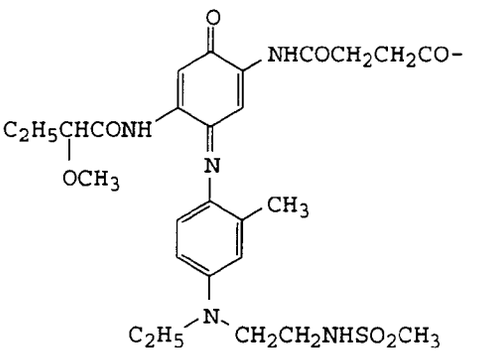
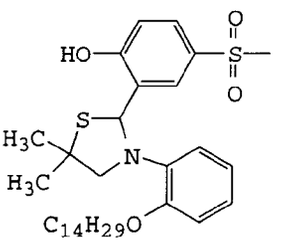
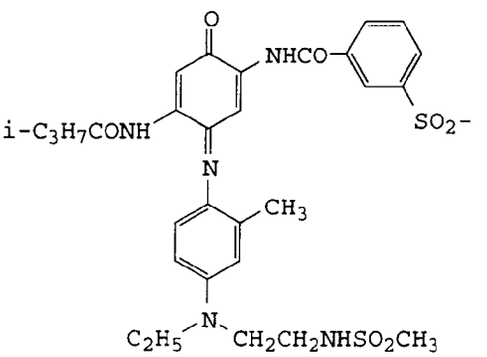
| Compound No. | A | Dye |
|---|---|---|
| C-1 |  |  |
| C-2 | ditto |  |
| C-3 | ditto |  |

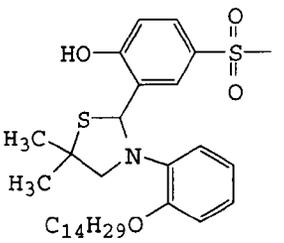
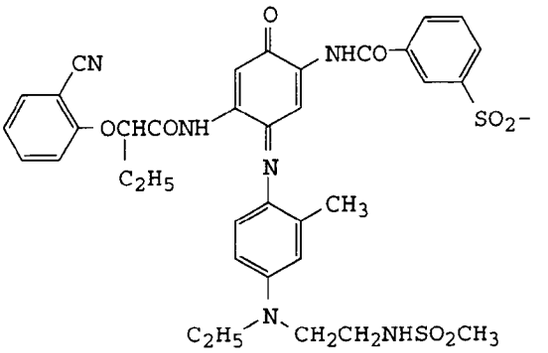
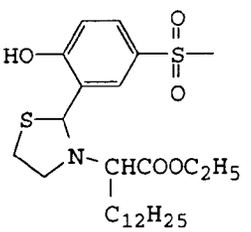
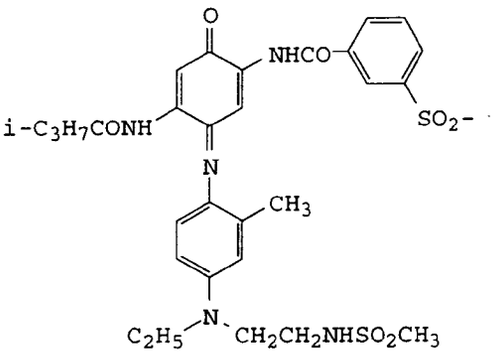
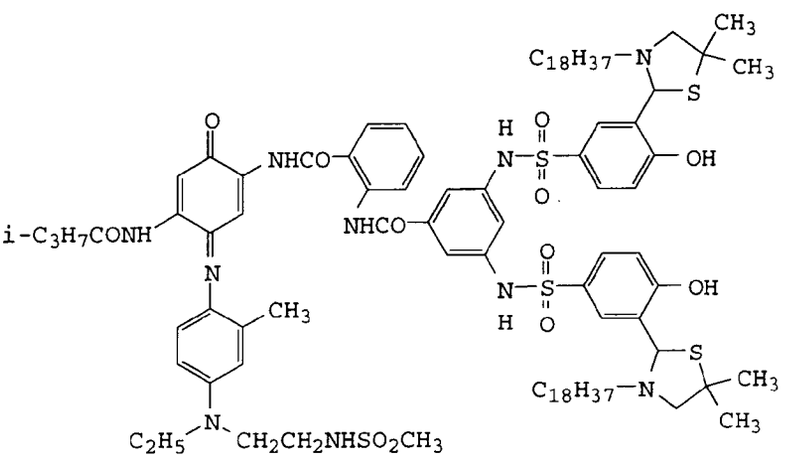
| Compound No. | A | Dye |
|---|---|---|
| C-4 |  |  |
| C-5 | ditto |  |
| C-6 | ditto |  |

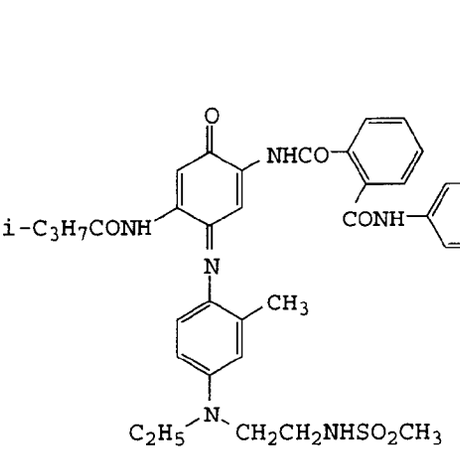
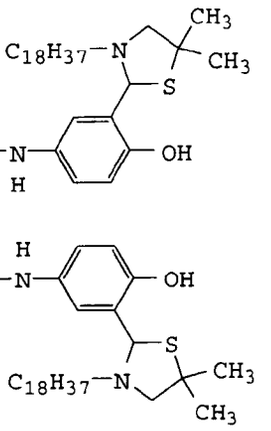
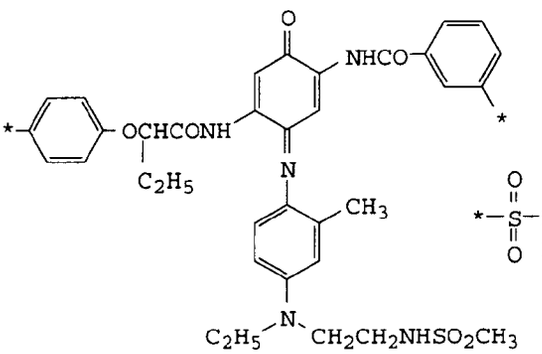
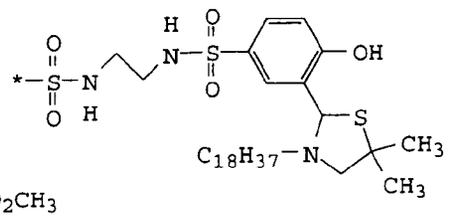
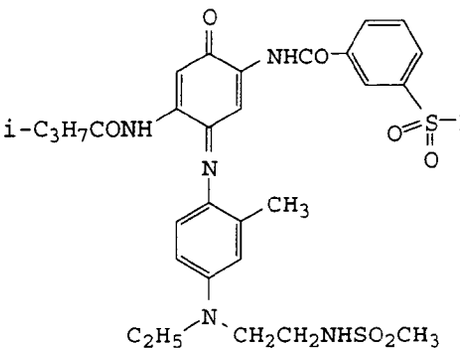
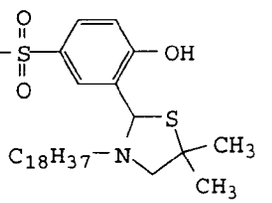
| Compound No. | A | Dye |
|---|---|---|
| C-7 |  |  |
| C-8 | ditto |  |
| C-9 | ditto |  |

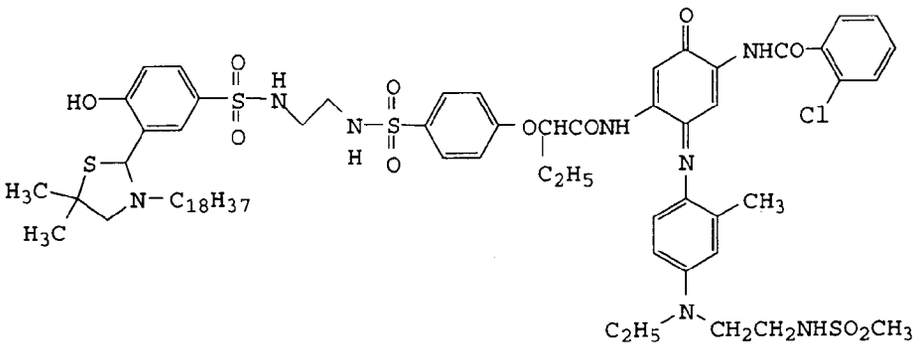
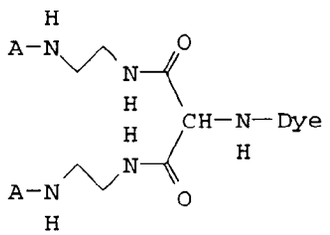
| Compound No. | A | Dye |
|---|---|---|
| C-10 |  |  |
| C-11 | ditto |  |
| C-12 | ditto |  |

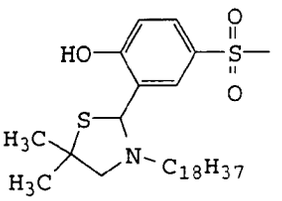
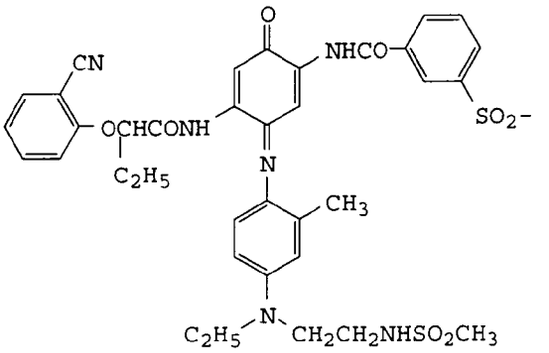
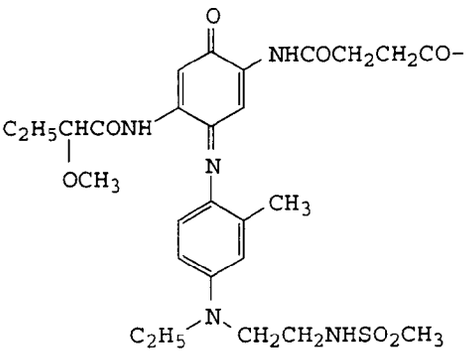
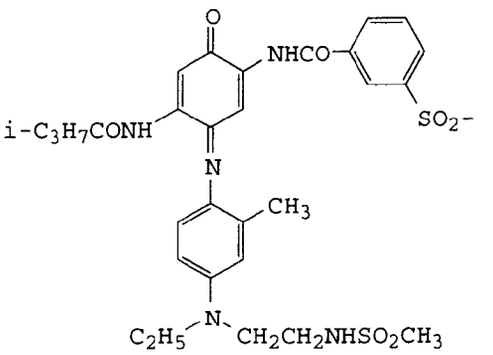
| Compound No. | A | Dye |
|---|---|---|
| C-13 |  |  |
| C-14 | ditto |  |
| C-15 | ditto |  |

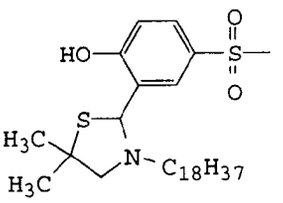
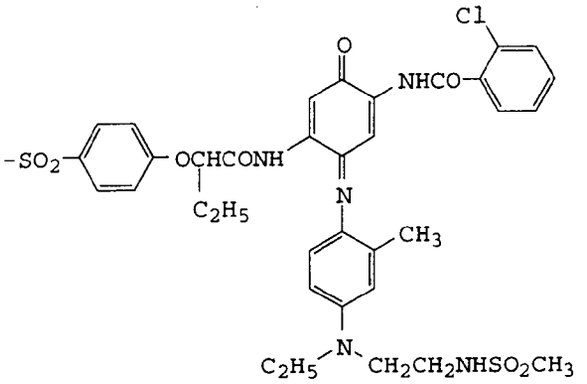
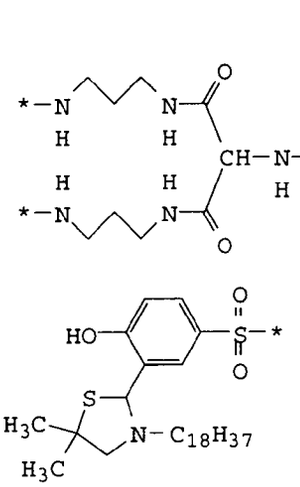
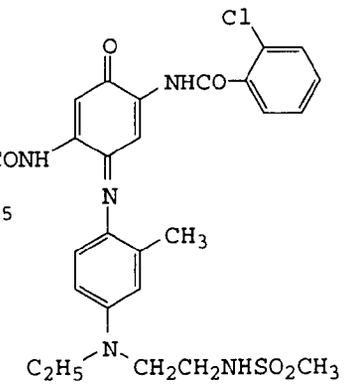
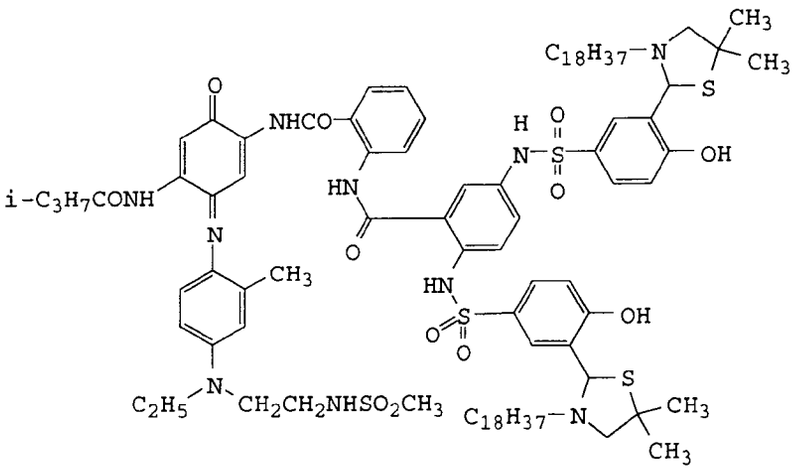
| Compound No. | A | Dye |
|---|---|---|
| C-16 |  |  |
| C-17 | ditto |  |
| C-18 |  |  |

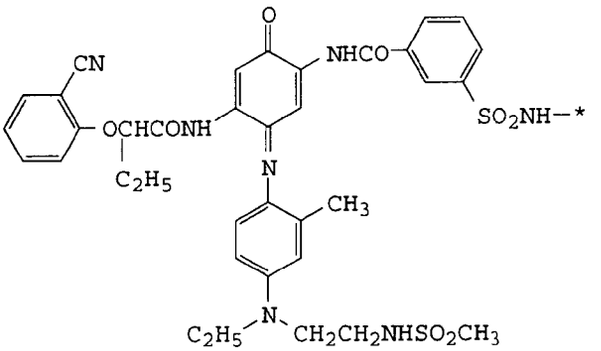
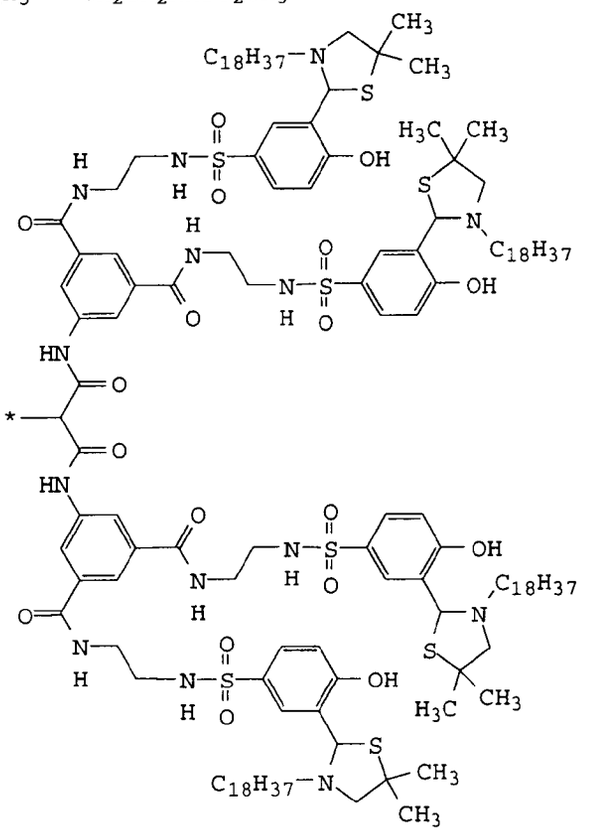
| Compound No. | A | Dye |
|---|---|---|
| C-19 |  |  |
| C-20 |  |  |
| C-21 | |  |

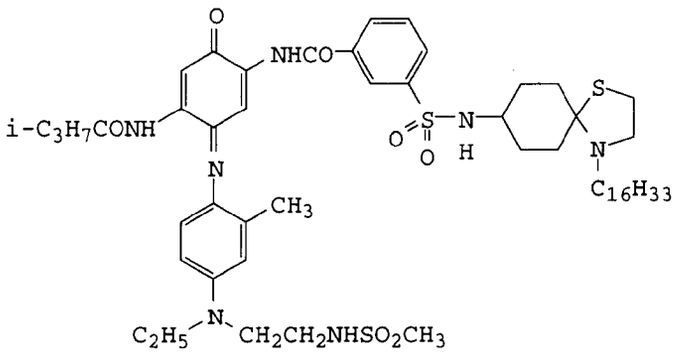
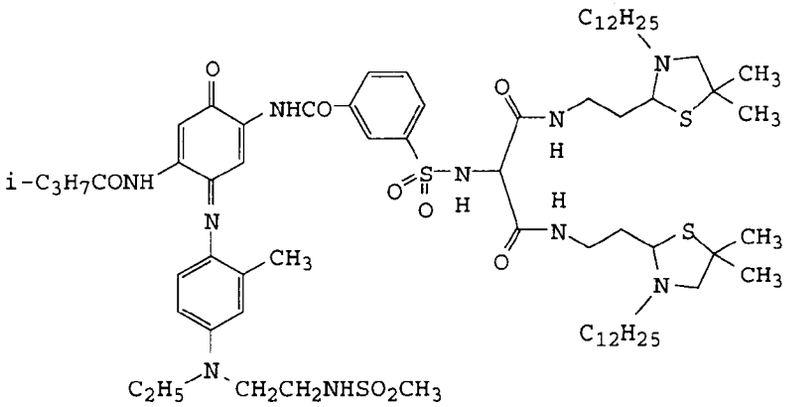
| Compound No. | A | Dye |
|---|---|---|
| C-22 |  |  |
| C-23 |  |  |
| C-24 |  |  |

| Compound No. | A | Dye |
|---|---|---|
| C-25 |  |  |

| Compound No. | A | Dye |
|---|---|---|
| C-26 |  |  |
| C-27 | ditto |  |
| C-28 | ditto |  |

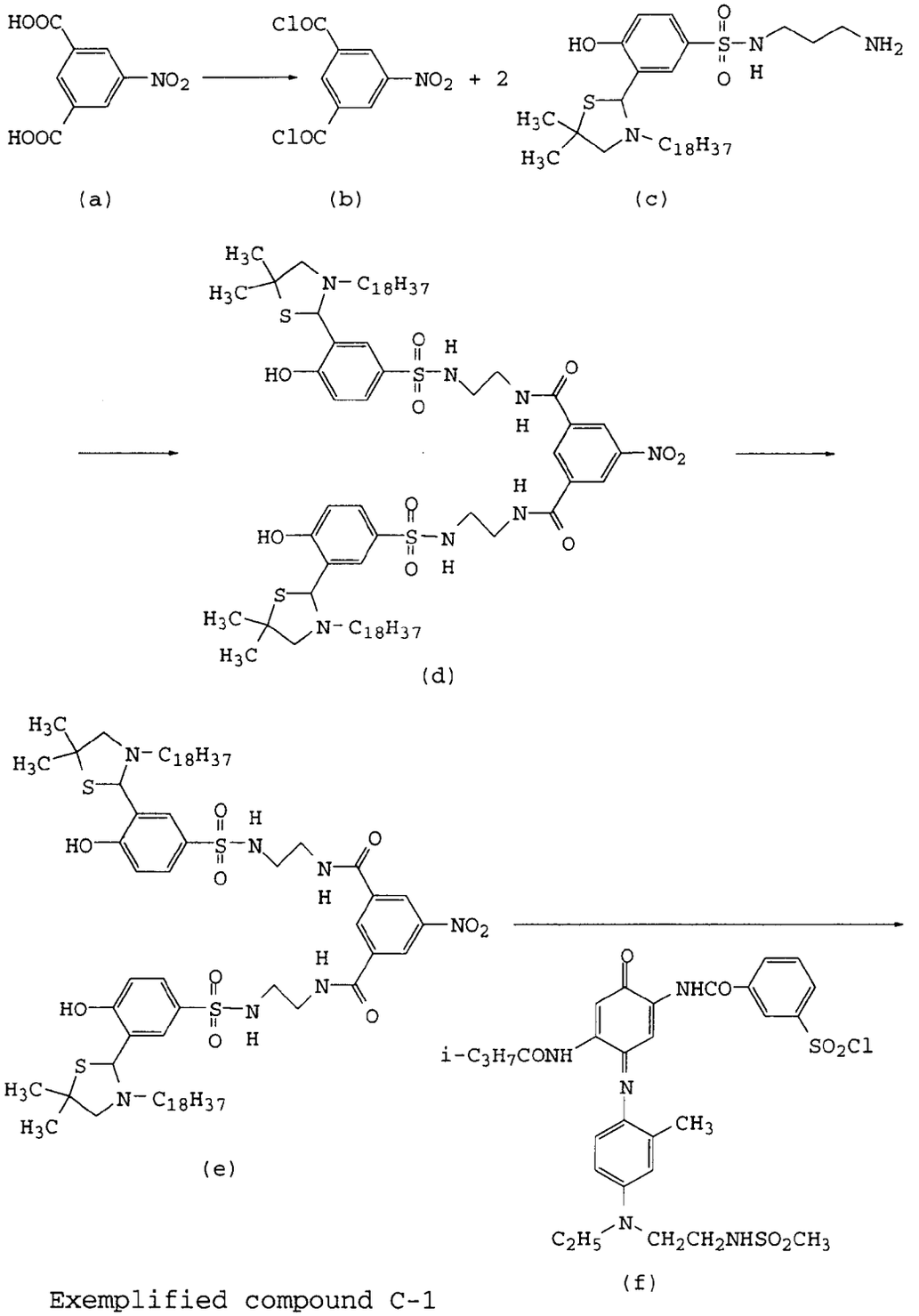
| Compound No. | A | Dye |
|---|---|---|
| C-29 |  |  |
| C-30 |  |  |
| C-31 |  | |

| Compound No. | A | Dye |
|---|---|---|
| C-32 |  |  |

| Compound No. | A | Dye |
|---|---|---|
| C-33 | |  |
| C-34 | |  |

The above-mentioned dye-providing material can be synthesized easily in a way wherein a dye portion and a 1,3-S-N-compound group or a 1,3-Se-N-compound group are synthesized in advance and they are then bound. In addition, the dye portion and the 1,3-S-N-compound group or the 1,3-Se-N-compound group can be synthesized easily in a known method. For example, the dye portion can be synthesized easily in accordance with methods described in U.S. Patent Nos. 2,369,929, 2,772,162, 2,895,826 and 3,758,308, Japanese Patent O.P.I. Publication No. 163537/1980 and Japanese Patent Publication Nos. 10818/1988, 30619/1988 and 18175/1991 and European Patent No. 250,954. In addition, the 1,3-S-N-compound group or the 1,3-Se-N-compound group can be synthesized easily in accordance with a method described in U.S. Patent Nos. 4,098,783, 4,332,950, 4,336,387 and 4,355,169 and J. Amer. Chem. Soc. (Journal of the American Chemical Society), Volume 101, page 420 (1979).

Hereinafter, typical examples of dye-providing compounds of the present invention are exhibited.



Exemplified compound C-1

Dye intermediate (f) and thiazolizine intermediate (c) used in the present synthesis examples are synthesized in accordance with the description in the above-mentioned references.

Synthesis example (Synthesis of Illustrated compound C-1)

Synthesis of intermediate (b)

m-Nitroisophthalic acid of 21.1 g and thionyl chloride of 71.4 g were mixed and reacted for 3 hours while

heating and refluxing. After heating, excessive thionyl chloride was evaporated under reduced pressure so that the targeted intermediate (b) was obtained in a form of light yellow solid. The yield was 24.5 g (the quantitative yield). Intermediate (b) was used for the following step without purifying.

Synthesis of intermediate (d)

Intermediate (b) of 6.2 g and intermediate (c) of 29.2 g were mixed in 300 ml of acetonitrile. Pyridine of 4.8 g was added thereto, and then, the resulting solution was stirred for 3 hours at a room temperature. After reaction, the solution was filtrated. The solvent of the filtrate was evaporated under reduced pressure. The residue was dissolved in 300 ml of ethyl acetate, and the solution was washed with 200 ml of an aqueous 5% hydrochloric acid solution two times, followed by washing with water. The organic solvent phase was dried over anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure so that the targeted intermediate (d) was obtained in a form of light yellow solid. The yield was 27.2 g (the yield was 81%). Intermediate (c) was used for the following step without purifying.

Synthesis of intermediate (e)

Intermediate (d) of 26.8 g was dissolved in 500 ml of ethyl acetate. To the slution, 1.4 g of a 5% palladium-carbon was added. The resulting solution was subjected to hydrogen catalytic reduction under normal atmosphere. After reaction, the solution was dried over anhydrous magnesium sulfate and was filtrated with palladium catalyst. The solvent of the filtrate was evaporated under reduced pressure so that the targeted intermediate (e) was obtained in a form of light gray solid. The yield was 26.0 g (the quantitative yield). Intermediate (e) was used for the following step without purifying.

Synthesis of illustrated compound C-1

Intermediate (e) of 13.1 g and intermediate (f) of 6.3 g were mixed in 130 ml of acetonitrile. Pyridine of 0.95 g was added thereto, and was reacted for 5 hours by heating and refluxing. After reaction, the resulting solution was allowed to stand and cooled to a room temperature. The solution was filtrated. The solvent of the filtrate was evaporated under reduced pressure. The residue was dissolved in 300 ml of ethyl acetate, and the solution was washed with 200 ml of an aqueous 5% hydrochloric acid solution two times and then with tap water. The organic solvent phase was dried over anhydrous magnesium sulfate, and the solvent was evaporated under reduced pressure so that the residual was purified by means of silica gel column chromatography for obtaining a targeted illustrated compound C-1 in a form of bluish green solid. The yield was 9.7 g (51%).

The structure of C-1 was confirmed by means of NMR, IR and mass spectrum.

The production of other exemplified compounds was started from relevant raw materials, and synthesized in accordance with the above-mentioned synthesis example.

The dye-providing material of the present invention may be used alone, or in combination of two or more kinds of them. The amount used may be varied due to the kind of the dye-providing material or the application method of heat-processable photosensitive material. Generally, the amount is 0.05 to 10 g, and preferably 0.1 to 5 g per $m^2$ of the photosensitive material.

As a method for incorporating a dye-providing material in the photographic constituting layer of the heat-processable photosensitive material, any conventional method such as a method wherein the dye-providing material is emulsified and dispersed in a hydrophilic colloidal solution by the use of dibuthylphthalate, dioctylphthalate and tricresylphosphate, a method wherein a dye-providing material is dissolved in an aqueous alkali hydrophilic colloidal solution and then neutralized with acid for dispersion or a method wherein a dye-providing material is dispersed mechanically for fine grains solid state in an aqueous hydrophilic colloidal solution for dispersing can appropriately be selected. When the dye-providing material is used for a dispersion of fine grains, its average grain size is ordinarily 0.05 to 10 μm and preferably 0.1 to 5 μm.

In addition, the heat-processable photosensitive material of the present invention can be applied to an image-forming method wherein a dye-providing material is incorporated in a micro-capsule together with a polymerizable compound as described in Japanese Patent Publication Open to Public Inspection Nos. 293753/1990 and 308162/1990, the capsule is subjected to heat development so that the polymerization reaction of the polymerizable compound is caused imagewise or reversely imagewise to harden the micro-capsule and diffusion property of the dye-providing material to the image-receiving layer is varied.

A photosensitive silver halide used in the heat-processable photosensitive material of the present invention includes conventional types such as silver chloride, silver bromide, silver bromoiodide, silver bromochloride and silver bromochloroiodide.

The above-mentioned silver halides may have a uniform composition throughout portions from inside of a grain to the surface thereof, a so-called core/shell structure wherein the composition of the inside is different from the surface thereof and a multilayered structure wherein the composition is varied stepwise or continuously.

In addition, the silver halide may be mono-dispersed wherein grain sizes are relatively uniform or poly-dispersed having wide grain distribution.

As a form of silver halide, those having specific crystal habit such as a cube, a sphere, an dodecahedron and a tetradecahedron and those having no specific crystal habit can be used. In addition, tabular silver halides as described in Japanese Patent O.P.I. Publication Nos. 111933/1983 and 111934/1983 and Research Disclosure (RD) No. 22534 wherein a grain has a two-paralleled crystal surface, its crystal surface respectively has area larger than the crystal surface of other crystal surfaces and the ratio between the diameter of a grain and thickness is about 5:1 or more.

In addition, inside-latent-image silver halide emulsions as described in US. Patent Nos. 2,592,250, 3,220,613, 3,271,257, 3,317,322, 3,511,622, 3,531,291, 3,447,927, 3,761,266, 3,703,584, 3,736,140 and 3,761,276 and Japanese Patent O.P.I. Publication Nos. 8524/1975, 38525/1975, 15661/1977 and 127549/1980 wherein the surface of grains are not fogged in advance.

To photosensitive silver halide, a metallic ion seeds such as iridium, gold, rhodium, iron and lead can be added in a form of salt at an arbitrary step during the formation of grains. In such cases, it is ordinary to add these metallic ions in a range from $10^{-7}$ to $10^{-5}$ mol per mol of silver.

The grain size of the above-mentioned photosensitive silver halide emulsion is about 0.05 to 2 μm. In addition, it is allowed to use, for adjusting gradation, silver halide having grains with different grain sizes each other in the same photosensitive layer can be used in combination.

In the present invention, a photosensitive silver halide may be prepared by existing components for forming photosensitive silver halide components together with organic silver salts described later and by converting a part of organic silver salt to photosensitive silver halide.

The grain surface of photosensitive silver halide emulsion may be subjected to chemical sensitization with conventional sensitizers (for example, an active gelatin, an inorganic sulfur, sodium thiosulfate, thiourea dioxide and sodium chloro aurate). Chemical sensitization can be conducted in the presence of nitrogen-containing heterocyclic compounds and mercapto group-containing heterocyclic compounds.

Photosensitive silver halides may be provided with suitable spectral sensitization to a blue light, a green light, a red light and an infrared light by the use of conventional spectral sensitizers respectively. Typical sensitizing dyes are described in, for example, Japanese Patent Publication Nos. 180553/1984, 140335/1985, 263937/1985, 65232/1986, 153635/1986, 153631/1986, 32446/1987, 61242/1988, 138343/1988, 164440/1991, 31854/1992, 34547/1992 and 45833/193. In addition, for example, as described in Japanese Patent O.P.I. Publication Nos. 39846/1987, 86360/1987, 89037/1987, 147450/1987 and 147451/1987, two or more kinds of sensitizing dyes may be used for one silver halide.

Amount used of sensitizing dye is $10^{-5}$ to $10^{-2}$ mol per mol of silver halide. The sensitizing dye may be added at any step of the preparation of silver halide emulsion including during the formation of silver halide grains, when soluble salts are removed, before chemical sensitization, during chemical sensitization or after chemical sensitization.

The above-mentioned photosensitive silver halide and components for forming photosensitive silver salts is used in a range from about 0.01 to 10 g per 1 $m^2$ of the photosensitive material and preferably in a range from 0.05 to 1 g (for each photosensitive layer).

To the heat-processable photosensitive material of the present invention, when necessary, conventional organic silver salts can be used for enhancing sensitivity and improving developing property.

Organic silver salts capable of being used in the present invention include silver salts of long-chained aliphatic group carbonyl acid and silver salts of carbonyl acid having a heterocyclic ring (for example, behenic acid and silver α-(1-phenyltetrazolethio) acetate) described in Japanese Patent O.P.I. Publication Nos. 4921/1988, 52626/1974, 141222/1977, 36224/1988, 37626/1988, 36224/1988 and 37610/1988 and U.S. Patent Nos. 3,330,633, 3,794,496 and 4,105,451 and silver salts of compounds having imino group described in Japanese Patent Publication Nos. 26582/1969, 12700/1970, 18416/1970 and 22815/1970 and Japanese Patent O.P.I. Publication Nos. 137321/1977, 118638/1983 and 118639/1983 and U.S. Patent No. 4,123,274. In addition, silver acetylide described in Japanese Patent O.P.I. Publication No. 249044/1986 can be used.

Of these, the silver salts of compounds having an imino group are preferable. Specifically, benzotriazole and silver salts of its derivative are preferred. The amount used of the organic silver salts is in a range from 0.005 g to 10 g per 1 $m^2$ of photosensitive material, preferably in a range from 0.01 g to 5 g.

The reducing agent used for the heat-processable photosensitive material of the present invention may be selected to be used from well-known reducing agents in the conventional heat-processable photosensitive

material employing a development mechanism, a dye-forming mechanism or a dye-releasing mechanism. The reducing agent in this case includes precursor for reducing agent releasing the reducing agent in heat development.

Reducing agents capable of being used in the present invention include p-phenylenediamine developing agents and p-aminophenol developing agents, phosphoric acid aminophenol developing agents, sulfonamide aniline developing agents, hydrazone developing agents, phenols, sulfonamide phenols, polyhydroxybenzenes, naphtols, hydroxybis naphtyls, methylenebisphenols, ascorbic acids, 1-aryl-3-pyrazolidones and hydrazones and the precursors of the above-mentioned reducing agents.

In addition, the dye-providing material can be used as a reducing agent too.

Two or more reducing agents can be used in combination. Especially, combination of 1-aryl-3-pyrazolidone and an anti-diffusible hydroquinone derivative is preferable. The amount used of the reducing agent is in a range from 0.01 to 100 mill mol per 1 $m^2$ of photosensitive material.

The binders capable of being used for the heat-processable photosensitive material of the present invention include synthetic or natural polymers such as polyvinyl butylal, vinyl polyacetate, ethyl cellulose, polymethacrylate, polyvinyl alcohol, polyvinyl pyrrolidone, gelatin, gelatin derivatives such as phthalated gelatin, cellulose derivatives, protein, stark and Arabic rubber. They can be used independently or two or more of them can be used in combination.

Especially, gelatin is used preferably. The gelatin includes ones subjected to ordinary alkali treatment or acid-treated gelatins or gelatin derivatives such as phenyl carbamoyl gelatin and phthalic gelatin. Two or more of them can be used in combination. In addition, combination of the above-mentioned gelatins and water-soluble polymers is preferable too. The amount used of the binder is ordinarily from 0.1 to 50 g per 1 $m^2$ of support, and preferably 1 to 20 g.

It is preferable that the above-mentioned binder is hardened with a conventional photographic binder. As a hardener, a vinyl sulfon type hardener, an aldehyde type hardener, an epoxy type hardener, an N-methylol type hardener and a halogen-substituted-s-triazine type hardener are cited. In addition, a polymer hardener may be used.

To the heat-processable photosensitive material of the present invention, various kinds of additives described below can be used when necessary.

(Heat solvent)

A heat solvent used for the promotion of dye transfer or some other purposes is liquidified in heat development so that it promotes heat development or heat transfer of dye. It is preferred that the heat solvent is in a solid state at room temperature.

Heat solvents usable in the present invention are compounds described in U.S. Patent Nos. 3,347,675, 3,667,959, 3,438,776 and 3,666,477, RD 17,643 and Japanese Patent O.P.I. Publication Nos. 19525/1976, 24829/1988, 60223/1988, 118640/1983, 198038/1983, 229556/1984, 68730/1984, 84236/1984, 191251/1985, 232547/1985, 14241/1985, 52643/1986, 78554/1987, 42153/1987, 44737/1987, 53548/1988, 161446/1988, 224751/1989 and 863/1990.

Of the above-mentioned heat solvents, water-insoluble solid heat solvents are preferably used. Practical examples thereof are compounds described in Japanese Patent O.P.I. Publication Nos. 136645/1987, 139545/1987, 161446/1988, 224751/1989, 863/1990, 120739/1990 and 123354/1990.

The heat solvent can be added in an arbitrary layer such as a photosensitive silver halide emulsion layer, an intermediate layer, a protective layer, an image-receiving layer for an image receiving material. The amount added is ordinarily 5 to 500 % by weight and preferably 10 to 200 % by weight based on the binder content.

(Development accelerator)

As a development accelerator, compounds described in Japanese Patent O.P.I. Publication Nos. 177550/1984, 111636/1984, 124333/1984, 72233/1986, 236548/1986 and 152454/1989 are useful. In addition, compounds releasing a development accelerator described in 159642/1986, 104645/1989 and 110767/1989 may also be used.

(Anti-foggant)

Higher fatty acid described in U.S. Patent No. 3,645,739, N-halogenated compounds described in Japanese Patent O.P.I. Publication No. 47419/1976, compound releasing mercapto compounds described in U.S. Patent No. 3,700,457 and Japanese Patent O.P.I. Publication Nos. 50725/1976, 29754/1990 and 282241/1990,

aryl sulfonic acid described in Japanese Patent O.P.I. Publication No. 125016/1974, oxidizers described in British Patent No. 1,455,271 and Japanese Patent O.P.I. Publication No. 101019/1975, sulfinic acids and thiosulfonic acids described in Japanese Patent O.P.I. Publication No. 19825/1988, thiouracyls described in Japanese Patent O.P.I. Publication No. 3223/1976, sulfur described in Japanese Patent O.P.I. Publication No. 26019/1976, disulfides and polysulfides described in Japanese Patent O.P.I. Publication Nos. 42529/1976, 81124/1976 and 93149/1980, rhodine or ditelpenes described in 57435/1976, carboxyl group or polymer acids having a sulfonic acid group described in Japanese Patent O.P.I. Publication No. 104338/1976, thiazolithione described in U.S. Patent No. 4,138,265, triazoles described in Japanese Patent O.P.I. Publication Nos. 51821/1979 and 142331/1980 and U.S. Patent No. 4,137,079, thiosulfinic acid esters described in Japanese Patent O.P.I. Publication No. 140883/1980, di- or tri-halogenated materials described in Japanese Patent O.P.I. Publication Nos. 46641/1984, 57233/1984 and 57234/1984, thiol compounds described in Japanese Patent O.P.I. Publication No. 111636/1984 and hydroquinone derivatives described in Japanese Patent O.P.I. Publication Nos. 198540/1985 and 227255/1985 are cited.

As other anti-foggants, anti-foggants having a hydrophilic group described in Japanese Patent O.P.I. Publication No. 78554/1987, anti-foggant polymers described in Japanese Patent O.P.I. Publication No. 121452/1987 and anti-foggants having a ballast group described in Japanese Patent O.P.I. Publication No. 123456/1987 are cited.

In addition, water-soluble halogenated compounds (potassium bromide, potassium iodide and sodium chloride) can be used for preventing fogging and other purposes. The above-mentioned anti-foggants can be any layers containing heat-processable photosensitive materials or dye image receiving materials.

(Basic precursor)

As a basic precursor, compounds releasing basic compounds by decarbonating due to heating (guanizine trichloroacetic acid), basic precursor technology releasing base due to reaction between basic metallic compounds refractory to water (zinc hydroxide) and compounds capable of forming complex with aforesaid metallic compound and metallic ion-forming metal ions. Practically, they are described in Japanese Patent O.P.I. Publication Nos. 130745/1981, 157637/1984, 166943/1984, 180537/1984, 174830/1984, 174830/1984, 195237/1984, 108249/1987, 174745/1987, 187847/1987, 97942/1988, 96159/1988 and 68746/1989.

(Silver ion scavenger)

Conventional silver ion scavengers as diffusion transfer use such as a physical development nuclei described in Japanese Patent O.P.I. Publication No. 163345/1988, anti-diffusible compounds forming complex stable against silver ions and compounds for forming refractory silver salt can be used.

(Solvent for silver halide)

Compounds containing formulas described in Japanese Patent O.P.I. Publication No. 283335/1987, from the 15th line on the upper left column on page 3 to page 11.

(Silver ion complexing agent)

Bipyridines described in Japanese Patent O.P.I. Publication No. 309948/1988.

To the heat-processable photosensitive material of the present invention, various kinds of conventional photographic additives other than those described as above, for example, water-soluble or hydrophobic filter dyes, colloidal silver, fluorescent brightening agents, antistatic agents, surfactants (anion type, cation type, nonion type and fluorine-containing anion type), inorganic and organic matting agents, anti-fading agents, UV absorbers and regulators for the color tone of white background can be added. Practically, these compounds are described in RD Nos. 17029 and 29963 and Japanese Patent O.P.I. Nos. 135825/1987 and 13546/1989.

These additives can be added not only to a photosensitive layer but also to arbitrary layers such as intermediate layers, subbing layers, protective layers and backing layers.

When the heat-processable photosensitive material is composed of two or more photosensitive layers, it is preferred that an intermediate layer is used between these two layers for preventing color stain. The intermediate layer is ordinarily composed of a hydrophilic binder such as gelatin. To the intermediate layer, in order to prevent color stain effectively, reducing agents such as an anti-diffusible hydroquinone for preventing the shift of an oxidation substance of the reducing agent to other layers and silver ion scavengers for preventing the diffusion of silver ions can be added.

As a support usable for the heat-processable photosensitive material of the present invention, transparent or intransparent synthetic plastic films such as a polyethylene terephthalate film and a polyethylene naphthalate film, various coated papers such as an art paper, a cast-coated paper and a baryta paper, papers laminated with a polyethylene resin and supports wherein an electron beam hardenable resin composition is coated and hardened are cited.

The heat-processable photosensitive material of the present invention contains (a) a photosensitive silver halide emulsion, (b) a reducing agent, (c) a binder and (d) a dye-providing material. These may be added to a single photographic layer or to two or more layers separately. Practically, the components of (a), (b) and (c) can be added to the same layer while (d) is added to a layer adjoining thereto. Otherwise, components of (a), (c) and (d) are added to the same layer while (b) is added to the other layer.

Two or more photosensitive layers may have substantially the same color sensitivity. A low sensitivity layer and a high sensitivity layer may be provided.

When the heat-processable photosensitive material of the present invention is used for a full color recording material, it ordinarily has three photosensitive layers having different sensitivity each other, wherein dyes having different hue are formed or released in each photosensitive layer due to heat development. In such cases, generally, a blue sensitive layer (B) is combined with a yellow dye, a green sensitive layer (G) is combined with a magenta dye (M) and a red sensitive layer (R) is combined with a cyan dye (C). However, in the present invention any combination is allowable. Practically, combinations of (B-C)/(G-M)/(R-Y) and (infrared sensitive-C)/(G-Y)/(R-M) are allowed. In addition, the represent invention can be applied to a heat-processable photosensitive material wherein infrared region has two different sensitivity And a red region has the third sensitivity as described in Japanese Patent O.P.I. Publication No. 162251/1985. In addition, as described in Japanese Patent O.P.I. Publication No. 162251/1985, the present invention can be applied a method to form a black image by the use of a diffusible dye.

To the heat-processable photosensitive material of the present invention, a non-sensitive layers such as a subbing layer, an intermediate layer, a protective layer, a filter layer, a backing layer and a peeling layer can be provided arbitrarily in addition to the sensitive layer.

When the heat-processable photosensitive material of the present invention takes a dye transfer system, an image receiving material having a dye image-receiving layer is preferably used. The image receiving material may be composed of a support and the image receiving layer having a dye receiving ability provided thereon, or the support itself may serve as the image receiving layer having the dye receiving ability. The type of an image receiving layer is generally separated into two types; one is a type wherein a binder constituting the image receiving layer has dye receiving ability, and the other is a type wherein a mordant which can receive a dye is added to the binder.

As a binder having the dye-receiving ability, a polymer having a glass transition temperature of about 40 to 250°C is preferably used. Practically, synthetic polymers described in "Polymer Handbook 2nd ed., edited by J. Brandrup, E.H. Immergut, published by John Wiley & Sons wherein the glass transition temperature is about 40°C or more are useful. These polymers may be used singly or two or more thereof can be used in combination. In addition, they may be copolymeric polymers having two or more kinds of repetitive units, for example, polyvinyl chloride, polyester, polycarbonate, polyvinylidene chloride and polyether.

Another type of image-receiving material wherein an image receiving layer has a mordant in a hydrophilic binder is preferably used. As a mordant, polymers containing a tertiary amine salt or a quarternary ammonium salt are preferably used, including polymer mordants having a tertiary ammonium group described in Japanese Patent O.P.I. Publication Nos. 75237/1973, 61228/1975, 80132/1975, 73440/1975, 129034/1978, 145529/1979, 142339/1980, 161410/1981, 219745/1984, 30249/1987 and 34159/1987, polyvinyl pyridine mordants described in U.S. Patent No. 3249393 and Japanese Patent O.P.I. Publication No. 23851/1985, polyvinyl imidazole mordants described in U.S. Patent No. 4115124, British Patent Nos. 2056101 and 2093041, Japanese Patent O.P.I. Publication Nos. 55436/1984, 23854/1985, 39644/1985, 60643/1985, 118834/1985, 122941/1985 and 235124/1985, mordants described in Japanese Patent O.P.I. Publication No. 3689/1982 wherein a group having dying ability is graftized, combination of the use of a tertiary amine mordant and a quarternary ammonium mordant described in Japanese Patent O.P.I. Publication No. 57836/1985 and mordants having an image stabilizing group described in Japanese Patent Publication O.P.I. Publication Nos. 198051/1988 and 32335/1990.

As a binder used for keeping the above-mentioned mordants, for example, a hydrophilic binder such as gelatin and polyvinyl alcohol are preferably used.

The image receiving material may be provided with one image receiving layer on a support or may be provided with plural layers. In the latter case, all of them may be dye image receiving layers, or some of them may be image receiving layers.

When the image receiving material has a support and an image receiving layer, the support in the image

receiving material may either be a transparent support or a reflection support. Practically, a support composed of polyethylene terephthalate or polypropyrene and a support wherein white pigment such as barium sulfate and titanium dioxide are added to polyethylene terephthalate or polypropylene, an art paper, a cast-coated paper, a baryta paper, a laminated paper laminated with a thermoplastic resin (polyethylene) containing white pigment, clothes, glasses and a metallic foil such as aluminum can be used. In addition, a support wherein an electron beam hardenable resin composition containing a pigment on the support is coated and hardened and a reflection support having a second-category diffusion reflectivity can be used as a support for the image-receiving material.

When a paper support is used as a support for a heat-processable photosensitive material and/or an image receiving material of the present invention, a support laminated with polyethylene on both sides of the paper support, is especially preferable. In such a case, it is preferable that titanium oxide is added in at least one side of the laminated polyethylene.

It is preferable that the flatness of the paper support laminated with the above-mentioned polyethylene is excellent on the point of smoothness. The Beck smoothness degree, which is stipulated in JIS-P-8119, of the surface wherein the dye image receiving layer or the photosensitive layer is coated is preferably 50 seconds or more and more preferably 100 seconds or more. With regard to a filter wave waving curve induced from a cross-sectional curve wherein the surface of aforesaid support was measured in accordance with the standard of JIS-B-0610 under the cut-off value of 0.8 mm, when the maximum filter wave waving value with 2.5 mm as the standard length is measured, it is preferable that the number of points wherein the maximum waving of 4 μm or more is not more than 4 at arbitrary 100 measurement points. In addition, the average roughness of the central line in such cases is preferably 3 μm or less.

In addition, it is preferable that the base paper for the above-mentioned polyethylene-laminated paper has constitution and characteristics as described in Japanese Patent O.P.I. Publication No. 321043/1992, from 32nd line in the 6th column on page 4 to the 28th line on 8th column on page 5.

The heat-processable photosensitive material of the present invention may be so-called mono-sheet type heat-processable photosensitive material as described in RD No. 15108, Japanese Patent O.P.I. Publication Nos. 198458/1982, 207250/1982 and 80148/1986 wherein the photosensitive layer and the image-receiving layer are laminated on the same support in advance.

Conventional additives can be added to the image receiving material of the present invention. Examples of such additives include contamination preventing agents, UV absorbers (benzophenone compounds described in Japanese Patent O.P.I. Publication Nos. 130735/1985 and 153638/1986), fluorescent brightening agents (diaminostylbene compounds described in Japanese Patent O.P.I. Publication No. 143752/1986 and compounds described in Japanese Patent O.P.I. Publication No. 147166/1988), image stabilizers (those described in Japanese Patent O.P.I. Publication Nos. 182785/1984 and 159644/1986), development accelerators, anti-foggants (KBr, NaCl, KI, benzotriazole derivatives and nitrogen-containing heterocyclic compounds such as 1-phenyl-5-mercapto triazole derivatives), pH regulators (an acid, an acid precursor and a basic precursor), heat solvents, organic fluorine type compounds, oil drops, surfactants, hardeners, polymer latex (described in Japanese Patent O.P.I. Publication No. 156045/1986), matting agents and various transmission metals.

The photosensitive material and the image receiving material of the present invention may be provided with the so-called backing layer in order to take color balance and improve smoothness. As the backing layer, a hydrophilic binder and a hydrophobic binder can be used. They can be selected appropriately depending upon application or constitution.

The heat-processable photosensitive material of the present invention is exposed to light by means of a conventional exposure means suitable for the spectral sensitivity of the photosensitive material.

As a usable light source for exposure, a tungsten lamp, a halogen lamp, a xenon lamp, a mercury lamp, a CRT light-source, a FO-CRT light-source, a light-emitting diode, a laser light source, (for example, a gas laser, a dye laser, a YAG laser and a semi-conductor laser) can be used singly or in combination. In addition, a light-source combining a semiconductor laser and a SHG element (the second harmonics generating element) can be used.

Exposure time varies depending upon whether one image plane is subjected to a single exposure or each pixel on the image plane is digitally exposed. In the case of the former, the exposure time is ordinarily 0.001 second to 10 seconds. In the case of the latter, it is conducted from $10^{-8}$ to $10^{-2}$ second. In the case of digital exposure, each pixel may be subjected to either a single exposure or multiple exposures. In the case of multiple exposure, each image region may be slid little by little for every exposure.

The heat-processable photosensitive material of the present invention is, after or during imagewise exposure, heated at preferably 60 to 200°C and more preferably at 70 to 170°C and for preferably 1 to 100 seconds and more preferably 2 to 60 seconds for development so that dye images are formed. The transfer of diffusible dyes to an image receiving material may be conducted during heat development by bringing an image receiving

layer surface of the image-receiving material into contact with a photosensitive layer side of the photosensitive material. In addition, after the heat-processable photosensitive material is subjected to heat development, the image receiving material may be brought into contact with the photosensitive material to transfer the dyes.

In addition, a photosensitive material may be heated in advance in a range from 50 to 150°C, and as described in Japanese Patent O.P.I. Publication Nos. 143338/1985 and 162041/1986, at least one of the photosensitive material and the image receiving member can be heated in advance in a range from 80 to 120°C.

Just before heat development, a small amount of water may be supplied to the photosensitive material or the image-receiving material. After that, both are adhered to each other and subjected to heat development. In such a case, water may be either pure water, or water containing an alkali aqueous solution, a surfactant and the above-mentioned heat solvent. It is preferred that the amount of water supplied is within the range of the maximum-swelled layer thickness of the photosensitive material or the image receiving material supplied.

When the heat-processable photosensitive material of the present invention is subjected to heat development, conventional heating means can be applied. For example, a method to bring the heat development material into contact with a heated heat block or surface heater or a heat roller or a heat drum, a method to let the heat-processable photosensitive material pass through ambience kept at high temperature, a method to use high frequency heating system and a method to utilize Joule heat wherein a heating conductive material such as a carbon black layer is provided on the rear surface of the photosensitive material or an image-receiving material is provided and electrified thereto.

There is no limitation to a heating method in heat development. An arbitrary method such as a method to heat at a constant temperature, a method to heat at a high temperature in the initial stage of development and then to heat at a low temperature in the second half of development, a reversed method in which the low temperature development precedes the high temperature development, a method to change temperature at three steps or more or a method to continuously change temperature can be used. Especially, as described in Japanese Patent O.P.I. Publication No. 250646/1988, it is allowed, in a dye releasing system, to heat at low temperature in advance for the development of silver to some extent so that the development of silver occurs priorily prior to the reaction of the release of dye.

## EXAMPLES

Example 1

<Preparation of the heat-processable photosensitive material>

The following layers were coated in order on a titanium oxide-containing polyethylene layer side of a 100 μm thick paper support wherein both sides thereof are laminated with polyethylenes and the polyethylene on one side of the support contains titanium oxide in an amount of 10 % by weight. Thus, the heat processable-photosensitive material 101 was prepared. The added amount of each component is indicated in terms of the weight per $m^2$ of the image receiving material and the amount of the light-sensitive silver halide emulsion is indicated by converting it to the silver amount.

1st layer

| | |
|---|---|
| Gelatin | 2.0 g |
| Blue sensitive silver halide emulsion | 2 mmol |
| Dye-providing material (C-1) | 1 mmol |
| Surfactant-1 | 0.14 g |
| High boiling organic solvent-1 | 1.9 g |

2nd layer

| | |
|---|---|
| Gelatin | 1.0 g |

Zinc hydroxide (the average grain size: about 0.2 μm)

10 mmol

Surfactant-1 0.07 g

Surfactant-2 0.004 g

1-phenyl-4,4-dimethyl-3-pyrazolidone (a reducing agent)

6 mmol

Hardener-1 (added immediately before coating)

0.15 g

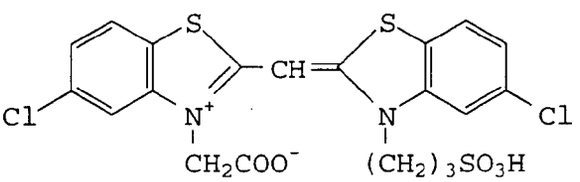
The chemical structure of additives used and the preparation method of the photosensitive silver halide emulsion are shown below. The dye-providing material was emulsified and dispersed in the gelatin solution together with a high boiling organic solvent and added.

| | |
|---|---|
| Surfactant-1: | Sodium tri-i-propyl naphthalene sulfonate |
| Surfactant-2: | Di(2-ethylhexyl)sodium sulfosuccinate |
| High boiling organic solvent-1: | Di(2-ethylhexyl)phthalate |
| Hardener-1: | Mixture of $C(CH_2SO_2CH=CH_2)_4$ and $NH_2CH_2CH_2SO_3K$ (1:0.75, mole ratio) |

(Preparation of blue sensitive silver halide emulsion)

A cubic crystal silver iodobromide emulsion comprising silver halide grains having an average grain size of about 0.4 μm (wherein the content of AgI was about 2 mol %) was subjected to chemical sensitization to the optimum sensitivity with sodium thiosulfate in the presence of 0.5 milli mol of the following sensitizing dye-1 per mol of silver halide and 0.12 g of 4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene (HMT) per mol of silver halide. After the chemical sensitization, 1 g of HMT per mol of silver halide was added.

Sensitizing dye-1




The resulting heat development light-sensitive material was stored for 2 days at 40°C and at 60%RH so that it was hardened up to the hardened degree targeted. The layer pH on the photosensitive layer side of the heat-processable photosensitive material was measured with a plane electrodes. As a result, the pH proved to be 6.1.

<Preparation of the image-receiving material>

The following layers were coated in order on a titanium oxide-containing polyethylene layer side of a 100 μm thick paper support wherein both sides thereof are laminated with polyethylenes, the polyethylene on one side of the support containing titanium oxide in an amount of 10 % by weight. Thus, the image receiving material was prepared. The added amount of each component is indicated in terms of the weight per $m^2$ of the image receiving material.

1st layer

| | |
|---|---|
| Gelatin | 0.6 g |
| Surfactant-1 | 0.02 g |
| Potassium picolinate | 0.5 g |

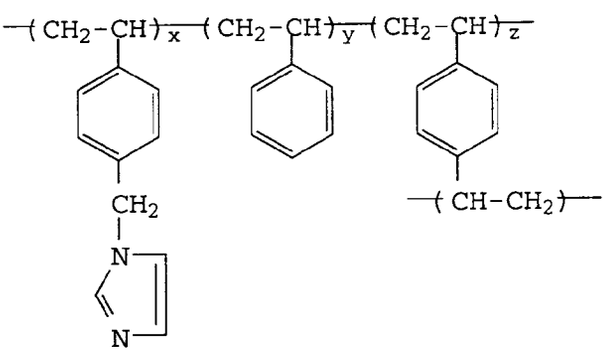
2nd layer

| | |
|---|---|
| Gelatin | 1.8 g |
| Surfactant-1 | 0.02 g |
| Surfactant-2 | 0.01 g |
| Dye mordant | 2.8 g |
| Potassium picolinate | 1.2 g |

3rd layer

| | |
|---|---|
| Gelatin | 0.5 g |
| Potassium picolinate | 0.8 g |
| Surfactant-1 | 0.01 g |
| Surfactant-2 | 0.02 g |
| Hardener-1 | 0.06 g |
| Silicone oil | 0.02 g |
| Matting agent (silica having an average grain size of 6 μm) | 0.01 g |

The mordant used has the following structure.



x:y:z= 70:26:4 (mole% ratio)

<Evaluation of the Heat-processable photosensitive material>

After the heat-processable photosensitive material was exposed to light, it was immersed in pure water

for 2 seconds. Then, the image receiving layer of the image receiving material and the photosensitive layer of the photosensitive material were superposed and heated at 80°C for 15 seconds. Next, the image receiving material was separated from the superposed material. A transfer cyan dye image having an excellent density was obtained on the image receiving layer.

The density of the transfer dye image was measured by optical densitometer PDA-65 produced by Konica Corporation. The density was 1.15.

Example 2

Heat-processable photosensitive materials 201 through 208 were prepared in the same manner as in Example 1, except that the dye-providing materials C-3, C-12, C-20, C-22, C-23, C-24, C-26 and C-28 were used respectively, instead of C-1. They are exposed and heat-developed in the same manner as in Example 1. Next, by separating the image receiving materials, samples gave a transfer cyan dye image having an excellent density on the image receiving layers.

The density of the transfer dye image was measured in the same manner as in Example 1. The results are shown in Table 1.

Table 1

| Sample No. | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 |
|---|---|---|---|---|---|---|---|---|
| Dye providing material used | C-3 | C-12 | C-20 | C-22 | C-23 | C-24 | C-26 | C-28 |
| Density | 1.05 | 0.95 | 1.24 | 1.02 | 1.11 | 1.28 | 1.00 | 0.92 |

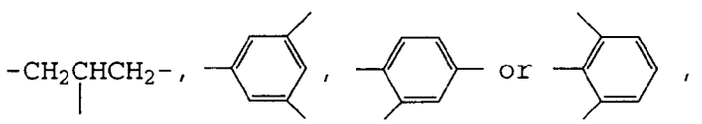
## Claims

1. A diffusion transfer heat-processable photosensitive material comprising a support and provided thereon, a layer comprising a hydrophilic binder, a light-sensitive silver halide and a dye-providing material, wherein the dye providing material is a compound represented by the following Formula (I):

Formula (I) $[A\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-Dye}$

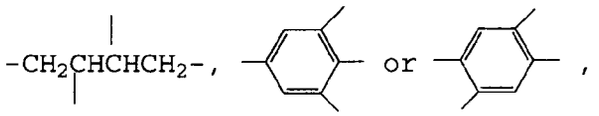
wherein A represents a 1,3-S-N- or 1,3-Se-N- compound residue, releasing $[\text{-}(J_1)_a\text{-}(X_1)_b]_c\text{-}(J_2)_d\text{-}(X_2)_e\text{-Dye}$ on cleavage reaction at a high temperature in the presence of a silver ion or a soluble silver complex; $J_1$ represents a divalent group; $J_2$ represents a divalent, trivalent, tetravalent or pentavalent group; $X_1$ and $X_2$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-; a, b, d and e independently represent 0 or 1; c represents an integer of 1 to 4; and Dye represents a residue of an indoaniline cyan dye prepared from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative.

2. The material of claim 1, wherein in Formula (I) the divalent group represented by $J_1$ or $J_2$ is an alkylene group, a cycloalkylene group, an alkenylene group, an alkinylene group or an arylene group, the trivalent group represented by $J_2$ is $>CHCH_2-$,

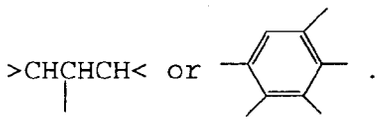



the tetravalent represented group by $J_2$ is

>CHCH<,

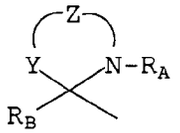


and the pentavalent represented group by $J_2$ is



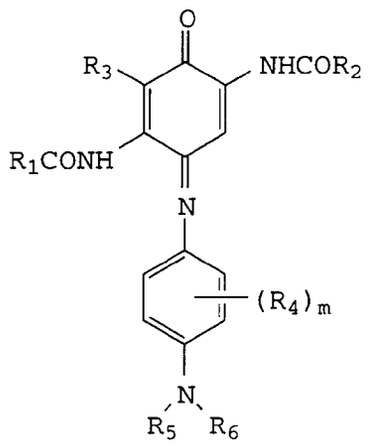
3. The material of claim 1, wherein in Formula (I), A represents a group represented by the following Formula (II):

Formula (II)



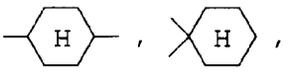
wherein $R_A$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group, an acyl group or a sulfonyl group; $R_B$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group or a group represented by $-(J_1')_{a'}-(X_1')_{b'}-(J_2')_{d'}-(X_2')_{e'}$-Dye', wherein $J_1'$ and $J_2'$ represent a divalent group, $X_1'$ and $X_2'$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-, a', b', d' and e' independently represent 0 or 1; and Dye' represents a residue of an indoaniline cyan dye prepared from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative; Y represents a sulfur atom or a selenium atom; and Z represents a non-metallic atomic group necessary to form a 5- to 7-membered ring; and Dye represents a residue of a dye represented by the following Formula (III):

Formula (III)



wherein $R_1$ represents an alkyl group, a cycloalkyl group or an aryl group; $R_2$ represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group; $R_3$ represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group, provided that $R_1$ and $R_3$ may combine each other to form a ring; $R_4$ represents an alkyl group, an acylamino group or an alkoxy group; m represents an integer of 0 through 4; $R_5$ and $R_6$ independently represent an alkyl group, a cycloalkyl group or or an aryl group, provided that Formula (III) is combined with the group represented by said $[A-(J_1)_a-(X_1)_b]_c-(J_2)_d-(X_2)_e-$ through at least one of $R_1$ through $R_6$.

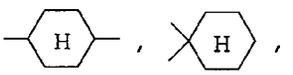
4. The material of claim 3, wherein $J_1$' and $J_2$' independently represent a divalent group selected from the group consisting of -$CH_2$-, -$CH(CH_3)$-, -$CH_2(CH_2)_nCH_2$- wherein n represent an integer of 0 to 10,



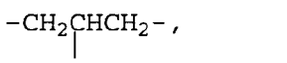
-CH=CH-, -C≡C-, phenylene and naphthylene.

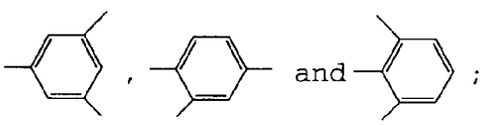
5. The material of claim 3, wherein Y in Formula (II) is a sulfur atom.

6. The material of claim 1, wherein in Formula (I), c represents 1 or 2; $J_2$ represents a divalent group selected from the group consisting of -$CH_2$-, -$CH(CH_3)$-, -$CH_2(CH_2)_nCH_2$- wherein n represent an integer of 0 to 10,



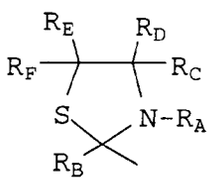
-CH=CH-, -C≡C-, phenylene and naphthylene or a trivalent group selected from the group consisting of >$CHCH_2$-,



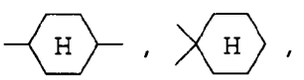


A represents a thiazolidinyl residue represented by the following formula (IV):

Formula (IV)

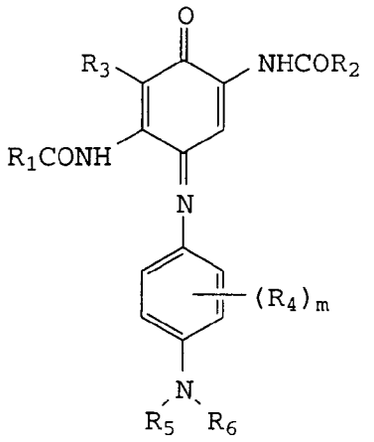


wherein $R_A$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group, an acyl group or a sulfonyl group; $R_B$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group or a group represented by -$(J_1')_{a'}$-$(X_1')_{b'}$-$(J_2')_{d'}$-$(X_2')_{e'}$-Dye', wherein $J_1$' and $J_2$' independently represent a divalent group selected from the group consisting of -$CH_2$-, -$CH(CH_3)$-, -$CH_2(CH_2)_nCH_2$- wherein n represent an integer of 0 to 10,



-CH=CH-, -C≡C-, phenylene and naphthylene, $X_1$' and $X_2$' independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, -$SO_2$-, -$SO_2NH$-, -$SO_3$-, -NHCO-, -$NHSO_2$- and -O-, a', b', d' and e' independently represent 0 or 1, and Dye' represents a residue of an indoaniline cyan dye prepared from a 2,5-diacylaminophenol derivative and a p-phenylenediamine derivative; $R_C$, $R_D$, $R_E$ and $R_F$ independently represent a hydrogen atom, an alkyl group, an aryl group, a heterocyclic group, a carboxyl group, an acyl group, a sulfonyl group or a sulfo group; and Dye represents a residue of a dye represented by Formula (III):

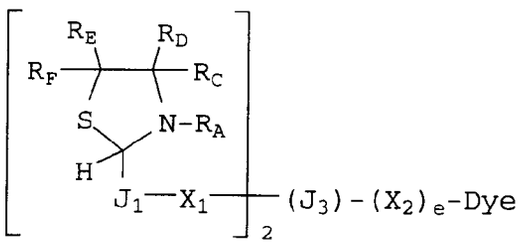
Formula (III)



wherein $R_1$ represents an alkyl group, a cycloalkyl group or an aryl group; $R_2$ represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group; $R_3$ represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group, provided that $R_1$ and $R_3$ may combine each other to form a ring; $R_4$ represents an alkyl group, an acylamino group or an alkoxy group; m represents an integer of 0 through 4; $R_5$ and $R_6$ independently represent an alkyl group, a cycloalkyl group or or an aryl group, provided that Formula (III) is combined with the group represented by said $[A-(J_1)_a-(X_1)_b]_c-(J_2)_d-(X_2)_e-$ through at least one of $R_1$ through $R_6$.

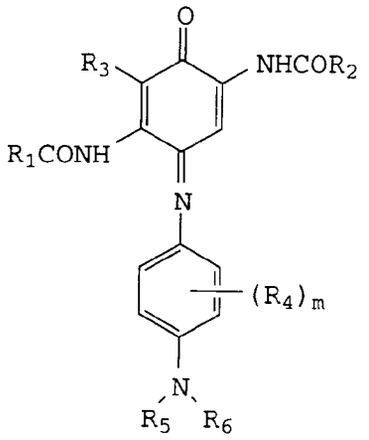
7. The material of claim 1, wherein the dye-providing material is a compound represented by the following Formula (V) or (VI):

Formula (V)

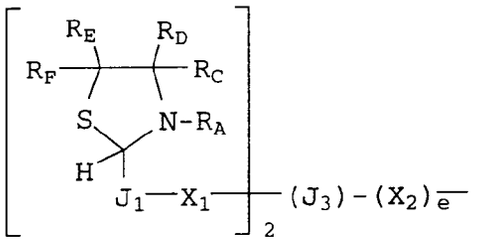


wherein $R_A$ represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group, an acyl group or a sulfonyl group; $R_C$, $R_D$, $R_E$ and $R_F$ independently represent a hydrogen atom, an alkyl group, an aryl group, a heterocyclic group, a carboxyl group, an acyl group, a sulfonyl group or a sulfo group; $J_1$ represents a divalent group; $J_3$ represents a trivalent group; $X_1$ and $X_2$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-; e represents 0 or 1; and Dye represents a residue of a dye represented by Formula (III):

Formula (III)

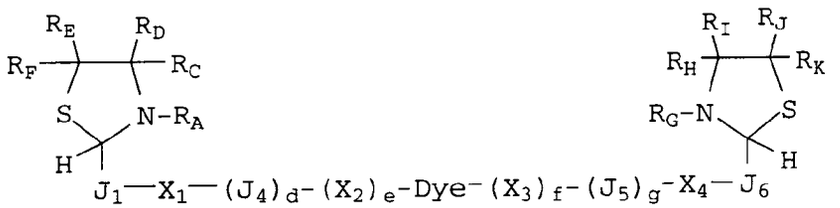


wherein $R_1$ represents an alkyl group, a cycloalkyl group or an aryl group; $R_2$ represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group; $R_3$ represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group, provided that $R_1$ and $R_3$ may combine each other to form a ring; $R_4$ represents an alkyl group, an acylamino group or an alkoxy group; m represents an integer of 0 through 4; $R_5$ and $R_6$ independently represent an alkyl group, a cycloalkyl group or or an aryl group, provided that Formula (III) is combined with the group represented by said



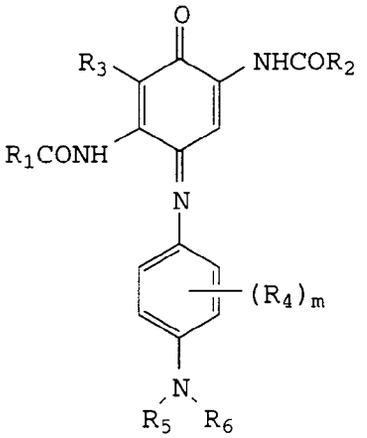
through at least one of $R_1$ through $R_6$,

Formula (VI)

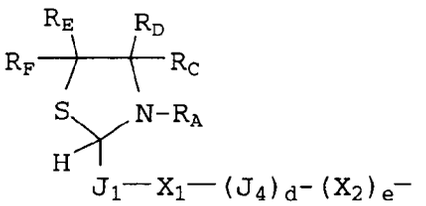


wherein $R_A$ and $R_G$ independently represent a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heterocyclic group, an acyl group or a sulfonyl group; and $R_C$, $R_D$, $R_E$, $R_F$, $R_H$, $R_I$, $R_J$ and $R_K$ independently represent a hydrogen atom, an alkyl group, an aryl group, a heterocyclic group, a carboxyl group, an acyl group, a sulfonyl group or a sulfo group; $J_1$, $J_4$, $J_5$ and $J_6$ represent divalent groups; $X_1$, $X_2$, $X_3$ and $X_4$ independently represent a divalent group selected from the group consisting of -CO-, -COO-, -CONH-, $-SO_2-$, $-SO_2NH-$, $-SO_3-$, -NHCO-, $-NHSO_2-$ and -O-; d, e, f and g independently represent 0 or 1; and Dye represents a residue of a dye represented by Formula (III):

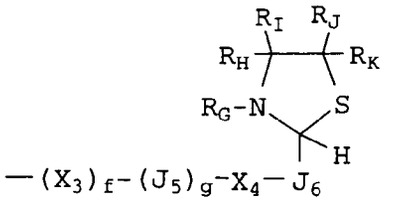
Formula (III)



wherein $R_1$ represents an alkyl group, a cycloalkyl group or an aryl group; $R_2$ represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group; $R_3$ represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group, provided that $R_1$ and $R_3$ may combine each other to form a ring; $R_4$ represents an alkyl group, an acylamino group or an alkoxy group; m represents an integer of 0 through 4; $R_5$ and $R_6$ independently represent an alkyl group, a cycloalkyl group or or an aryl group, provided that Formula (III) is combined with the groups represented by said

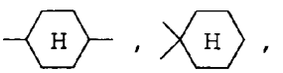


and

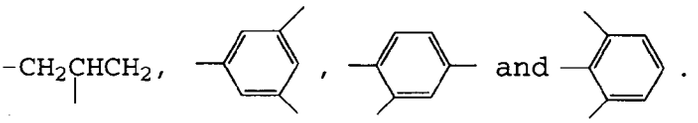


through two of $R_1$ through $R_6$.

8. The material of claim 7, wherein the divalent group represented by $J_1$, $J_4$, $J_5$ or $J_6$ is selected from the group consisting of $-CH_2-$, $-CH(CH_3)-$, $-CH_2(CH_2)_nCH_2-$ wherein n represent an integer of 0 to 10,



-CH=CH-, -C≡C-, phenylene and naphthylene and the trivalent group represented by $J_3$ is selected from the group consisting of $>CHCH_2-$,



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