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(54) **Silver halide photographic light sensitive material.**

(57) Disclosed is a silver halide photographic light-sensitive material comprising a support and provided thereon at least one silver halide light-sensitive emulsion layer, wherein at least one layer selected from said light-sensitive emulsion layer and other hydrophilic colloidal layers contains at least one dye having an absorption maxima at 630-680 nm (the first dye) and at least one dye having an absorption maxima at 680-750 nm (the second dye), as measured when they are present in a gelatin film.

A silver halide photographic light-sensitive material according to this invention, is improved in sharpness and sensitivity, and hardly undergoes fogging when exposed to safe light.

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FIELD OF THE INVENTION

The present invention relates to a silver halide photographic light-sensitive material, specifically to a silver halide photographic light-sensitive material which is improved in sharpness and sensitivity, and hardly undergoes fogging when exposed to safe light.

In recent years, there has been an increasing demand for a silver halide color photographic light-sensitive material (hereinafter often abbreviated as "a color photographic light-sensitive material") improved in image quality and handling properties.

To improve image quality, it is important to increase sharpness. It is well known in the art that sharpness can be increased by coloring silver halide emulsion layers or other hydrophilic colloidal layers with a dye that absorbs light of specific wavelength, whereby the optical characteristics of a support can be improved and a light-sensitive material can be protected from halation or irradiation.

Dyes are employed in a light-sensitive material normally for the following purposes:

(1) To eliminate unnecessary absorption of light; specifically, to adjust the spectral composition of light incident upon an emulsion layer to a preferable one, or, to change the amount of incident light to control sensitivity. For this purpose, a layer colored with a dye is provided on the side of an emulsion layer which is far away from a support. Such colored layer is called "a filter layer" and may be provided between two adjacent emulsion layers, when a light-sensitive material comprises a plurality of emulsion layers.

(2) To prevent light, that has passed through an emulsion layer and has been reflected at the interface between the emulsion layer and a support or at the opposite side of the support, from re-entering into the emulsion layer (that is, to prevent halation which makes a photographic image get blurred). For this purpose, a layer colored with a dye is provided between an emulsion layer and a support or on the opposite side (as viewed from an emulsion layer) of a support. Such colored layer is called "an anti-halation layer" and may be provided between two adjacent emulsion layers, when a light-sensitive material comprises a plurality of emulsion layers.

(3) To eliminate light scattering caused by the action of silver halide grains contained in an emulsion layer. Such scattering of light is called "irradiation". For this purpose, an emulsion layer itself is colored with a dye.

Dyes employed for these purposes must satisfy the following requirements:

- They must have spectral absorption characteristics suited to the purpose;
- They must be capable of being bleached or released from a light-sensitive material during processing to eliminate a fear of contaminating a photographic image.
- They mustnüLt affect adversely a photographic emulsion that has been spectrally sensitized. In other words, they mustnüLt allow an emulsion to get sensitized, desensitized or fogged.
- They mustnüLt fade or discolor with the passage of time.

For improved sharpness, it is preferred that the spectral sensitivity distribution characteristics of a silver halide emulsion that has been spectrally sensitized and the spectral absorption characteristics of a dye be well-matched. If not, employment of a large amount of a dye will be necessary. Use of a large amount of a dye, however, results in a lowering in sensitivity. If, the spectral sensitivity characteristics of an emulsion and the spectral absorption characteristics of a dye differ considerably, sharpness cannot be improved even when a large amount of a dye is employed.

In the case of a color photographic light-sensitive material for direct appreciation, a cyan dye image must be improved in sharpness to make users feel the photograph has a good image quality. For improved cyan dye image sharpness, in the negative-to-positive method, it is required that the spectral sensitivity distribution of a red-sensitive emulsion layer of a light-sensitive material for direct appreciation should not differ greatly from the spectral absorption distribution of a cyan dye image of an original. In addition, a red-sensitive emulsion layer of a light-sensitive material for direct appreciation is spectrally sensitized such that its spectral sensitivity distribution will culminate within the range of 670 to 720 nm, whereby the spectral sensitivity distribution of a red-sensitive emulsion layer can be prevented from overlapping with the longer wavelength region of the spectral sensitivity distribution of a green-sensitive layer. It is, therefore, preferred that a dye to be contained in a light-sensitive material have an absorption maxima in this wavelength region.

Many attempts were made to find a dye which satisfies the above requirement. Dyes which were found to satisfy the requirement include oxonol dyes (British Patent No. 506,385, U.S. Patent No. 3,247,127, Japanese Patent Examined Publication Nos. 22069/1964 and 13168/1968); styryl dyes (U.S. Patent No. 1,845,404); merocyanine dyes (U.S. Patent No. 2,493,747, British Patent No. 1,542,807); cyanine dyes (U.S. Patent Nos. 2,843,486 and 3,294,539); and anthraquinone dyes (U.S. Patent No. 2,865,752).

Of these dyes, oxonol dyes and anthraquinone dyes have been widely employed in silver halide photographic light-sensitive materials for direct appreciation due to their relatively small negative affects on photo-

graphic emulsions.

The inventors made extensive studies to find a dye which satisfy all of the requirements, i.e., a dye having spectral absorption distribution characteristics which are well-matched with the spectral sensitivity distribution characteristics of a silver halide emulsion; capable of being bleached completely in a processing liquid and released readily from a light-sensitive material, and hence, unlikely to contaminate a photographic image; producing no adverse effects, such as sensitization and desensitization, on a silver halide emulsion that has been spectrally sensitized; and exhibiting good time stability in a solution or in a light-sensitive material.

Through the studies, the inventors found several dyes that satisfied the above requirements. However, when employed in an amount sufficient to improve the sharpness of an image, these dyes affect adversely on sensitivity, which is a matter of crucial importance for a light-sensitive material for direct appreciation. In addition, the inventors found that these dyes deteriorated the safe light suitability of a light-sensitive material.

During the production or processing of a light-sensitive material, safe light which has spectral energy distribution characteristics suited to the spectral sensitivity distribution characteristics of the light-sensitive material is normally employed for enhanced working efficiency. In the case of color paper, of which the spectral sensitivity distribution has no peaks in the green-sensitive region (green lack), a colored filter which has a maximum transmittance at around 590 nm (generally called "a safe light filter") is employed. A light-sensitive material is required to have a higher sensitivity but not to safe light. Having a lower sensitivity to safe light will be referred to as "safe light suitability".

Japanese Patent Publication Open to Public Inspection (hereinafter referred to as "Japanese Patent O.P.I. Publication") No. 20830/1977, U.S. Patent No. 3,746,539 and FDR Patent No. 2,928,184 disclose use of specific oxonol dyes for improved safe light suitability.

However, these oxonol dyes do not fully satisfy the above requirements. In addition, to improve safe light suitability, these dyes must be employed in a large amount, which results in lowered sensitivity. Another serious problem is that these oxonol dyes tend to sensitize or desensitize a silver halide emulsion.

Japanese Patent O.P.I. Publication No. 235046 discloses the use of a specific oxonol dye in combination with other dyes, by which safe light suitability can be improved without adversely affecting a silver halide emulsion.

This method is, however, still unsatisfactory in respect of sharpness. In addition, it cannot improve the safe light suitability of a light-sensitive material prepared from an emulsion with a higher silver chloride content, which is suited to rapid processing. In short, this method cannot improve sharpness and safe light suitability without affecting adversely sensitivity.

SUMMARY OF THE INVENTION

An object of the invention is to provide a silver halide photographic light-sensitive material which is improved in sharpness, sensitivity and safe light suitability.

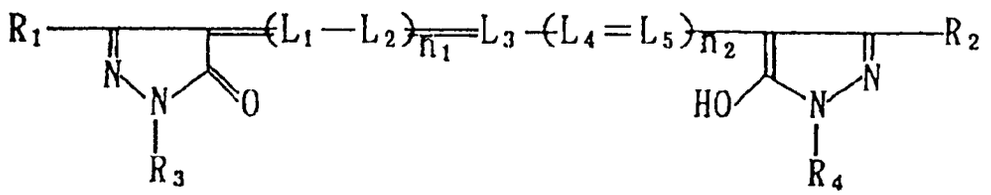
Another object of the invention is to provide a silver halide photographic light-sensitive material which contains a novel dye which does not produce negative effects, such as sensitization, desensitization and fogging, on a silver halide emulsion; exhibits good time stability in a solution or in a light-sensitive material; and is readily released from a light-sensitive material after processing, therefore, arises no fear of contaminating a photographic image.

The above object can be attained by a silver halide photographic light-sensitive material comprising a support and provided thereon at least one light-sensitive silver halide emulsion layer, wherein at least one layer selected from said light-sensitive emulsion layer and other hydrophilic colloidal layers contains at least one dye having an absorption maxima at 630-680 nm (the first dye) and at least one dye having an absorption maxima at 680 to 750 nm (the second dye), as measured when they are present in a gelatin film.

DETAILED DESCRIPTION OF THE INVENTION

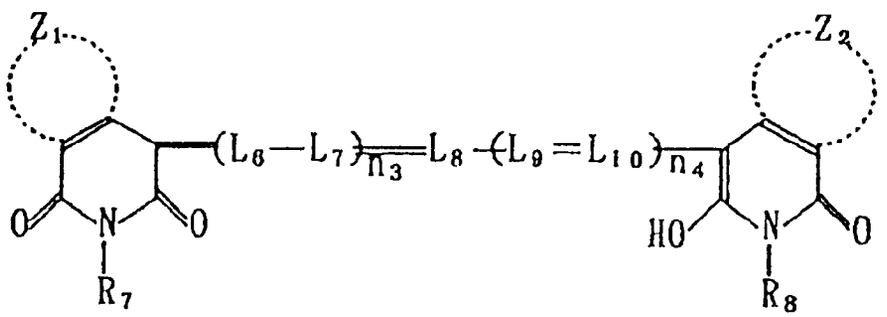
In the present invention, the first dye having an absorption maxima at 630-680 nm is preferably a compound represented by any one of Formula I to XI, and the second dye having an absorption maxima at 680-750 nm is preferably a compound represented by any one of Formula XII to XV. Explanation will be made on these compounds.

Formula I



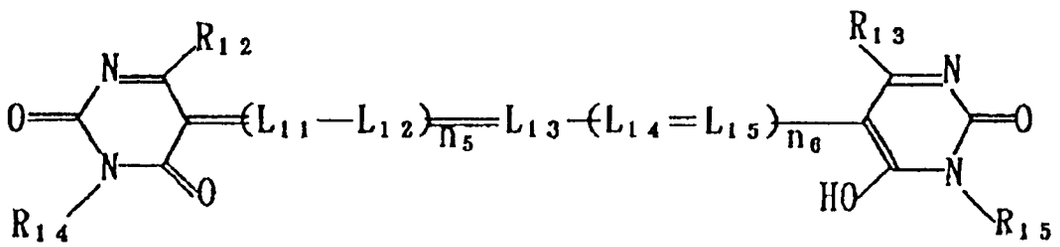
wherein R_1 and R_2 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_5$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_5$, $-SOR_5$ or a cyano group; R_3 and R_4 each represent a hydrogen atom, an alkyl group, an aryl group or a heterocyclic group; L_1, L_2, L_3, L_4 and L_5 each represent a methine group; n_1 and n_2 each represent 0 or 1; and R_5 and R_6 each represent a hydrogen atom, an alkyl group, an alkenyl group or a heterocyclic group. R_5 and R_5 may combine with each other to form a 5- or 6-membered ring.

Formula II



wherein R_7 and R_8 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Z_1 and Z_2 each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_6, L_7, L_8, L_9 and L_{10} each represent a methine group; n_3 and n_4 each represent 0 or 1; and R_9, R_{10} and R_{11} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group or a heterocyclic group. R_9 and R_{10} may combine with each other to form a 5- or 6-membered ring. The same can be applied to R_{10} and R_{11}.

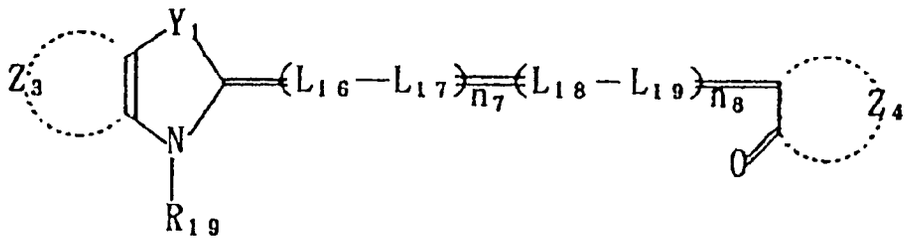
Formula III



wherein R_{12} and R_{13} each represent an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_{16}R_{17}$, $-OR_{16}$, $-N(R_{16})COR_{17}$, $-N(R_{16})SO_2R_{17}$, $-N(R_{16})CONR_{17}R_{18}$, $-COR_{16}$, $-CONR_{16}R_{17}$, $-SO_2R_{16}$, $-SO_2NR_{16}R_{17}$, $-COOR_{16}$ or a cyano group; R_{14} and R_{15} each have the same meaning as R_7 or R_5; R_{16}, R_{17} and R_{18} each have the same meaning as R_9, R_{10} or R_{11}; L_{11}, L_{12}, L_{13}, L_{14} and L_{15} each represent a methine group;

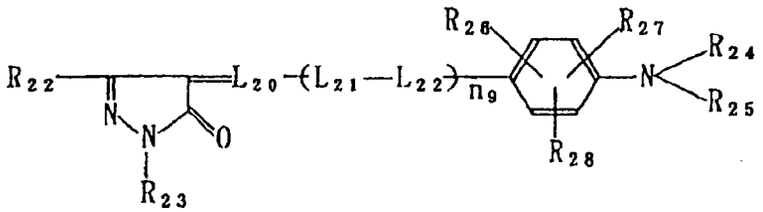
and n_5 and n_6 each represent 0 or 1.

Formula IV



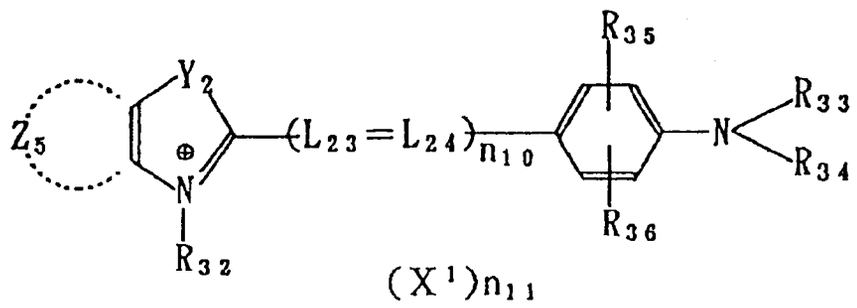
wherein R_{19} has the same meaning as R_7 or R_8; Y_1 represents an oxygen atom, a sulfur atom, a selenium atom, a tellurium atom or $=CR_{20}R_{21}$; R_{20} and R_{21} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group or a heterocyclic group; Z_3 and Z_4 each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_{16}, L_{17}, L_{18} and L_{19} each represent a methine group; and n_7 and n8 each represent 0 or 1. R_{20} and R_{21} may combine with each other to form a 5- or 6-membered ring.

Formula V



wherein R_{22} has the same meaning as R_1 or R_2; R_{23} has the same meaning as R_3 or R_4; R_{24} and R_{25} each have the same meaning as R_9 or R_{10}; R_{26}, R_{27} and R_{28} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a cyno group, -COR29, $-CONR_{29}R_{30}$, $-NR_{29}R_{30}$, $-OR_{29}$, $-SO_2R_{29}$, $-N(R_{29})COR_{30}$, $-N(R_{29})SO_2R_{30}$, $-N(R_{29})CONR_{30}R_{31}$, $-SR_{29}$, $-COOR_{29}$ or $-SO_2NR_{29}R_{30}$; L_{20}, L_{21} and L_{22} each represent a methine group; and n_9 represents 0 or 1. R_{24} and R_{25} may combine with each other to form a 5- or 6-membered ring.

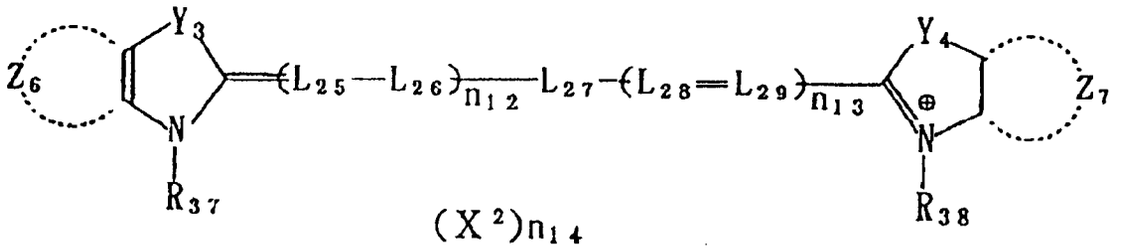
Formula VI



wherein R_{32} has the same meaning as R_7 or R_8; R_{33} and R_{34} each have the same meaning as R_9 or R_{10}; R_{35} and R_{36} each have the same meaning as R_{26}, R_{27} or R_{28}; Y_2 has the same meaning as Y_1; Z_5 has the same meaning as Z_3; L_{23} and L_{24} each represent a methine group; n_{10} represents 0 or 1; X_1 represents a group capable of being dissociated into anions; and n_{11} represents 0, 1 or 2. R_{33} and R_{34} may combine with each other to form

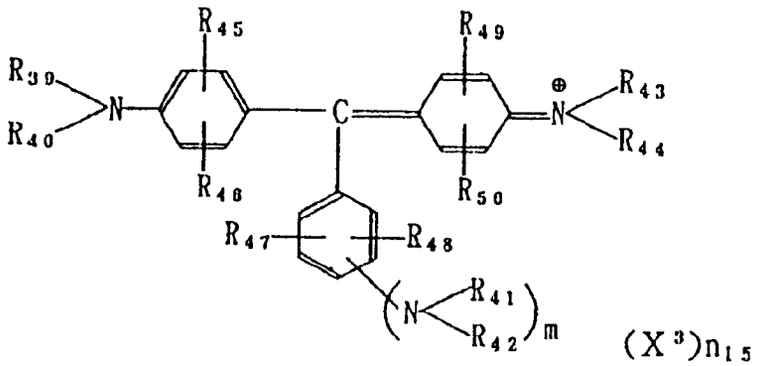
a 5- or 6-membered ring

Formula VII



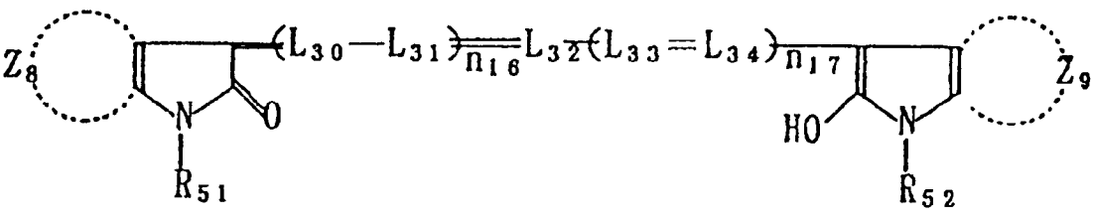
wherein R_{37} and R_{38} each have the same meaning as R_7 or R_8; Y_3 and Y_4 each have the same meaning as Y_1; Z_6 and Z_7 each have the same meaning as Z_1 or Z_2; L_{25}, L_{26}, L_{27}, L_{28} and L_{29} each represent a methine group; n_{12} and n_{13} each represent 0 or 1; X_2 has the same meaning as X_1; and n_{14} represents 0, 1 or 2.

Formula VIII



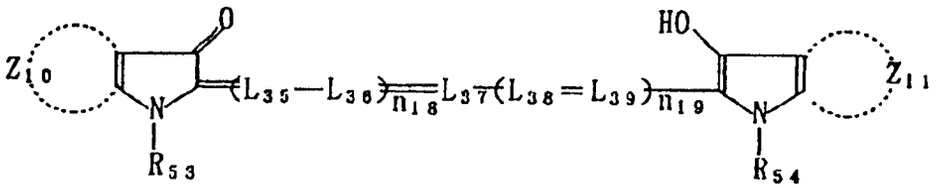
wherein R_{39}, R_{40}, R_{41}, R_{42}, R_{43} and R_{44} each have the same meaning as R_9 or R_{10}; R_{45}, R_{46}, R_{47}, R_{48}, R_{49} and R_{80} each have the same meaning as R_{26}, R_{27} or R_{28}; X_3 has the same meaning as X_1; n_{15} represents 0, 1 or 2; and m represents 0 or 1. R_{38} and R_{39} may combine with each other to form a 5-or 6-membered ring. The same can be applied to R_{40} and R_{41}, and R_{42} and R_{43}.

Formula IX



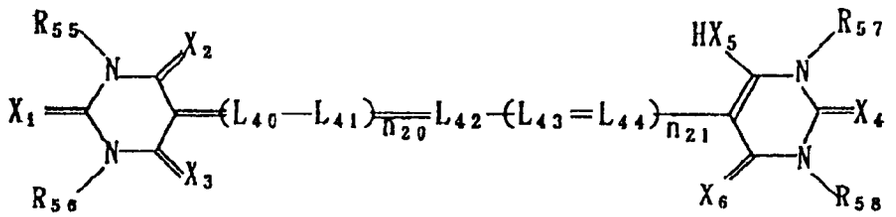
wherein R_{81} and R_{52} each have the same meaning as R_7 or R_8; Z_8 and Z_9 each have the same meaning as Z_1 or Z_2; L_{30}, L_{31}, L_{32}, L_{33} and L_{34} each represent a methine group; and n_{16} and n_{17} each represent 0 or 1.

Formula X



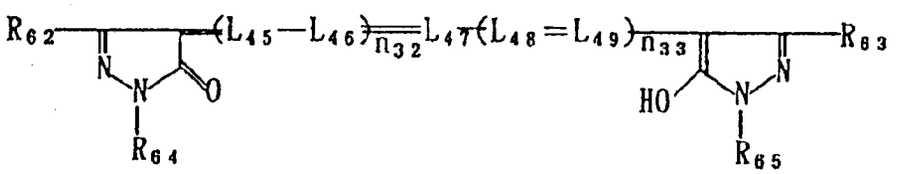
wherein R_{53} and R_{54} each have the same meaning as R_7 or R_8; Z_{10} and Z_{11} each have the same meaning as Z_1 or Z_2; L_{35}, L_{36}, L_{37}, L_{38} and L_{39} each represent a methine group; and n_{18} and n_{19} each represent 0 or 1.

Formula XI



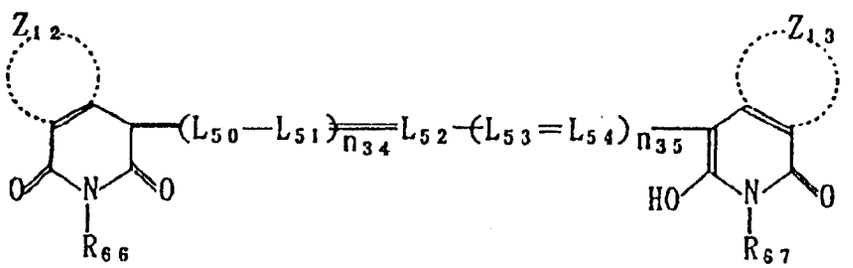
wherein R_{55}, R_{56}, R_{57} and R_{58} each have the same meaning as R_7 or R_8; X_1, X_2, X_3, X_4, X_5 and X_6 each represent an oxygen atom, a sulfur atom or $-NR_{59}R_{60}$; R_{59} and R_{60} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic atom, a hydroxyl group or $-OR_{61}$; R_{51} represents an alkyl group or an aryl group; and n_{20} and n_{21} each represent 0 or 1.

Formula XII



wherein R_{52} and R_{63} each have the same meaning as R_1 and R_2; R_{54} and R_{55} each have the same meaning as R_3 or R_4; L_{45}, L_{46}, L_{47}, L_{48} and L_{49} each represent a methine group; and n_{32} and n_{33} each represent 1 or 2.

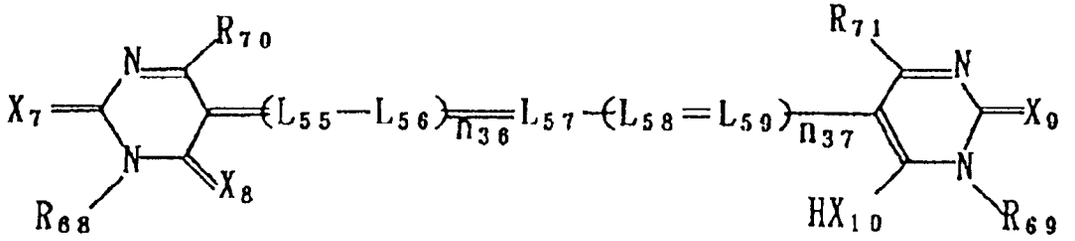
Formula XIII



wherein R_{66} and R_{57} each have the same meaning as R_7 or R_8; Z_{12} and Z_{13} each have the same meaning as

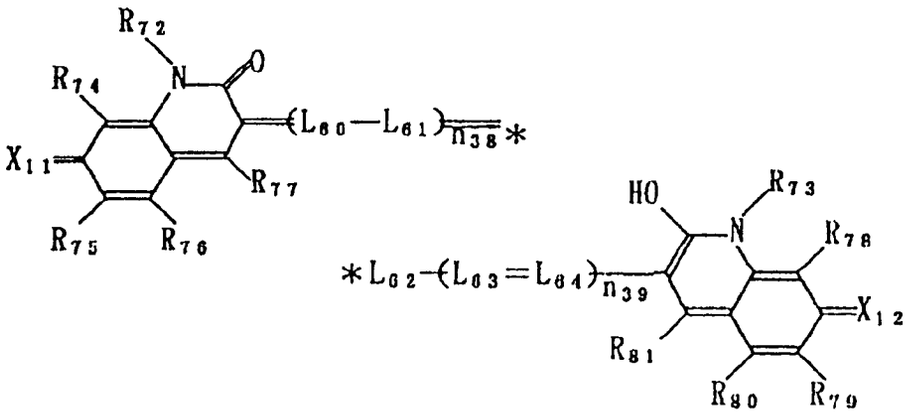
Z_1 or Z_2; L_{50}, L_{51}, L_{52}, L_{53} and L_{54} each represent a methine group; and n_{34} and n_{35} each represent 1 or 2.

Formula XIV



wherein R_{68} and R_{69} each have the same meaning as R_7 or R_6; R_{70} and R_{71} each have the same meaning as R_{12} or R_{13}; X_7, X_8, X_9 and X_{10} each have the same meaning as X_1, X_2, X_3, X_4, X_8 or X_6; L_{55}, L_{56}, L_{57}, L_{58} and L_{59} each represent a methine group; and n_{36} and n_{37} each represent 1 or 2.

Formula XV



wherein R_{72} and R_{73} each have the same meaning as R_7 or R_6; R_{74}, R_{75}, R_{76}, R_{77}, R_{78}, R_{79}, R_{60} and R_{61} each have the same meaning as R_{26}, R_{27} or R_{28}; X_{11} and X_{12} each have the same meaning as X_1, X_2, X_3, X_4, X_8 or X_8; L_{60}, L_{61}, L_{62}, L_{63} orL_{64} each represent a methine group; and n_{38} and n_{39} each represent 0, 1 or 2.

In Formulae I to XV, the group represented by any one of R_1 to $R8_1$ may have a substituent.

Examples of the alkyl group represented by any one of R_1 to R_{61} include methyl, ethyl, propyl, i-propyl, butyl, t-butyl, cyclopentyl and cyclohexyl. These alkyl groups each may be substituted with a hydroxyl group, a cyano group, a sulfo group, a carboxyl group, a halogen atom, an alkoxy group (e.g. methoxy, ethoxy), an aryloxy group (e.g. phenoxy, 4-sulfophenoxy, 2,4-disulfophenoxy), an aryl group (e.g. phenyl, 4-sulfophenyl, 2,5-disulfonyl), an alkoxycarbonyl (e.g. methoxycarbonyl, ethoxycarbonyl) or an aryloxycarbonyl (e.g. phenoxycarbonyl).

Examples of the aryl group represented by any one of R_1 to R_{61} include phenyl and naphthyl. These aryl groups each may be substituted. Suitable substituents include the alkyl groups represented by any one of R_1 to R_{81} and the groups mentioned above as the substituents for the alkyl group.

Examples of the heterocyclic group represented by any one of R_1 to R_{81} include pyridyl, thiazolyl, oxazolyl, imidazolyl, furyl, pyrrolyl, pyrazinyl, pyrizinyl, pyridazinyl, purinyl, selenazolyl, sulforanyl, piperidinyl, pyrazolyl and tetrazolyl. These heterocyclic groups each may be substituted. Suitable substituents include the alkyl groups represented by any one of R_1 to R_{61} and the groups mentioned above as the substituents for the alkyl group.

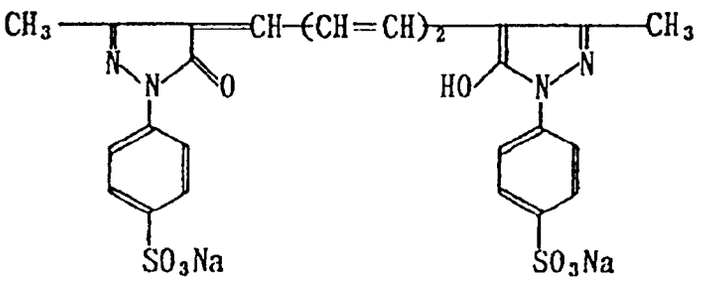
Examples of the alkenyl group represented by any one of R_1 to R_{61} include vinyl, allyl and butenyl. These alkenyl groups may be substituted. Suitable substituents include the alkyl groups represented by any one of R_1 to R_{81} and the groups mentioned above as the substituents for the alkyl group. Examples of the 5- or 6-

membered ring formed by any one of Z_1 to Z_{13} include benzene, naphthalene, thiophene, pyrrole, furan, pyrazole, indole, quinoline, pyridine, pyrazine, pyrimidine, cyclohexene and cyclopentene. These rings each may be substituted. Suitable substituents include the alkyl groups represented by any one of R_1 to R_{81} and the groups mentioned above as the substituents for the alkyl group.

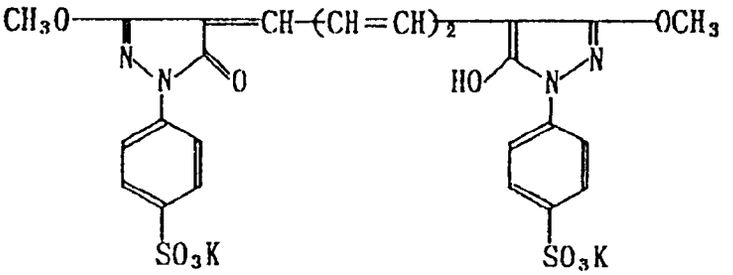
The methine group represented by any one of L_1 to L_{64} may have a substituent. Suitable substituents include an alkyl group (e.g. methyl, ethyl, i-butyl), an aryl group (e.g. phenyl, p-tolyl, p-carbonxyphenyl), an aralykyl group (e.g. benzyl, phenethyl), alkoxy (e.g. methoxy, ethoxy), an aryloxy group (e.g. phenoxy), a halogen atom and a cyano group.

Representative examples of the dye represented by any one of Formulae I to XV are given below:

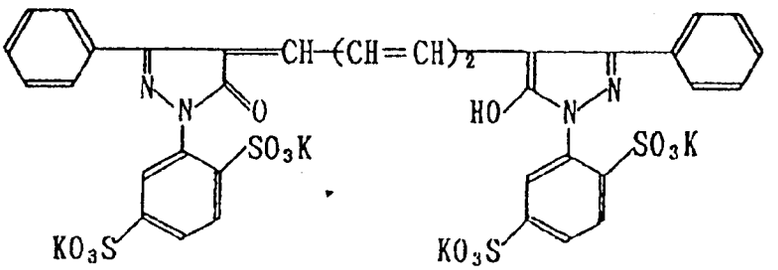
I − 1



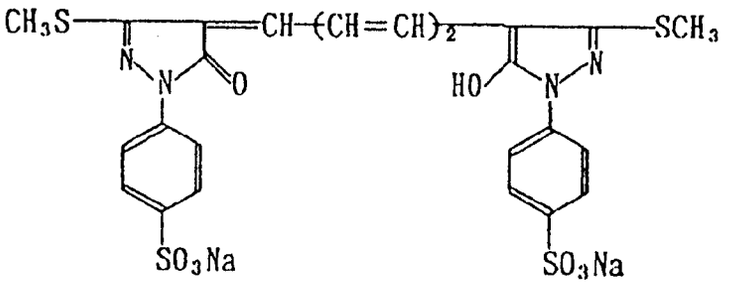
I − 2



I − 3



I − 4



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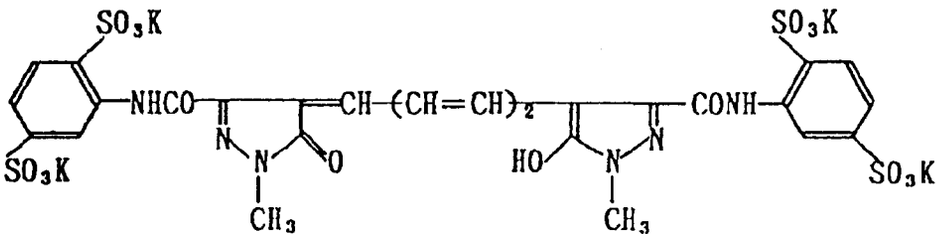

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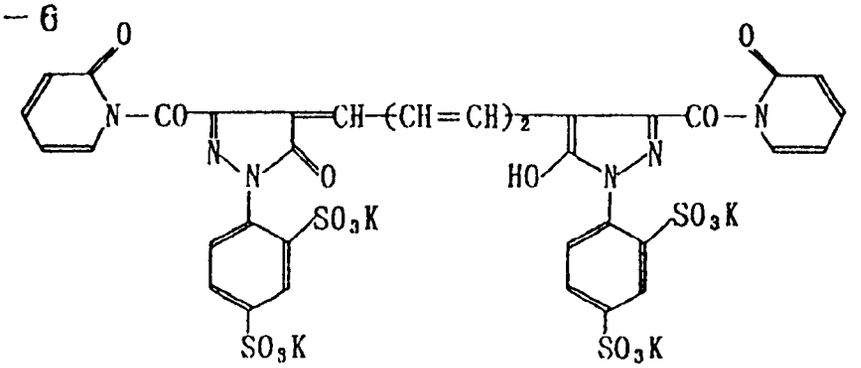

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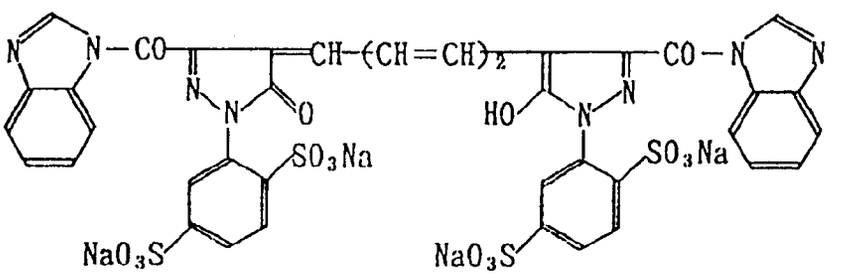

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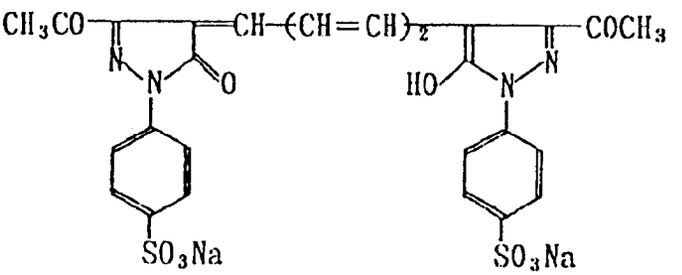

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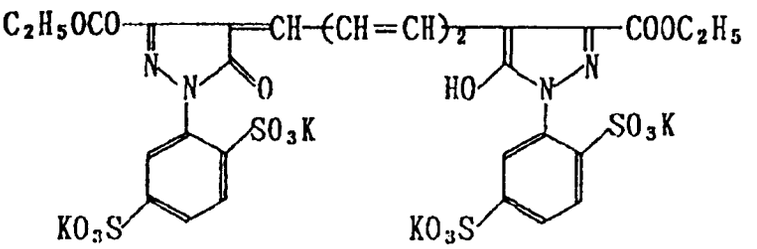

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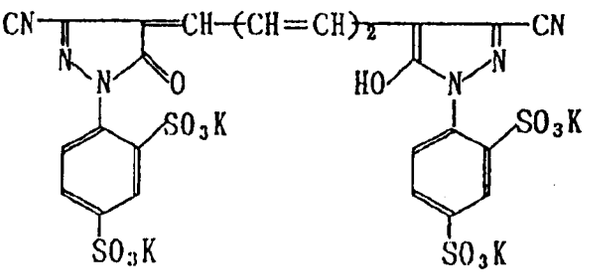

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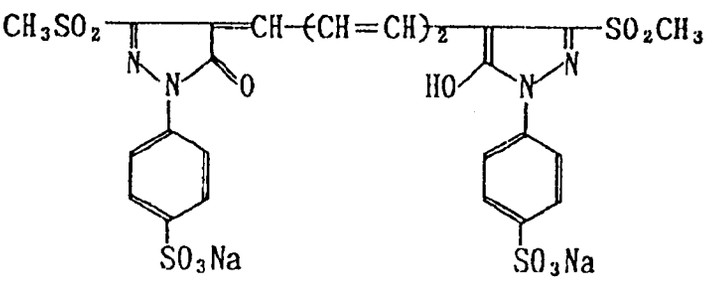

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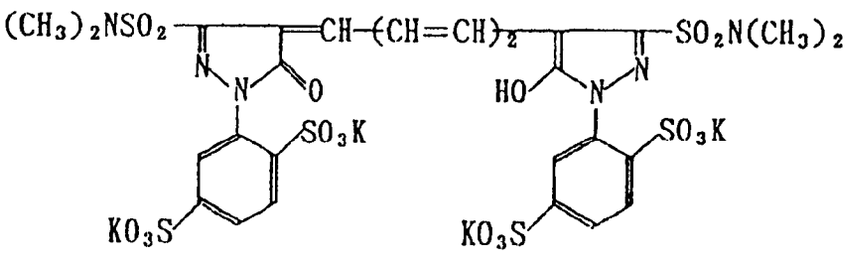

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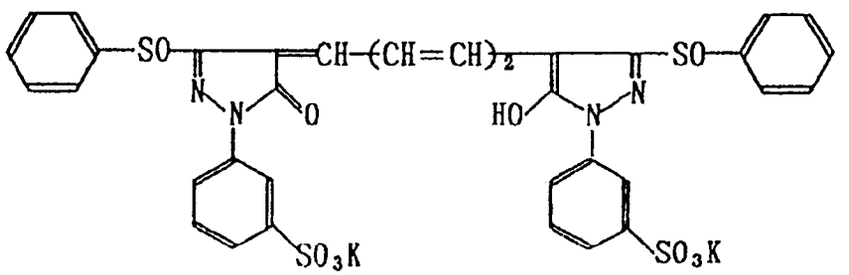

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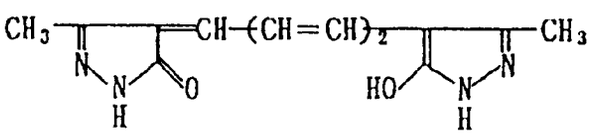

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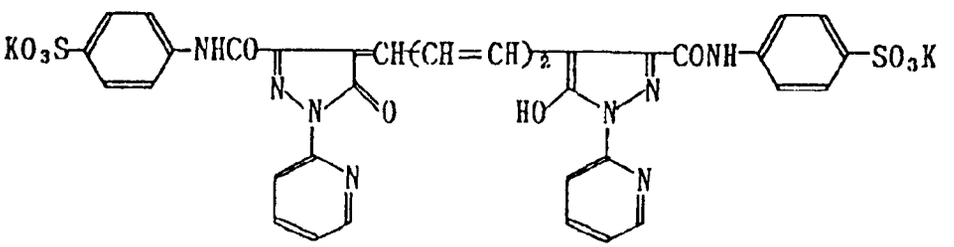

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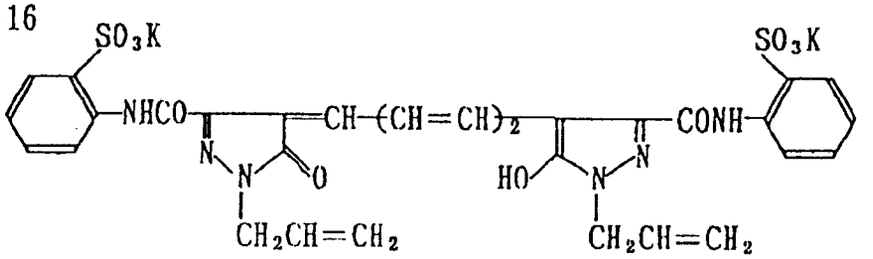

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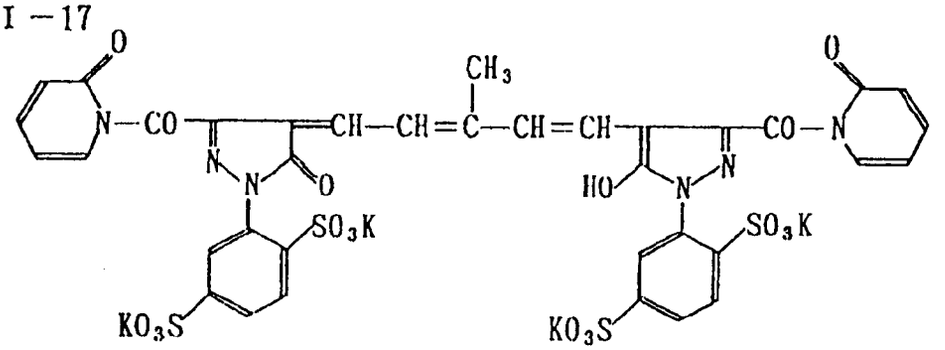

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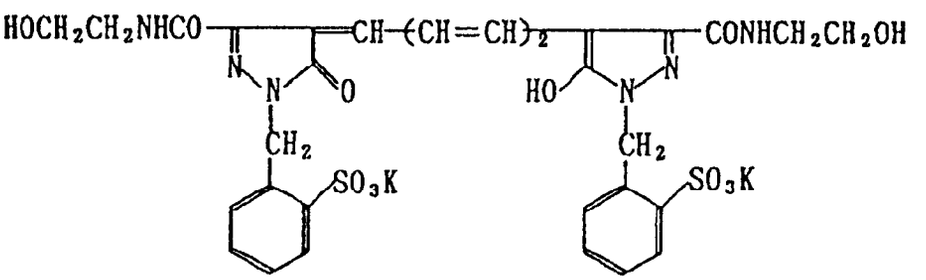

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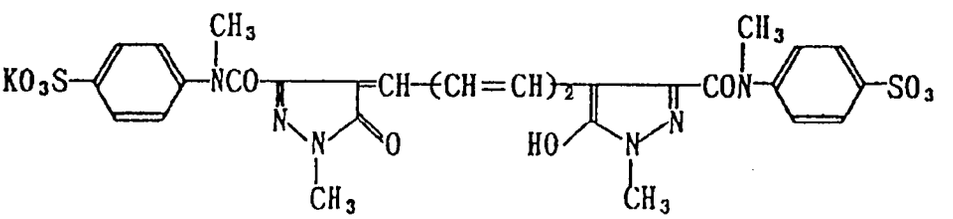

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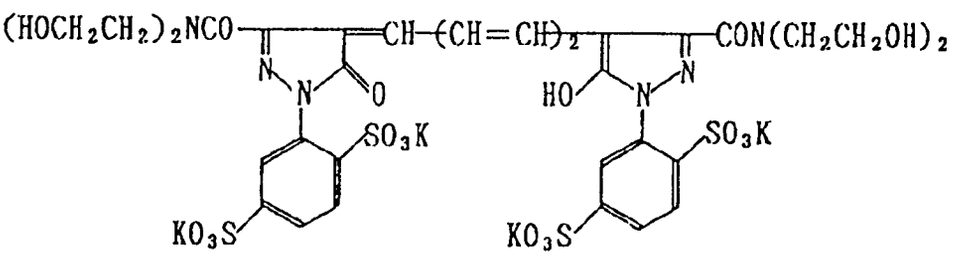

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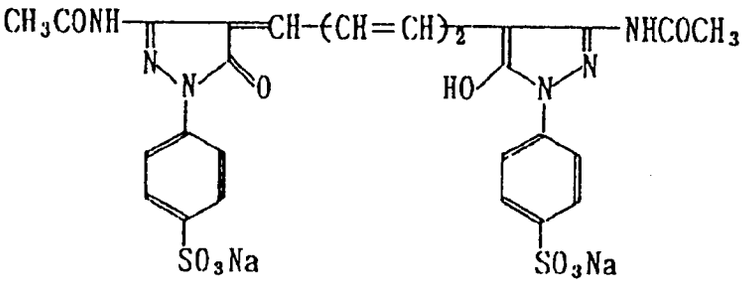

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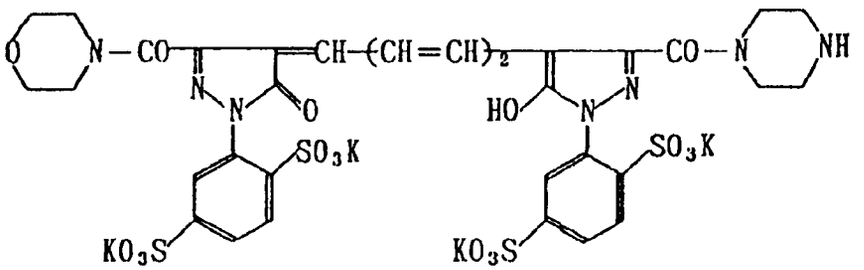

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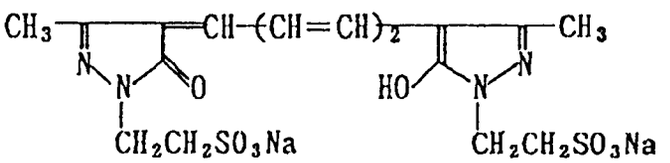

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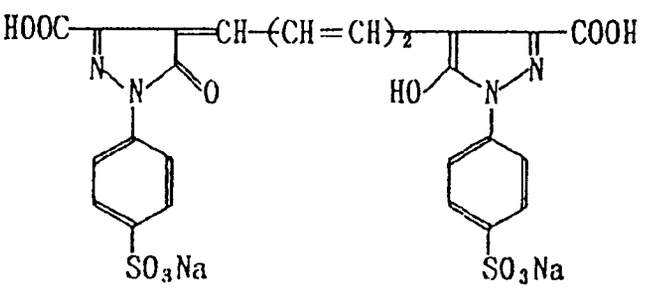

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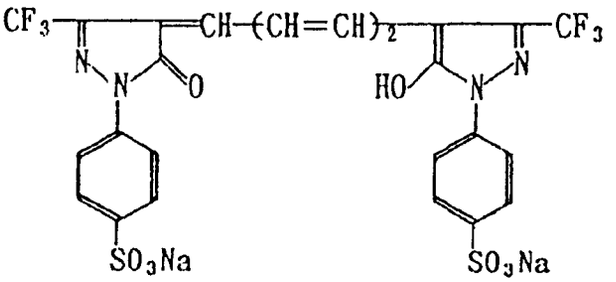

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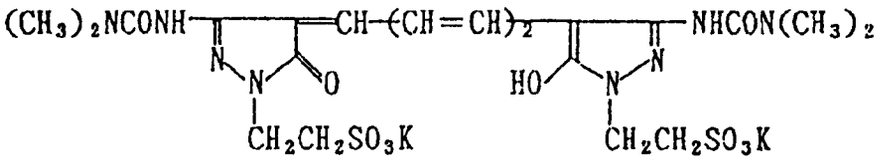

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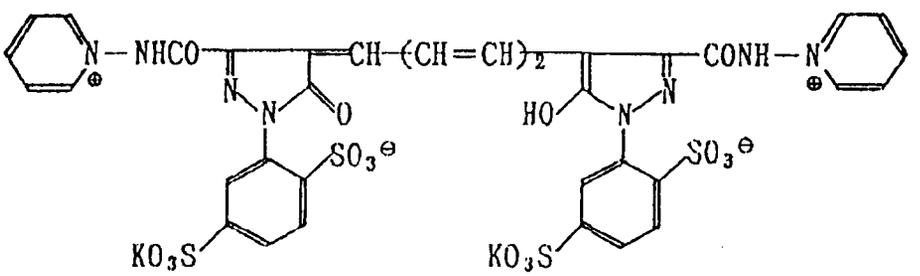

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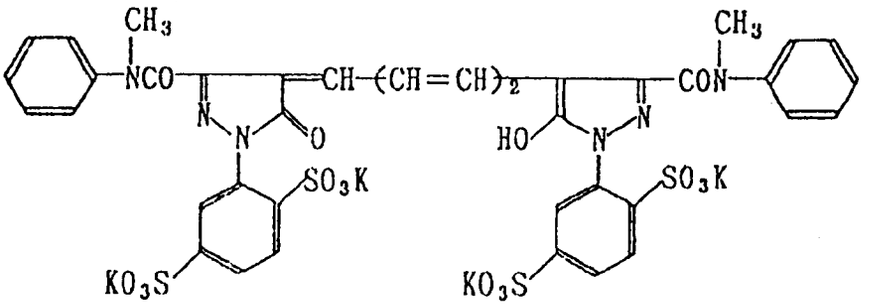

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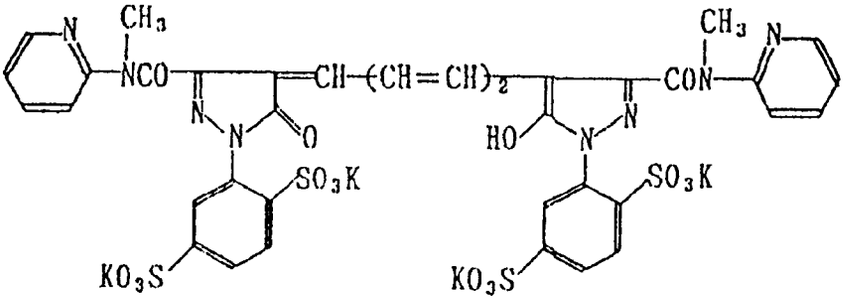

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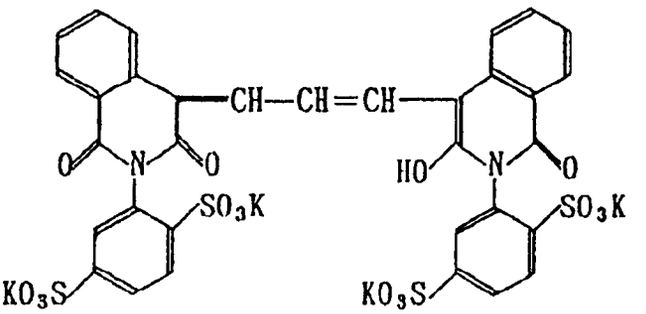

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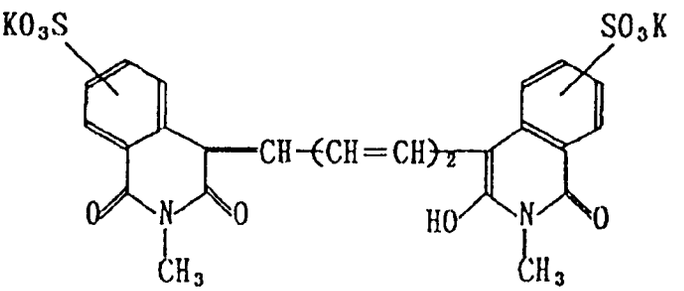

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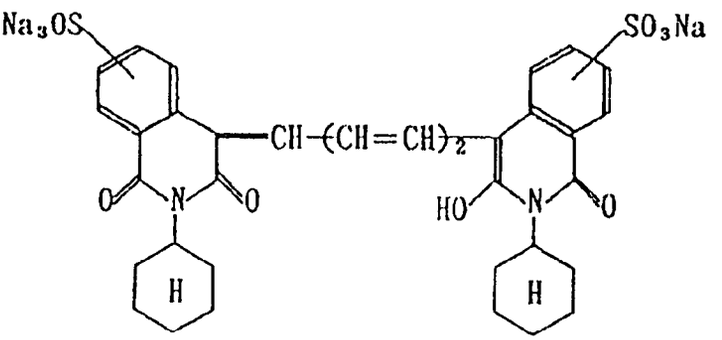

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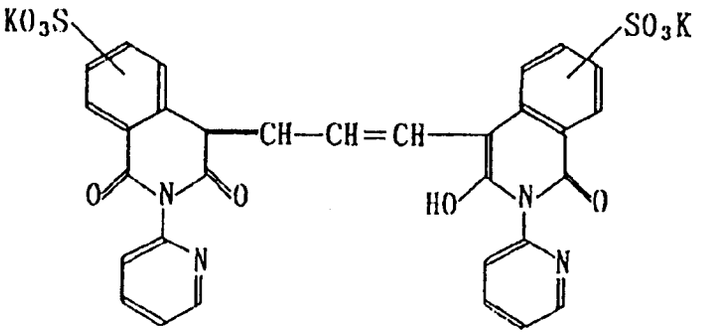

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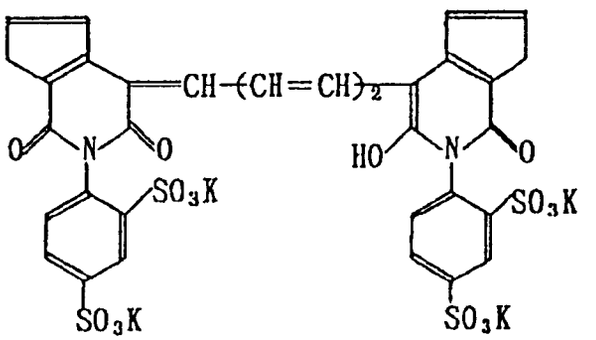

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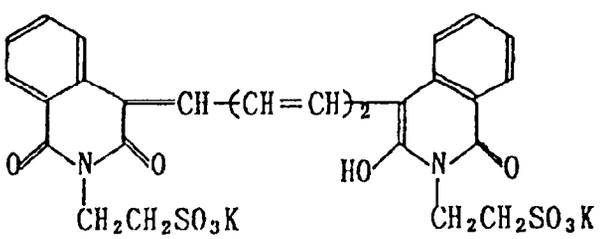

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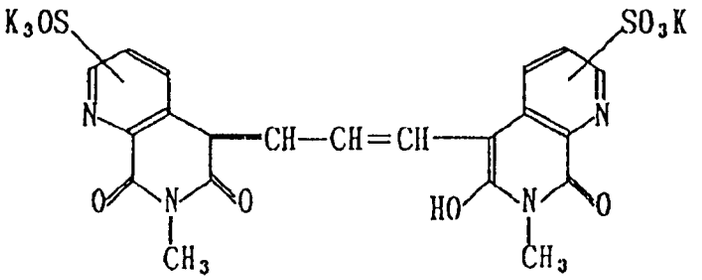

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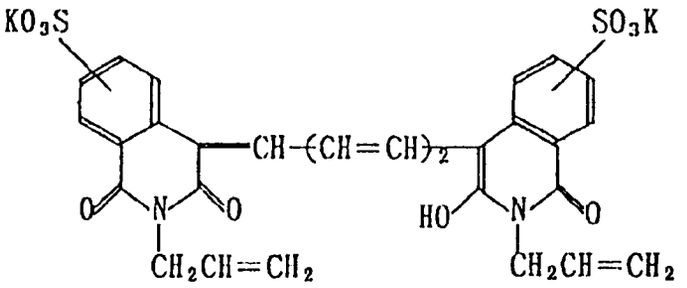

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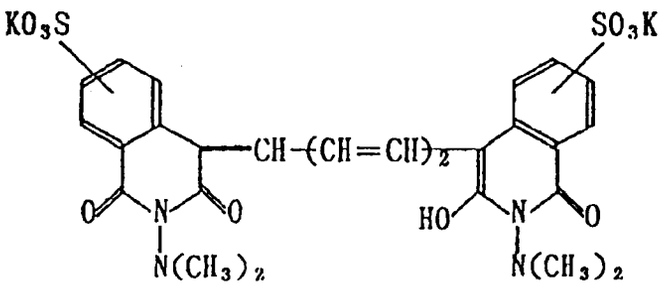

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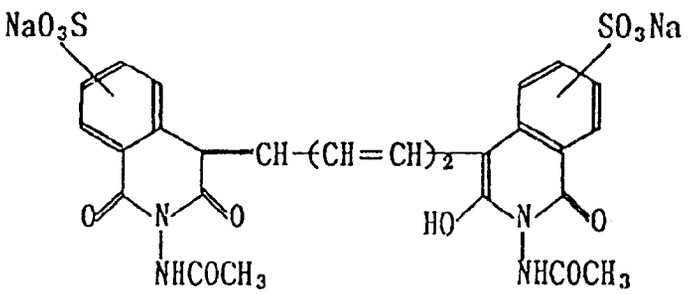

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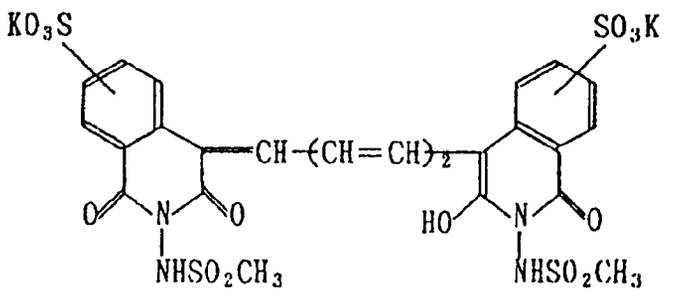

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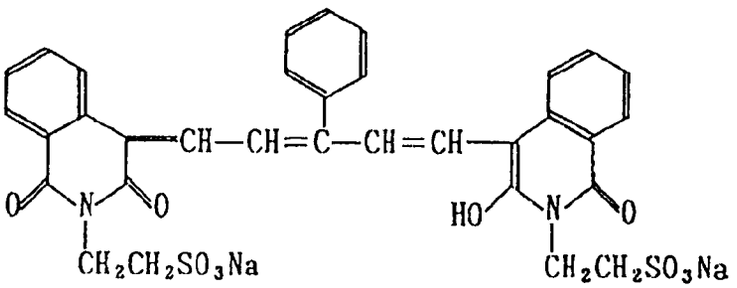
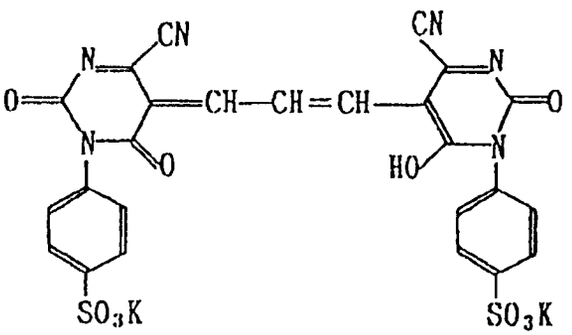
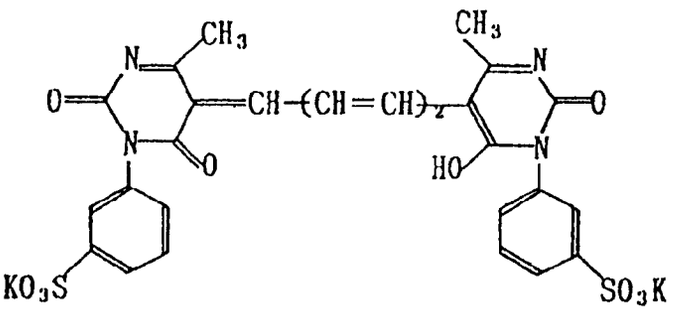


III－1



III－2



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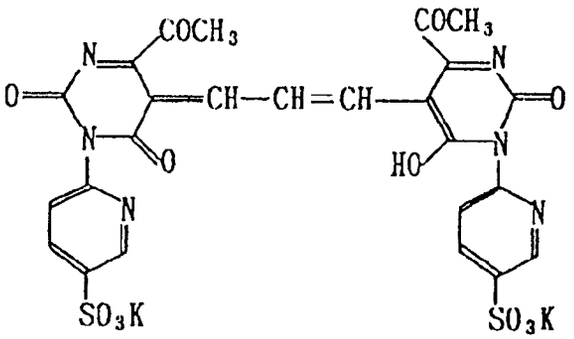

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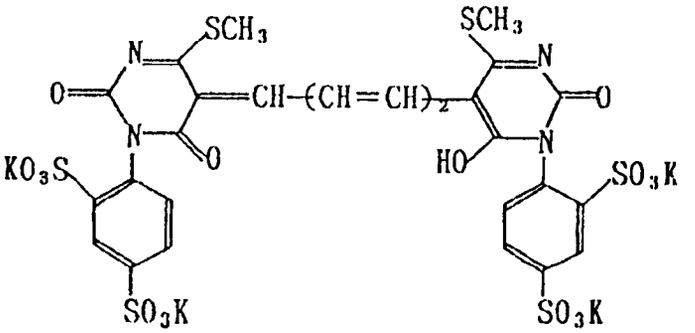

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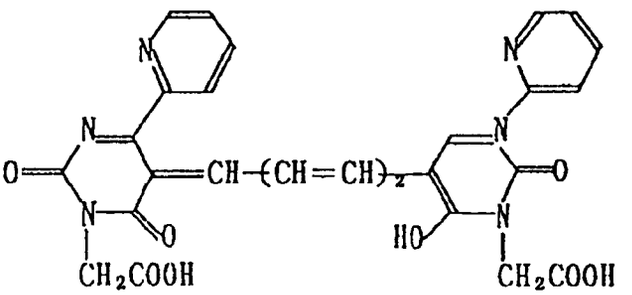

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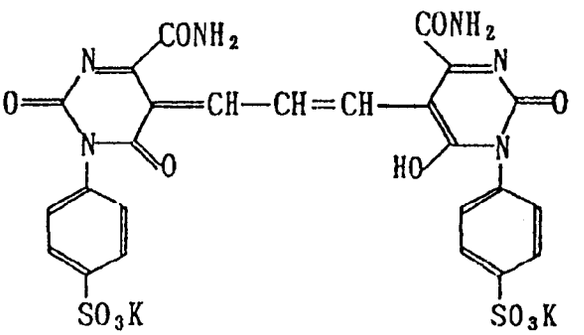

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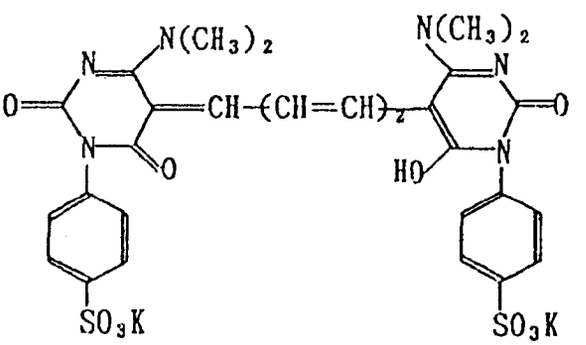
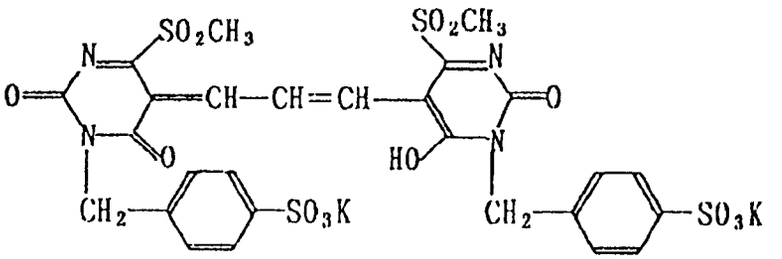


III − 8



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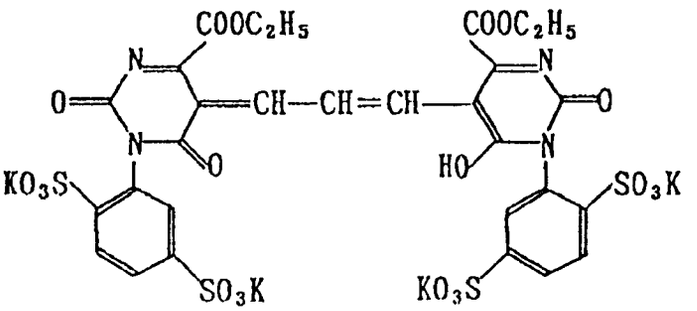

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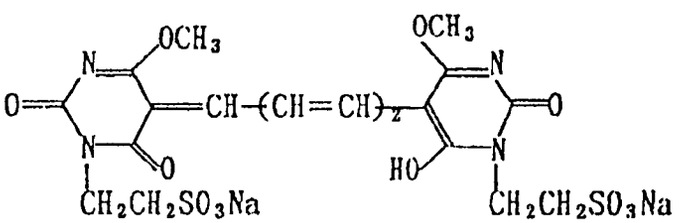

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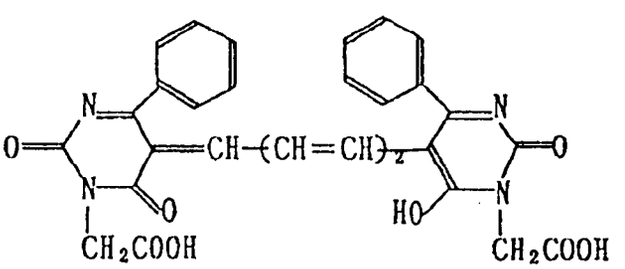

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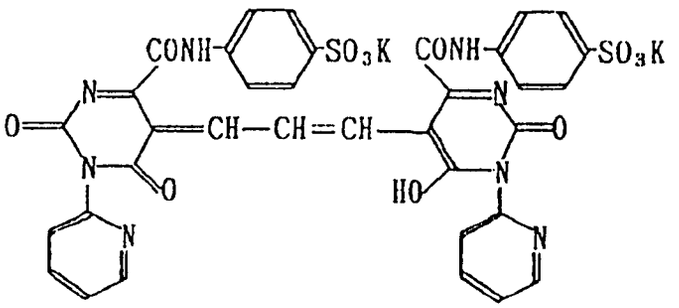

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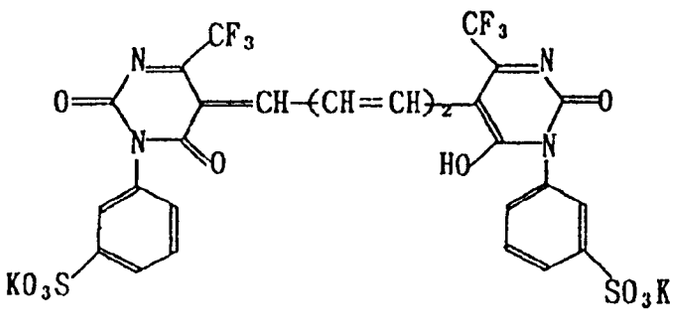

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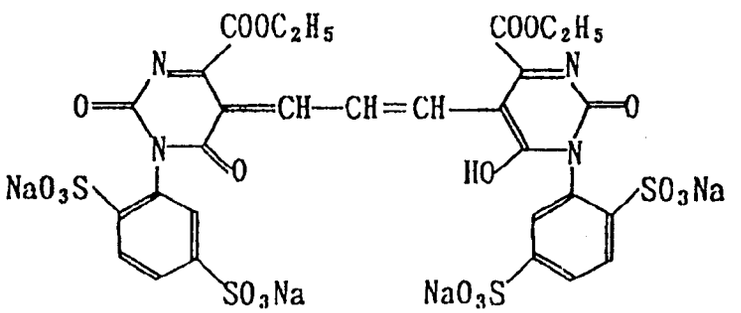

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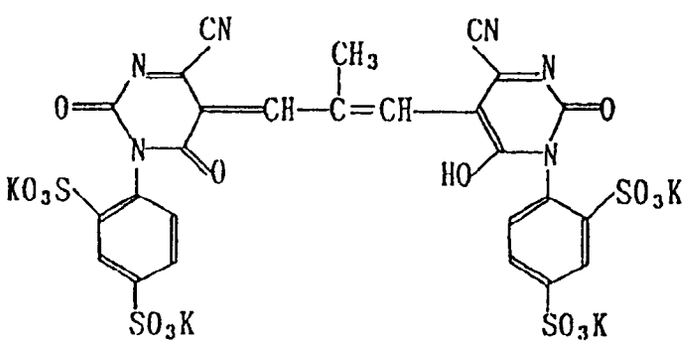

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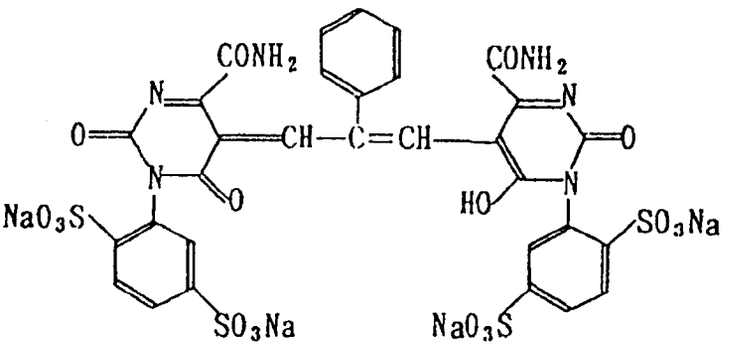
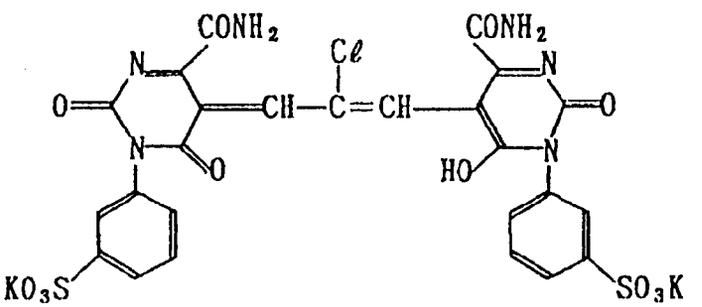


Ⅲ－17



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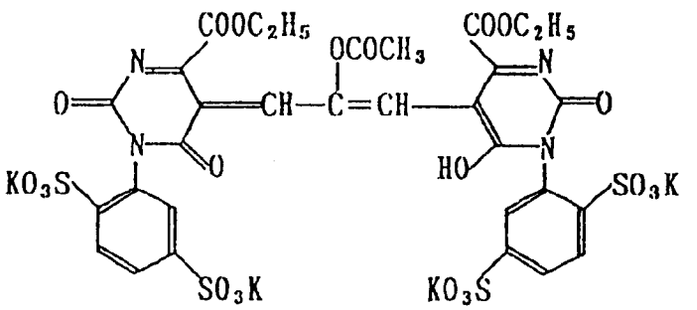

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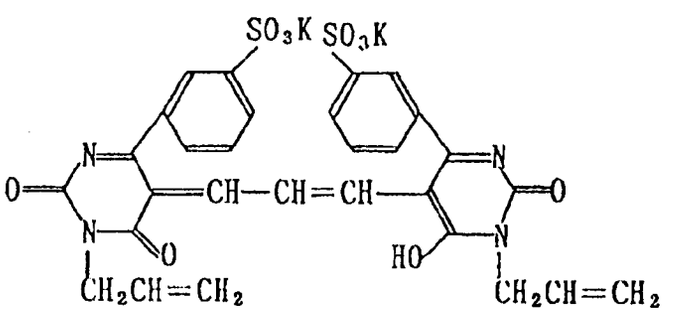
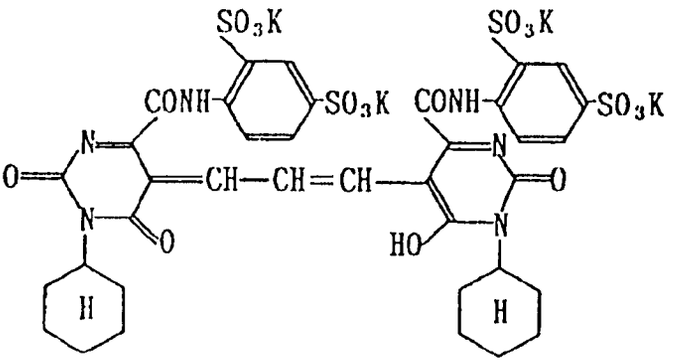
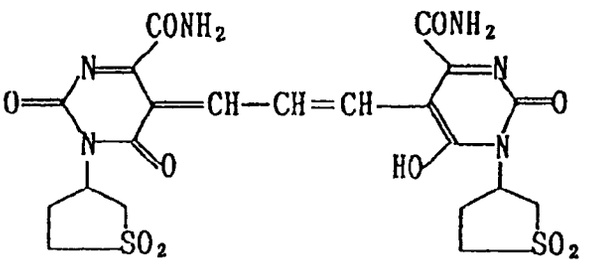


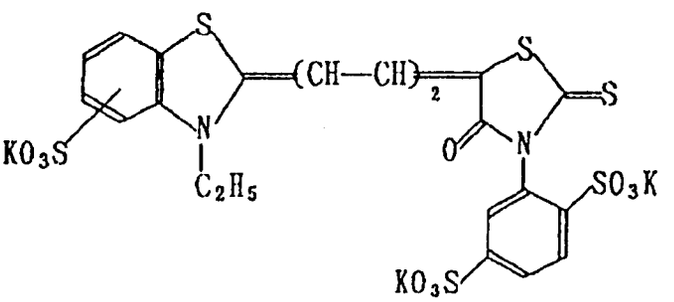
III－20



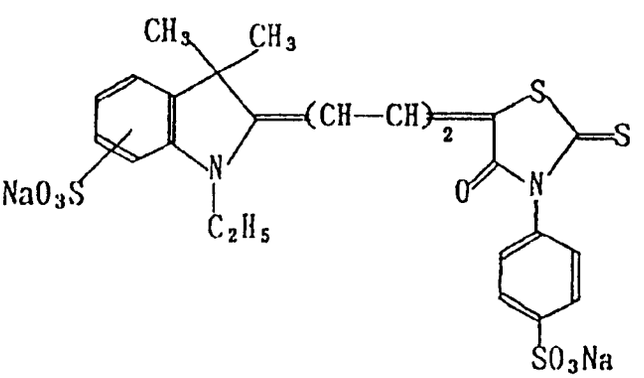
III－21



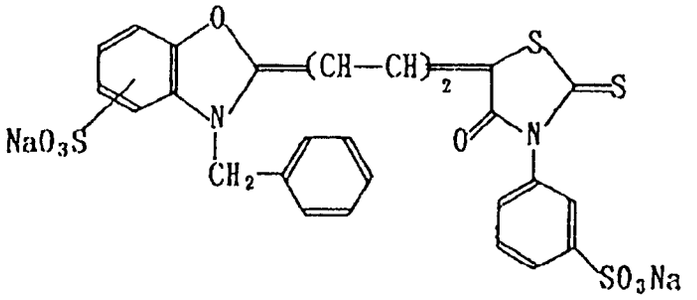
IV－1



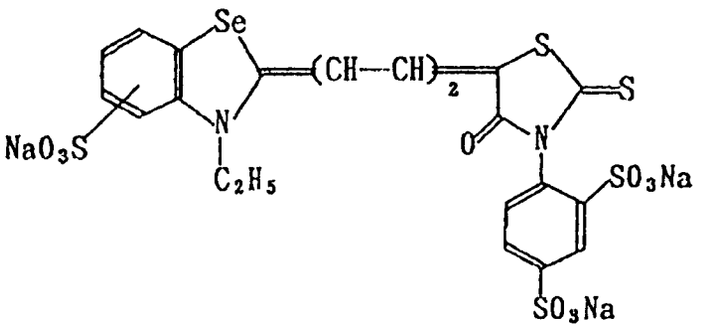
IV－2



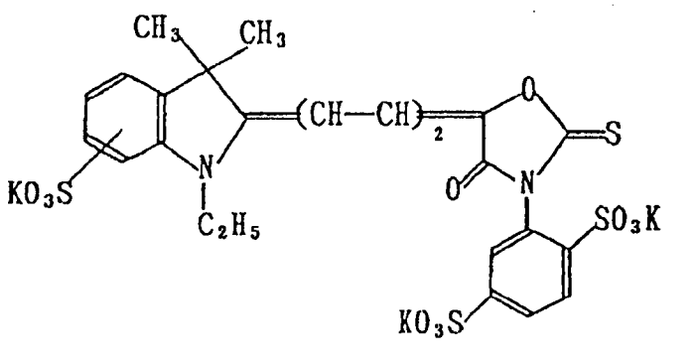
IV − 3



IV − 4



IV − 5



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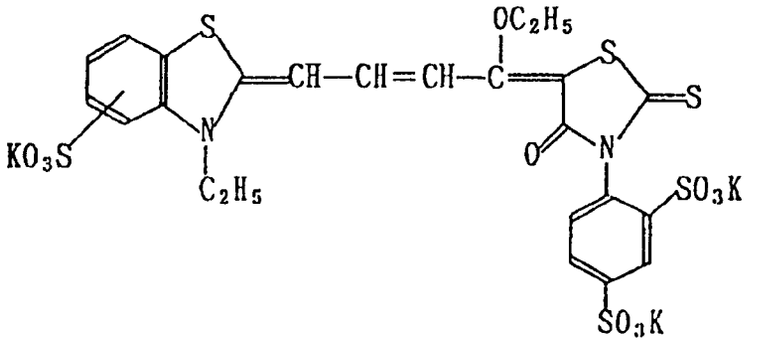

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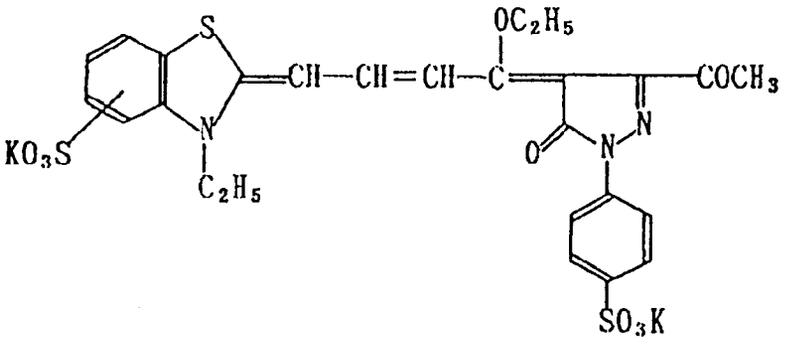
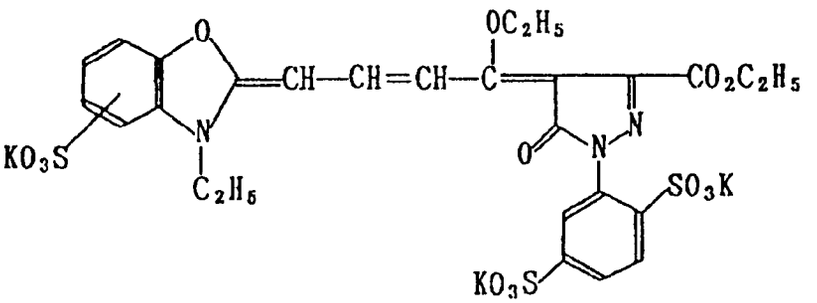


IV − 8



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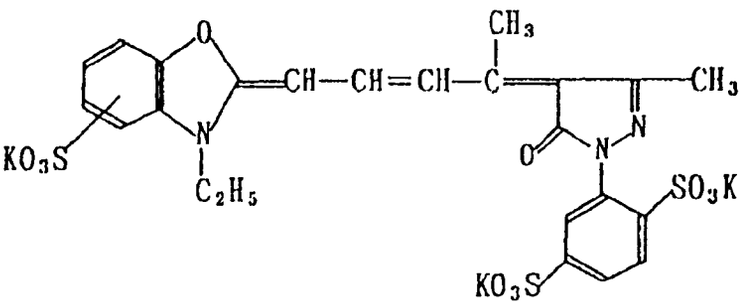

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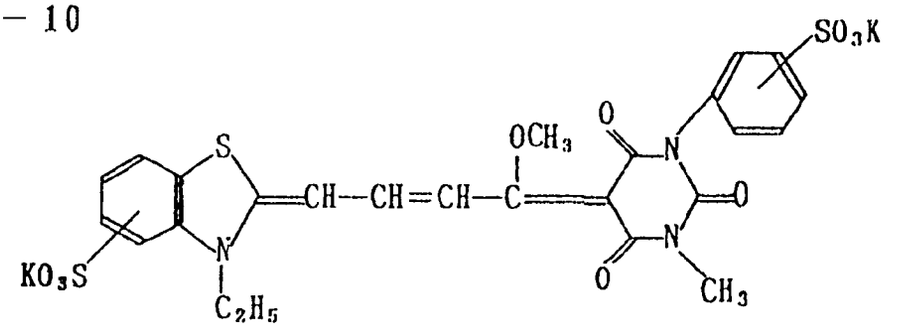

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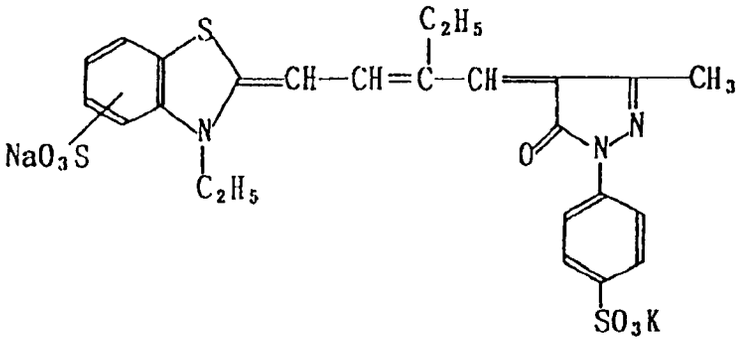

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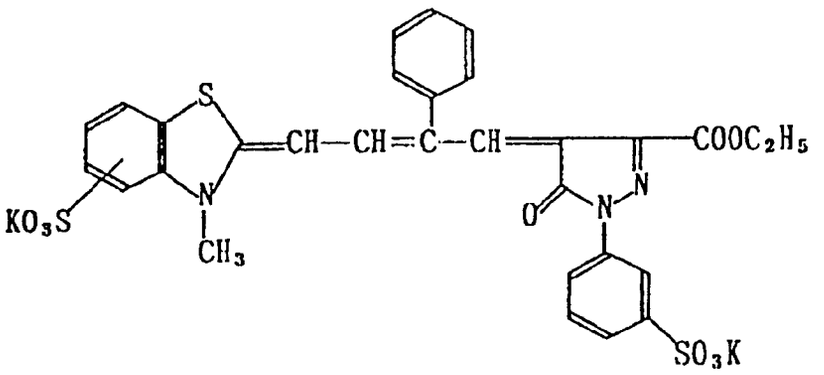

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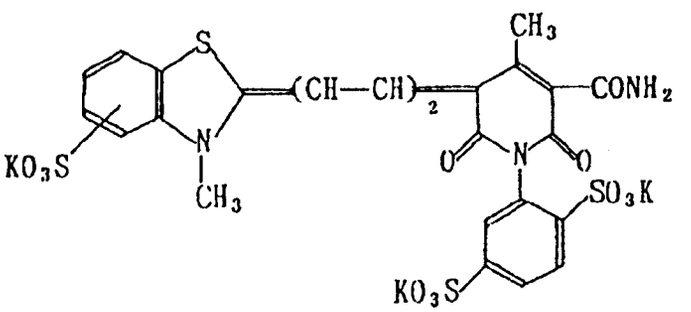

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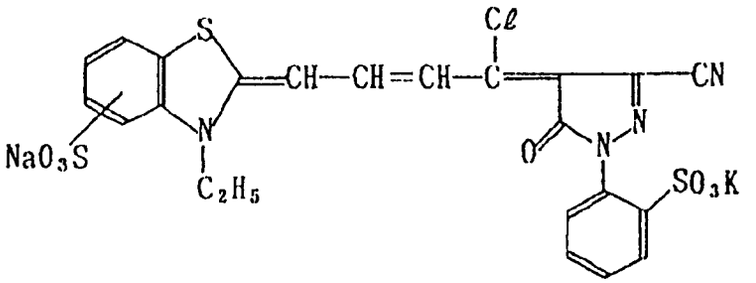

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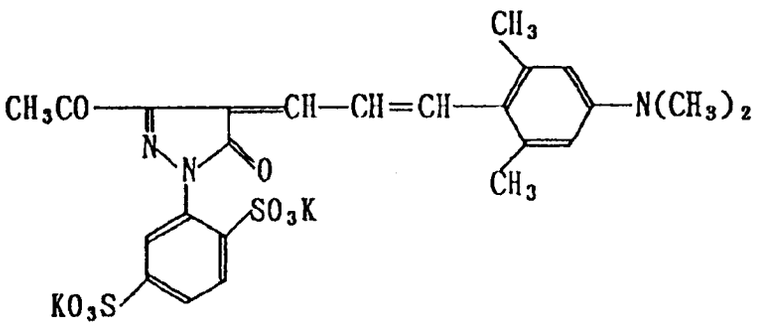
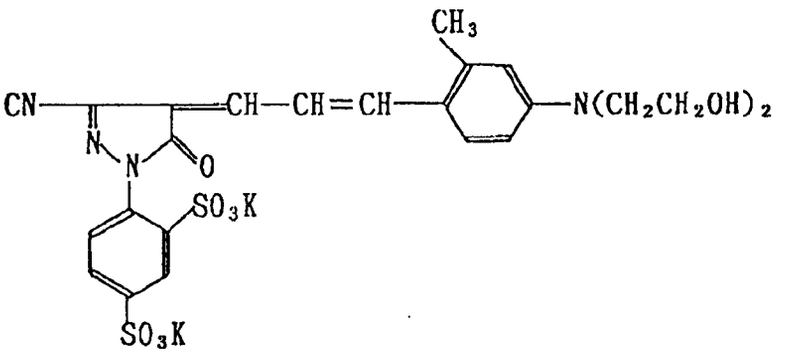
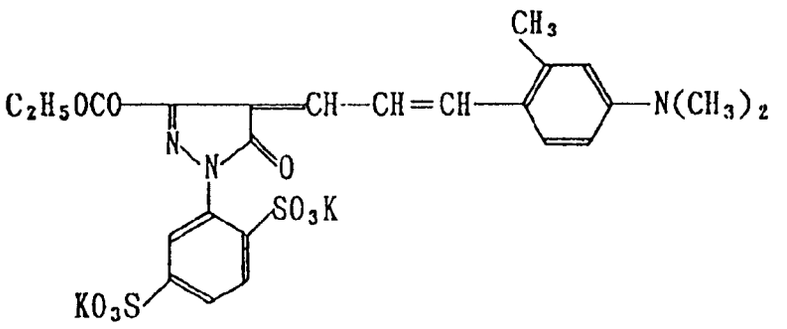


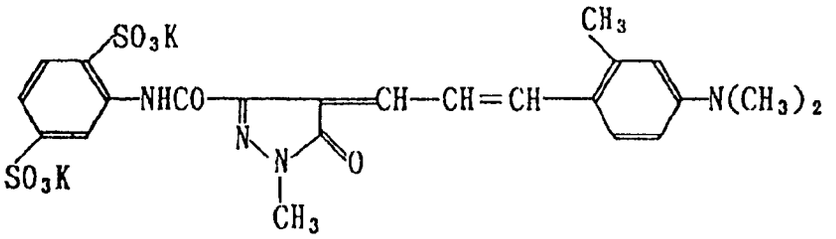
V − 2



V − 3



V－4



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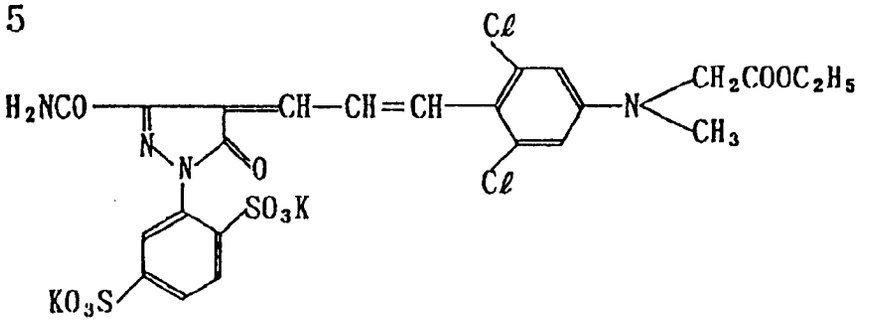

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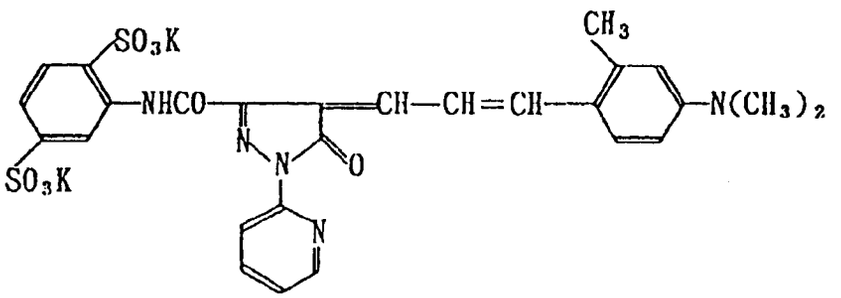

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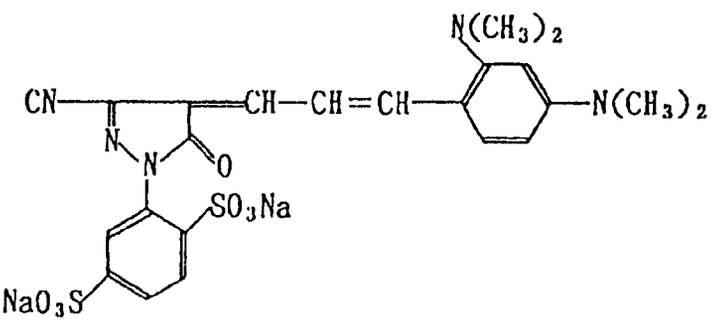

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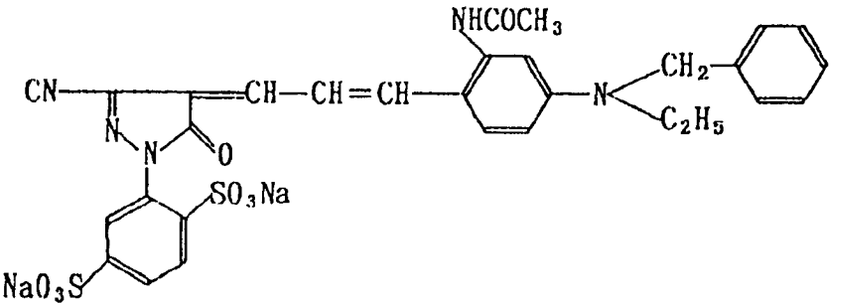

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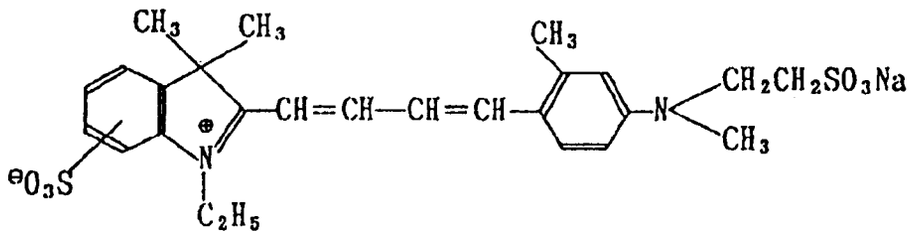
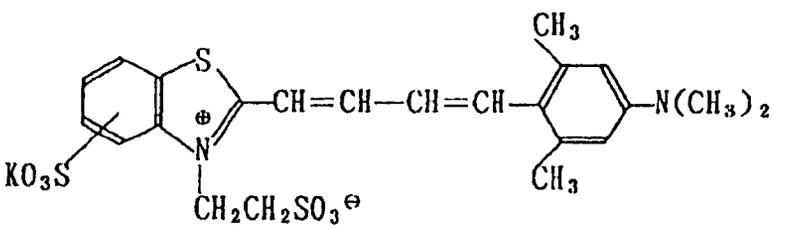
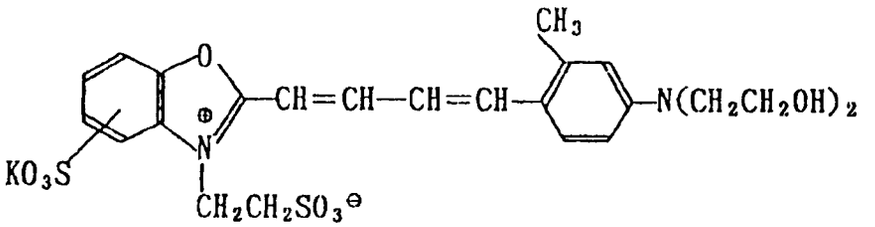


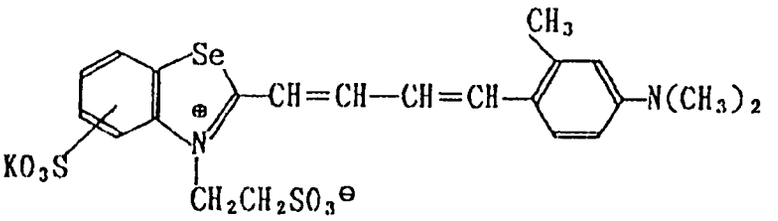
VI－2



VI－3



VI－4



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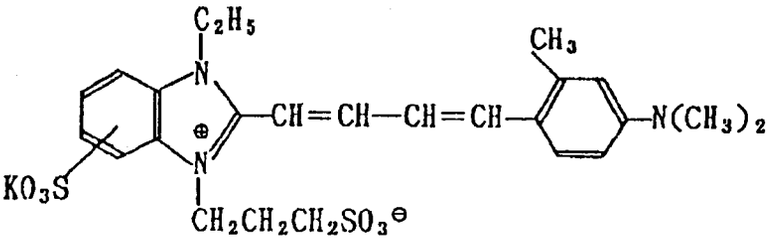

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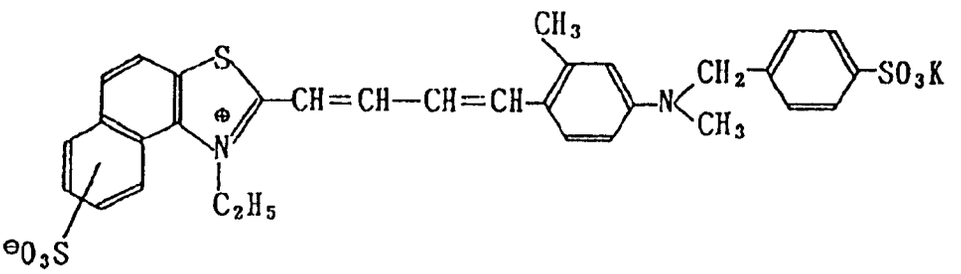

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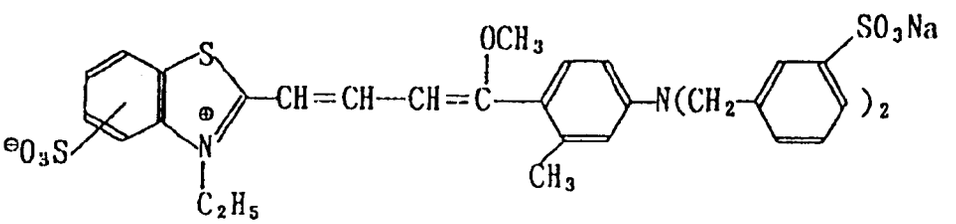

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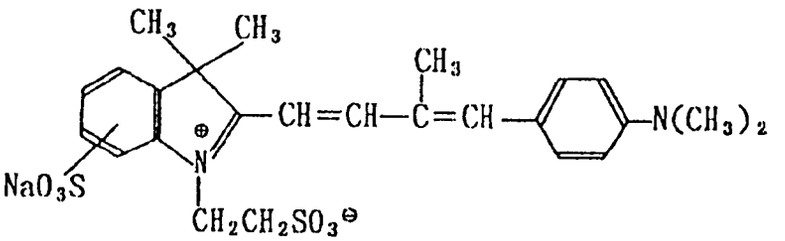

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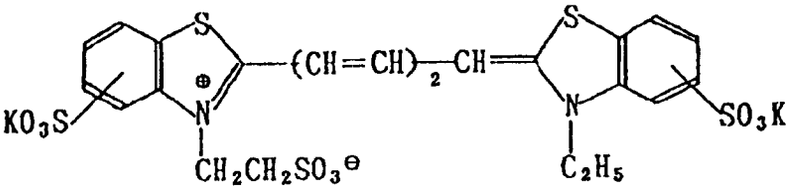
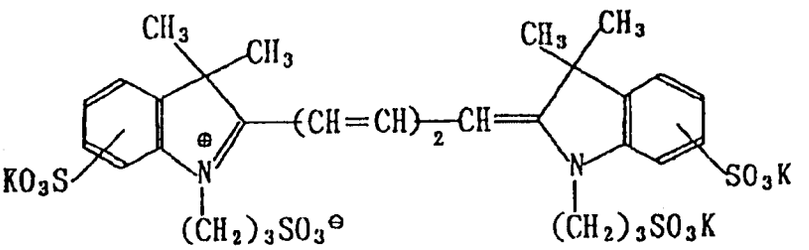


VII－2



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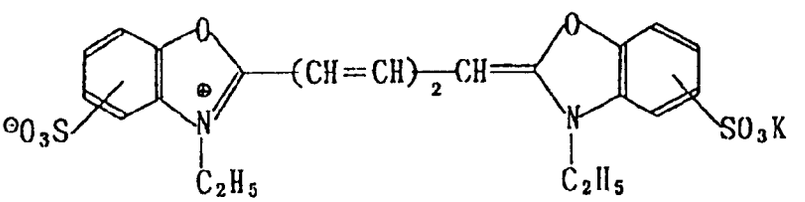
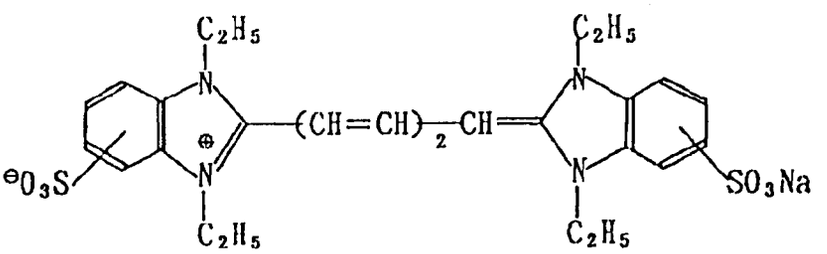


VII－4



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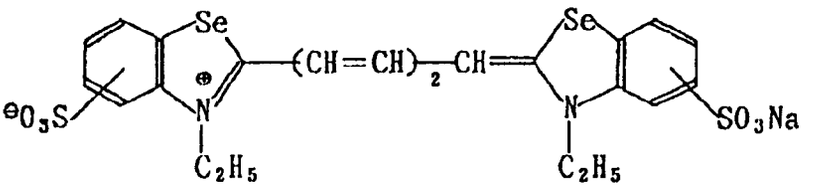

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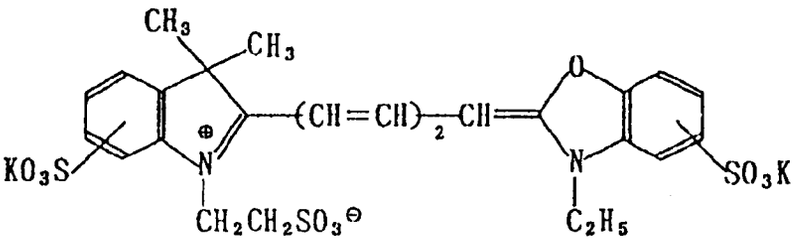
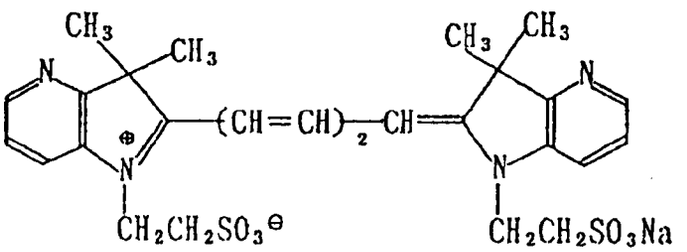
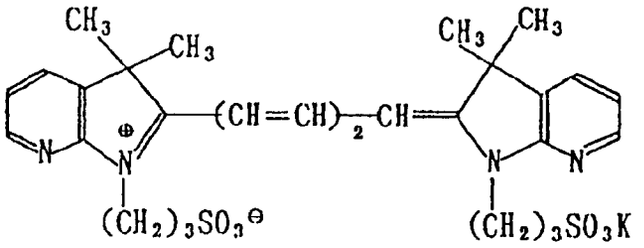


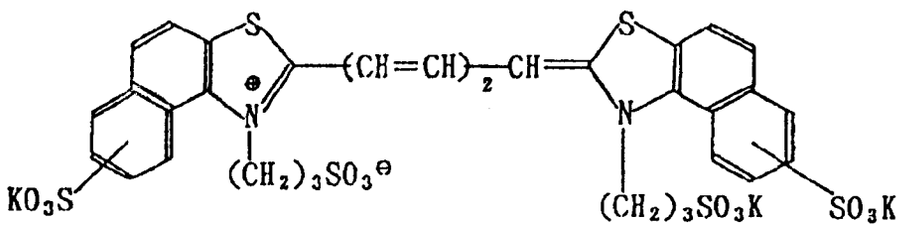
VII－7



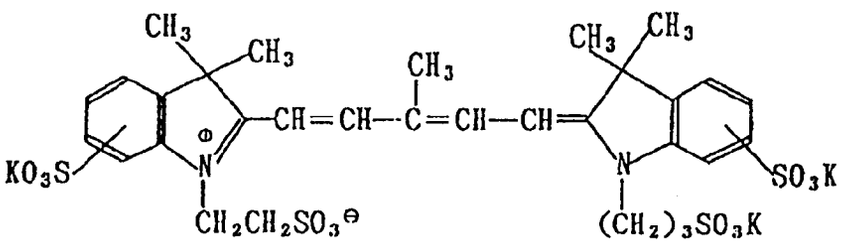
VII－8



VII－9



VII－10



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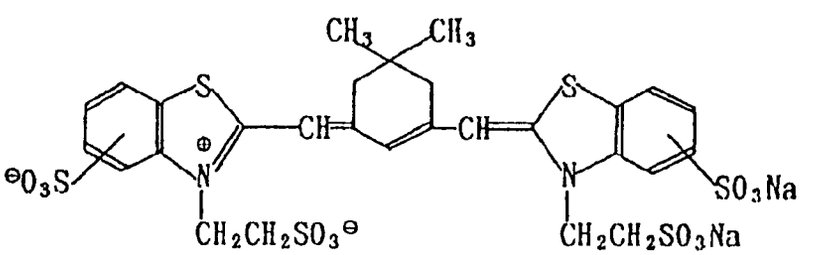
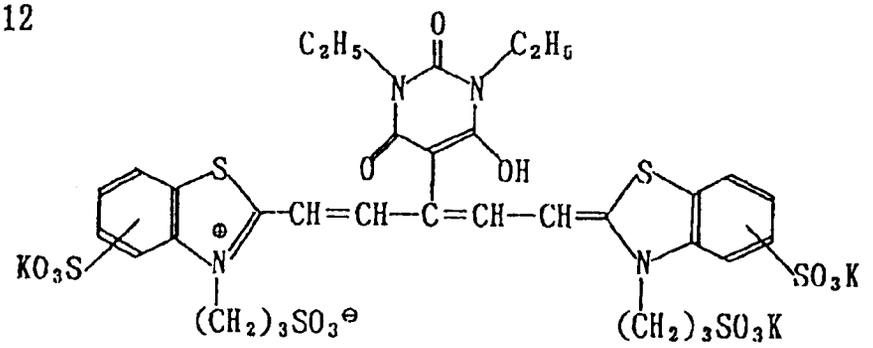
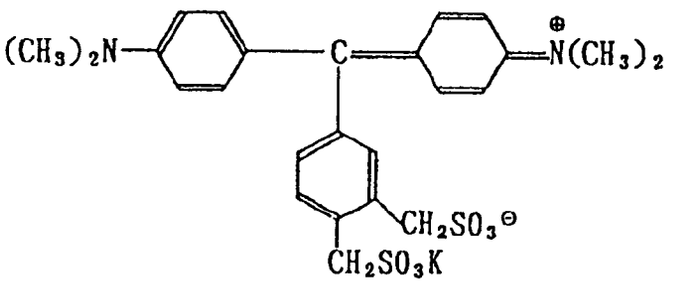


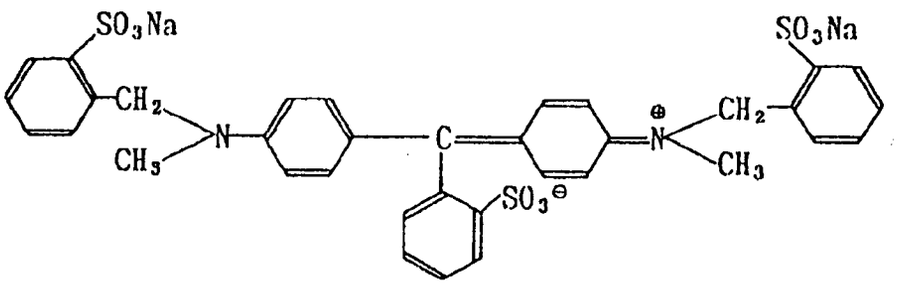
VII－12



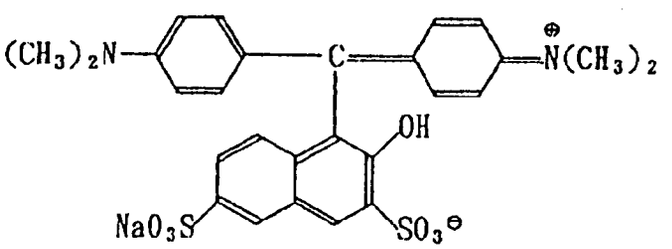
VII－1



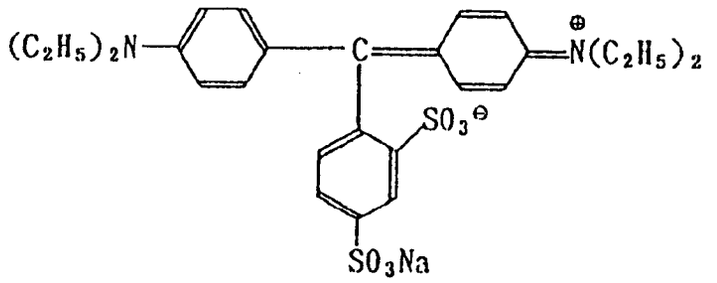
VII－2



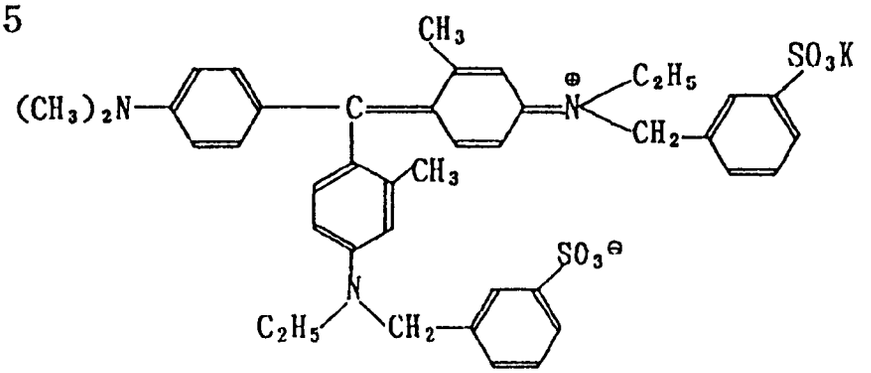
VII－3



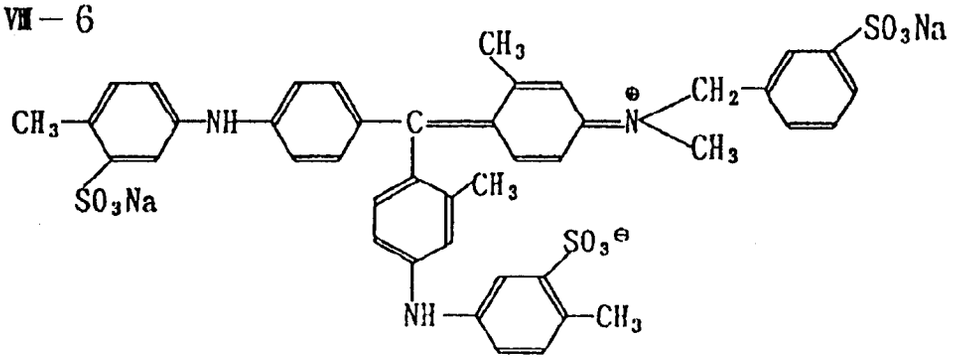
VII – 4



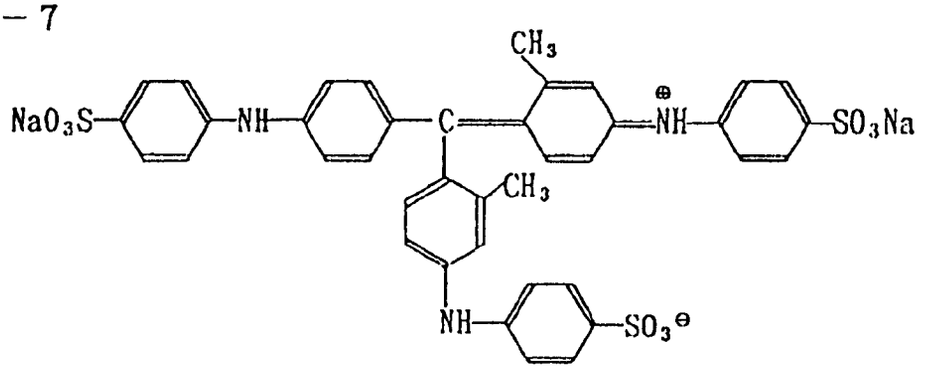
VII – 5



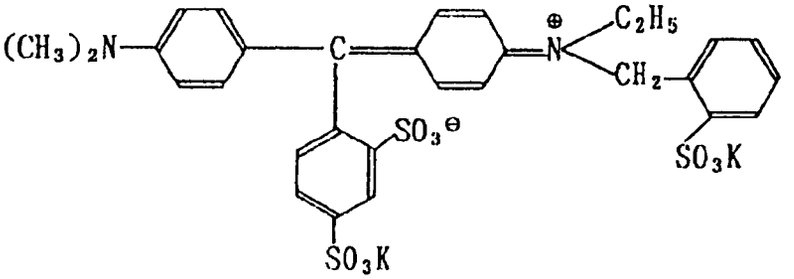
VII – 6



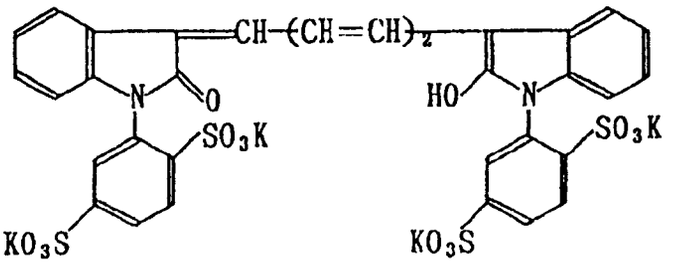
VII – 7



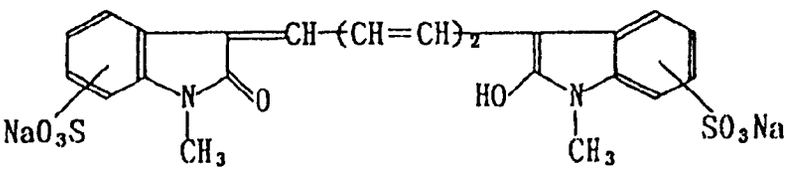
VIII－8



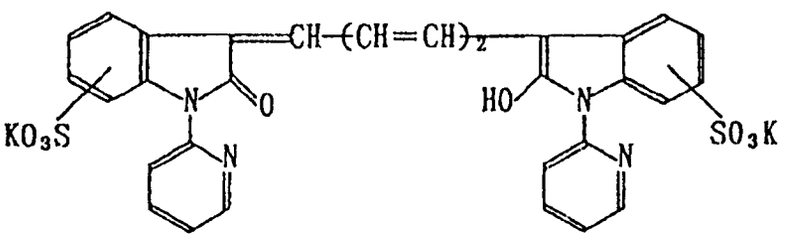
IX－1



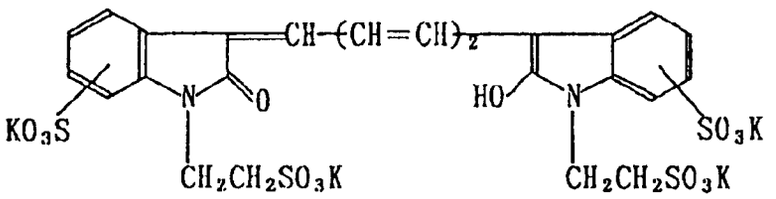
IX－2



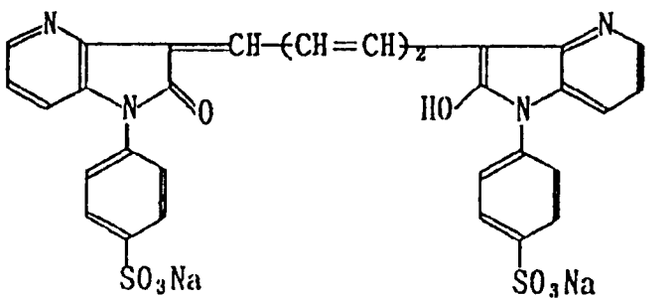
IX－3



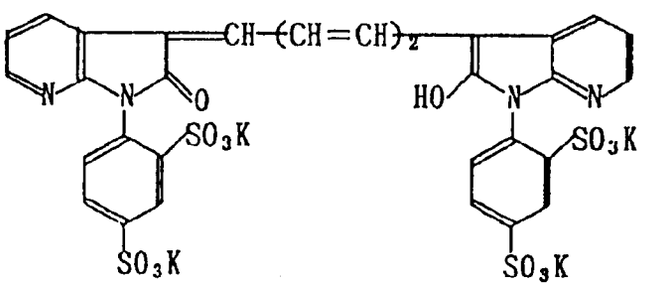
IX－4



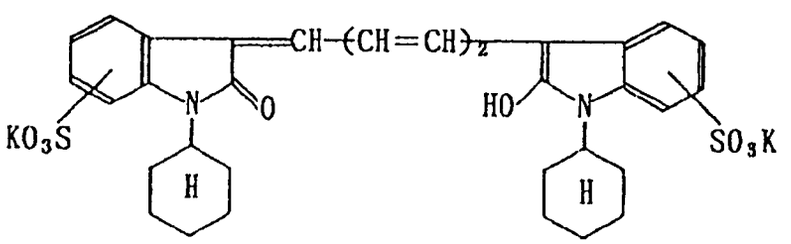
IX－5



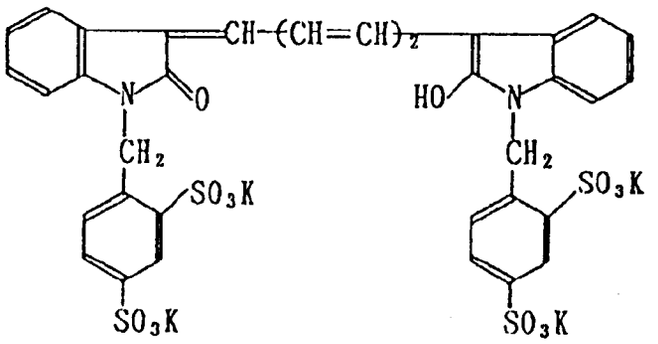
IX－6



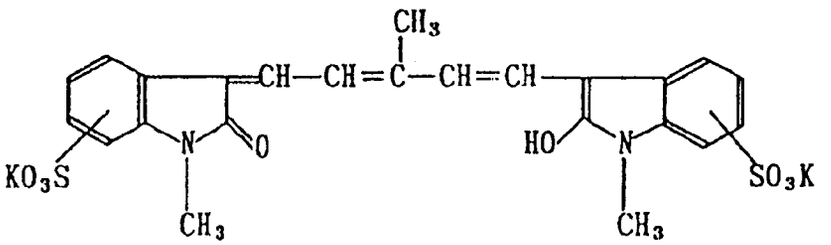
IX－7



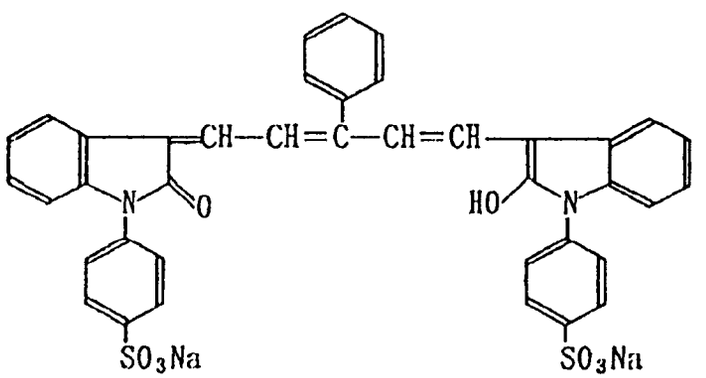
IX－8



IX－9



IX－10



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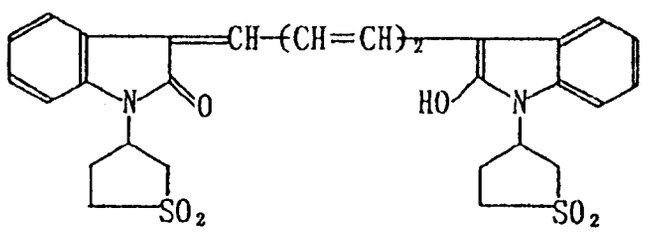

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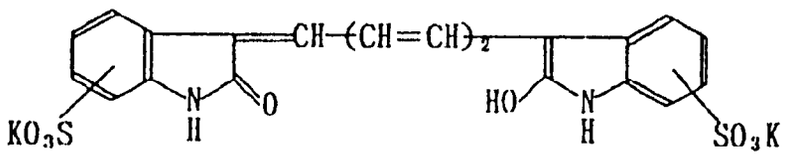

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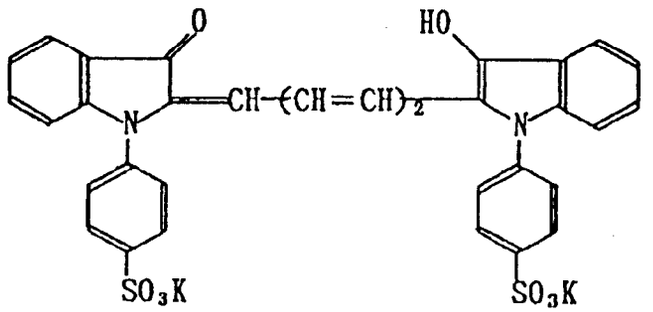

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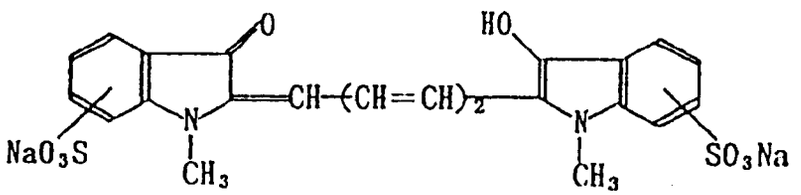

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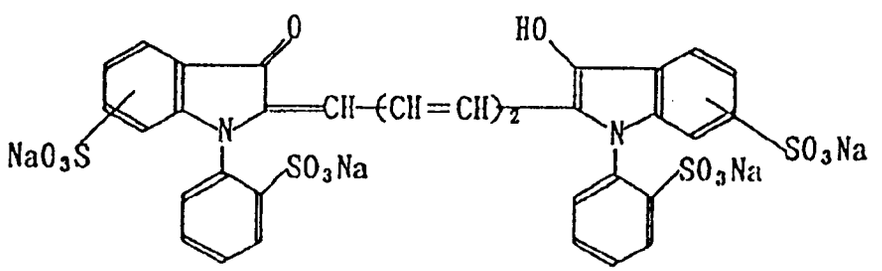

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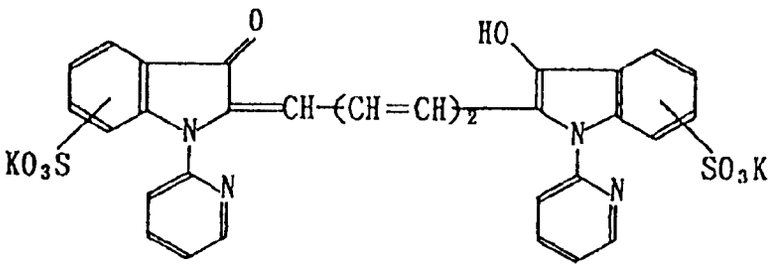

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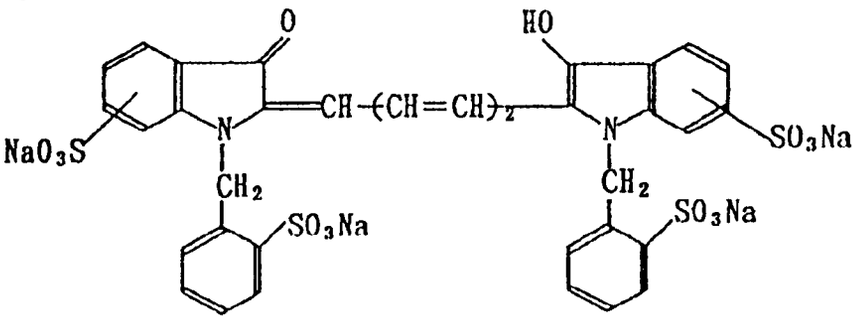

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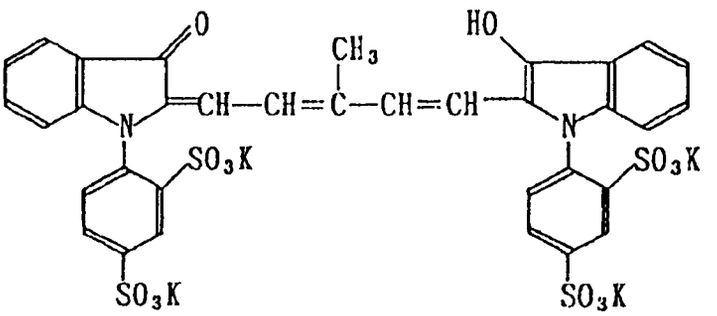

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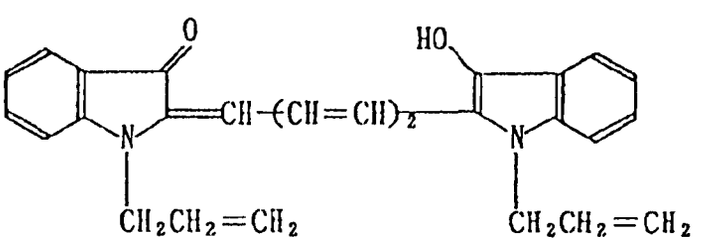

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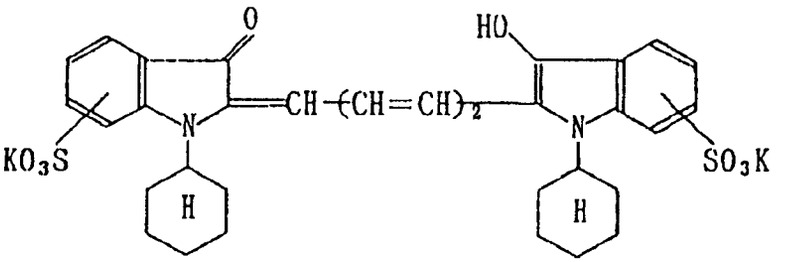

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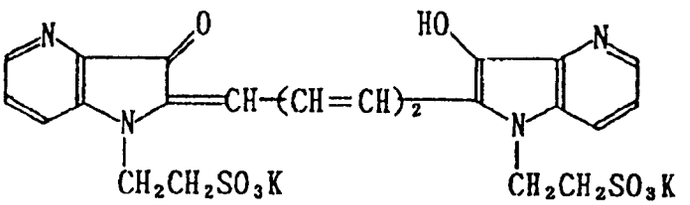

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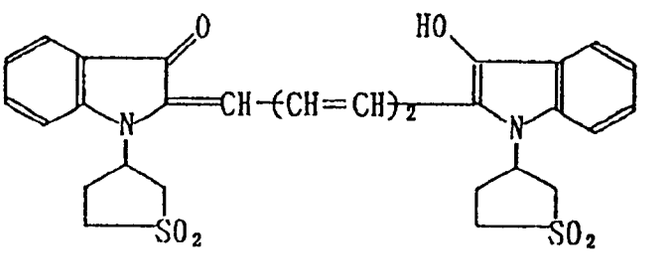

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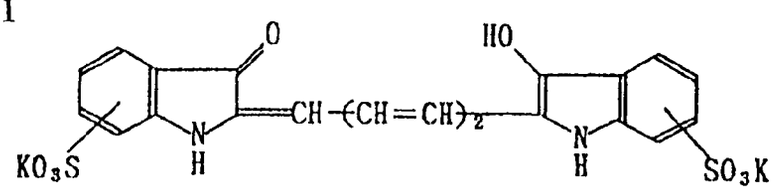

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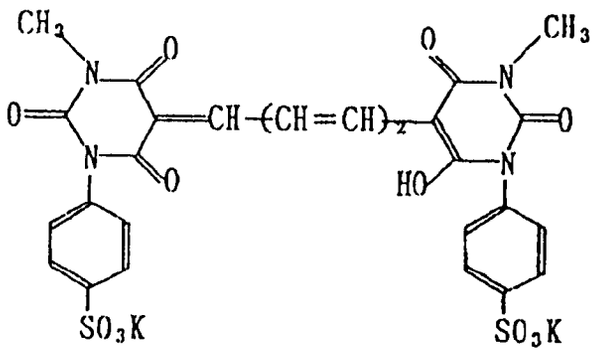

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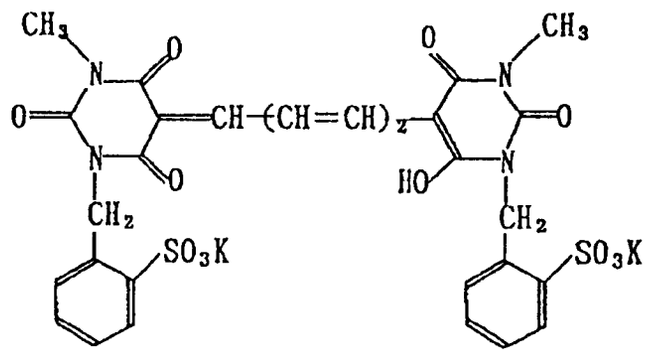

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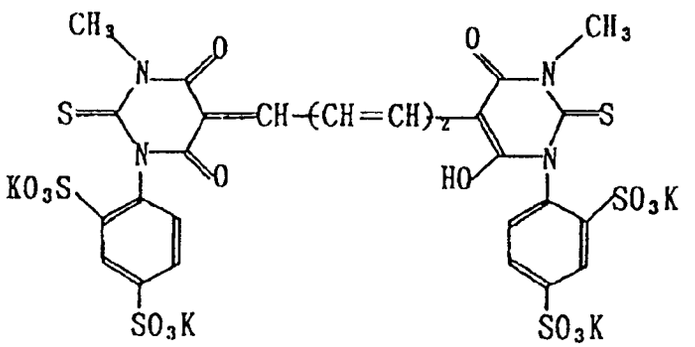

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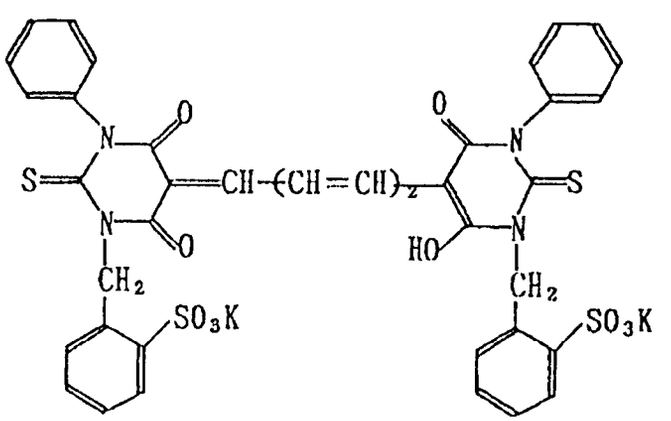

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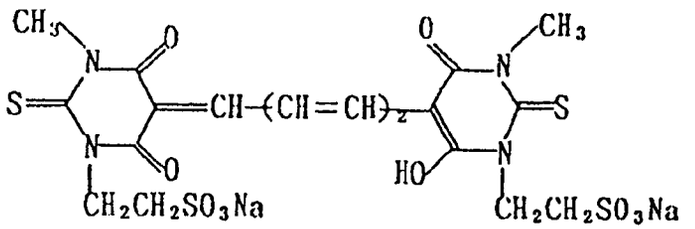

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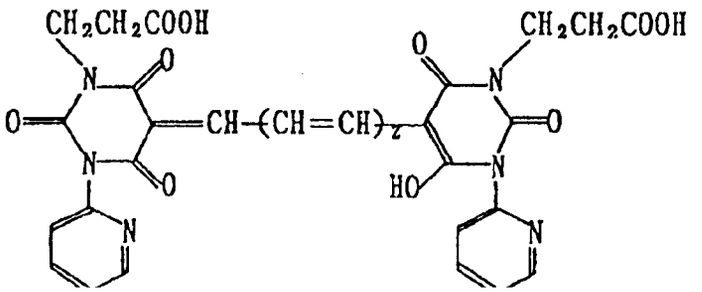

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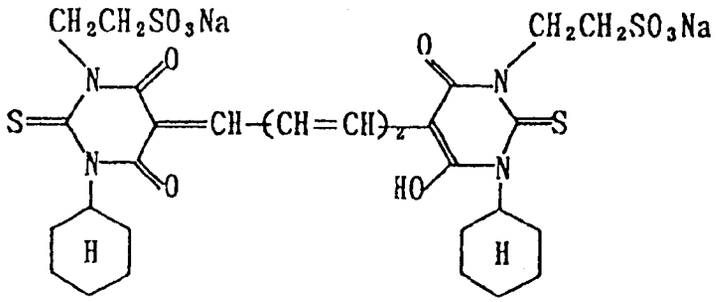

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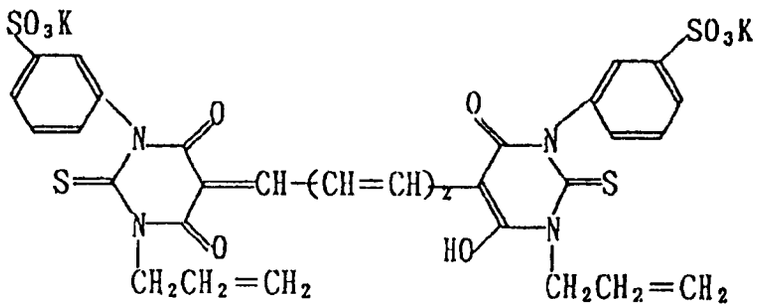

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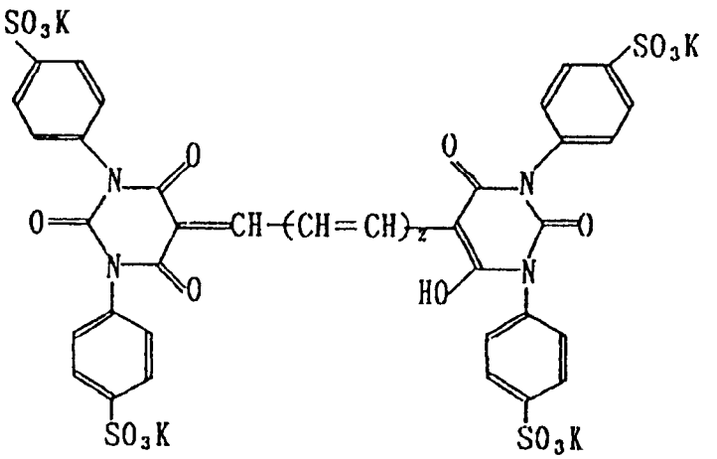

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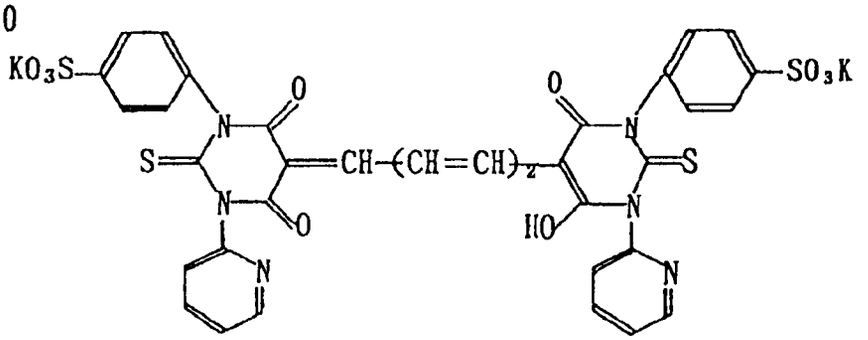

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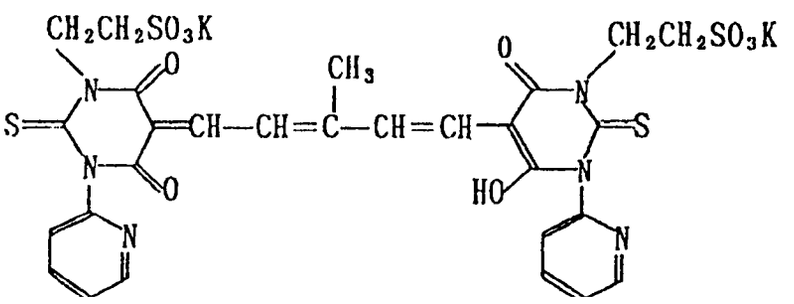

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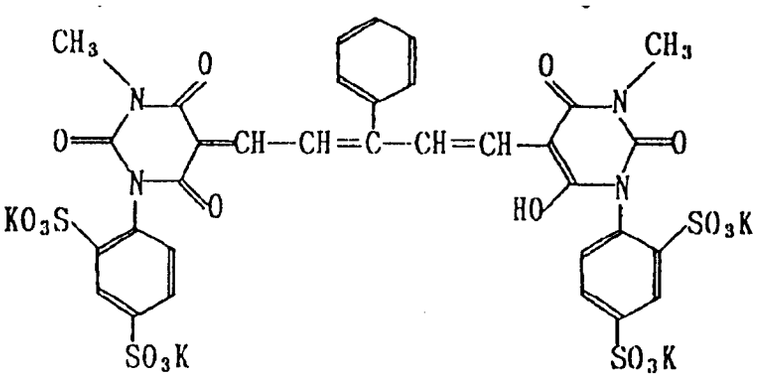

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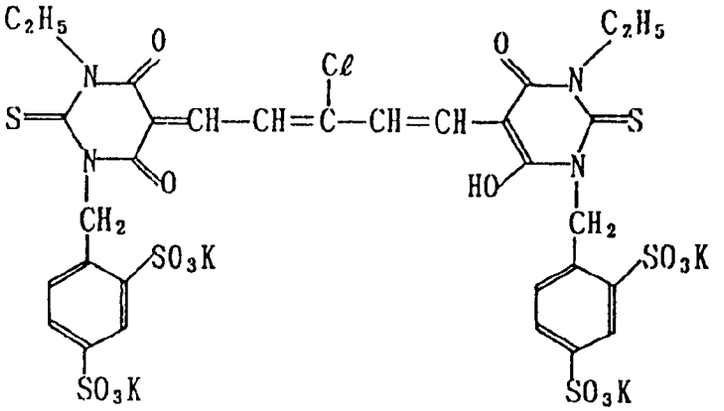

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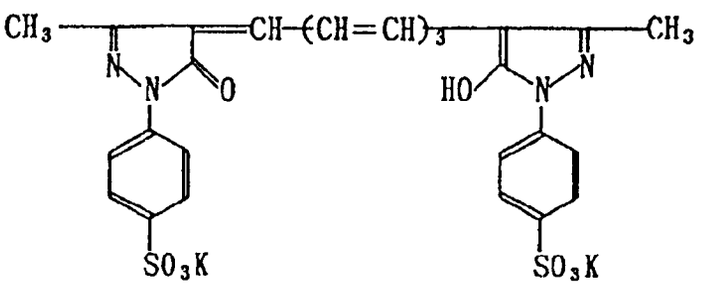

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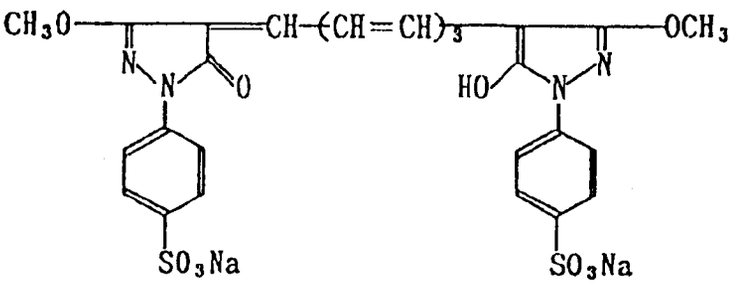

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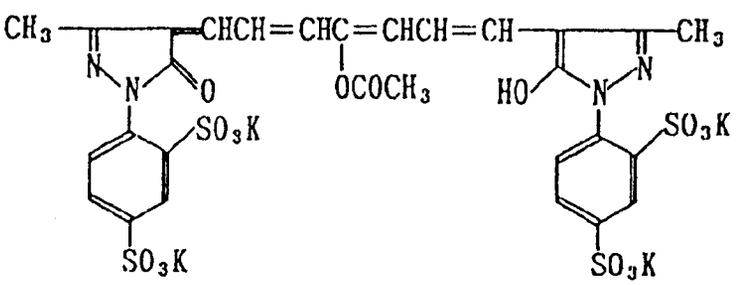

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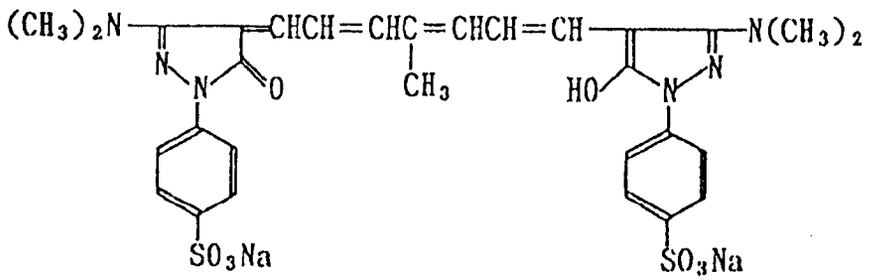

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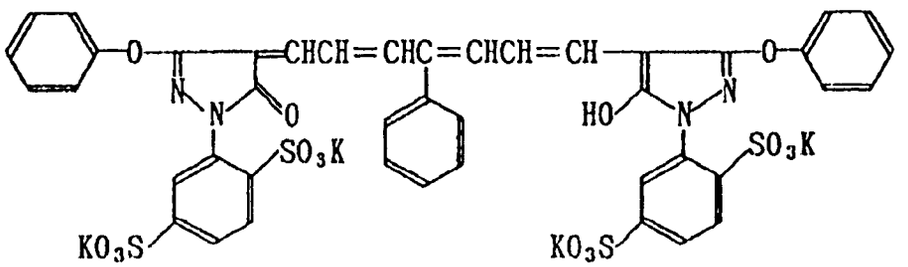

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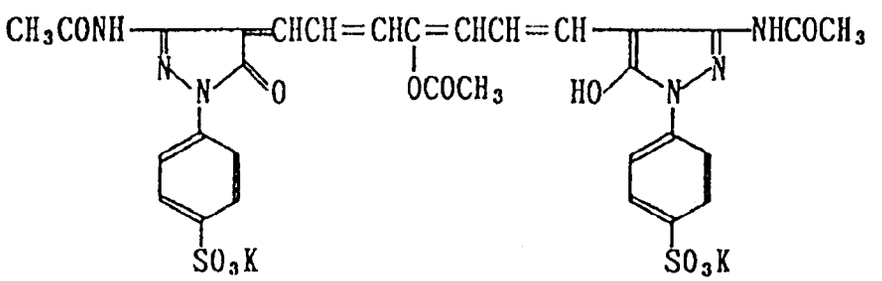

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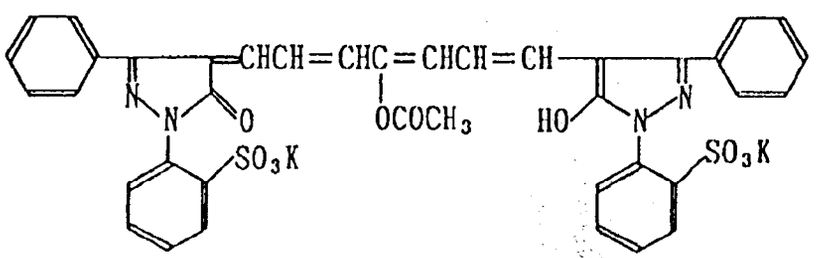

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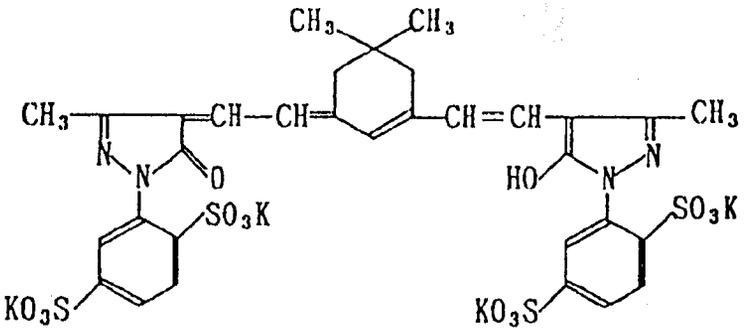

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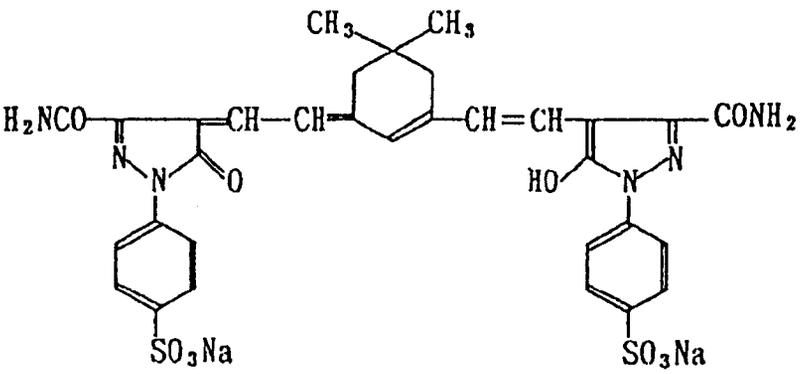

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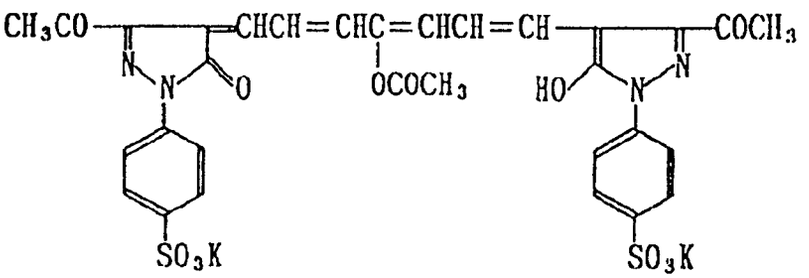

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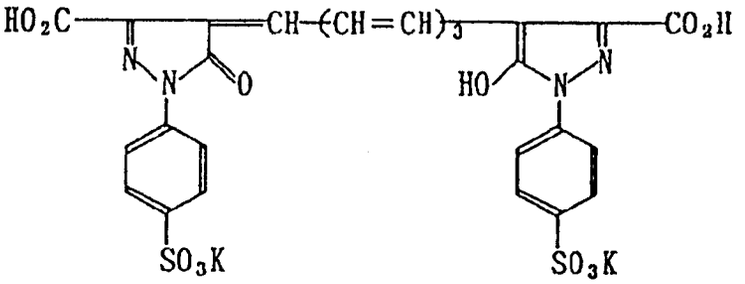

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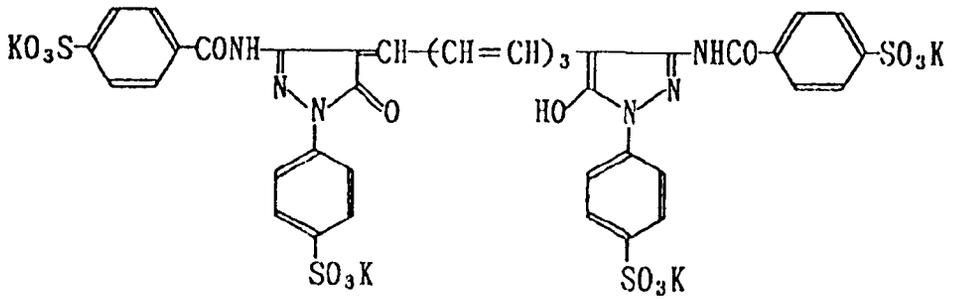

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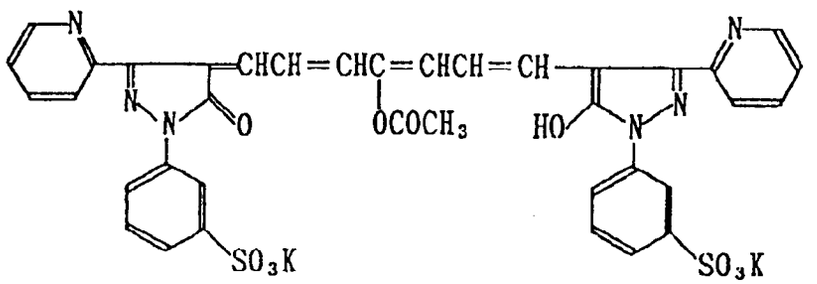

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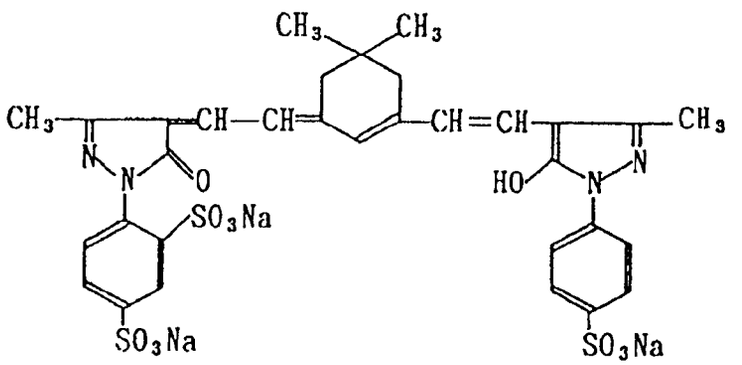
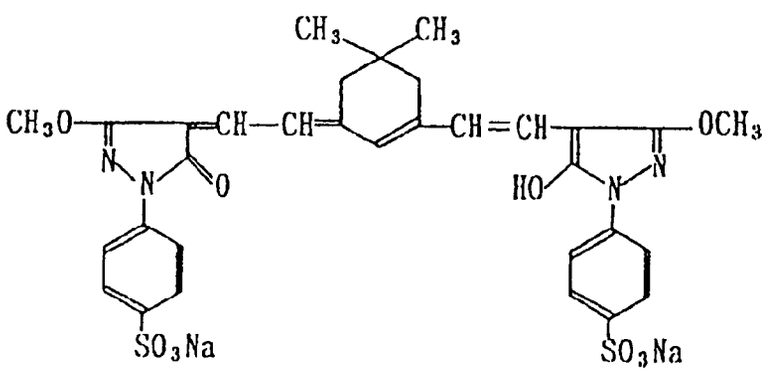
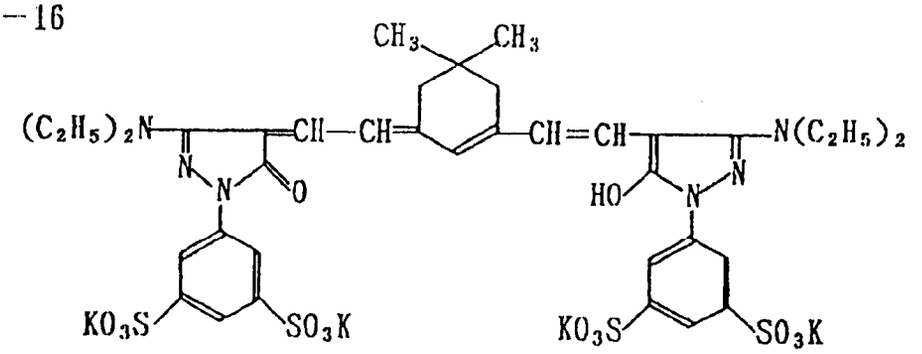


XII－15



XII－16



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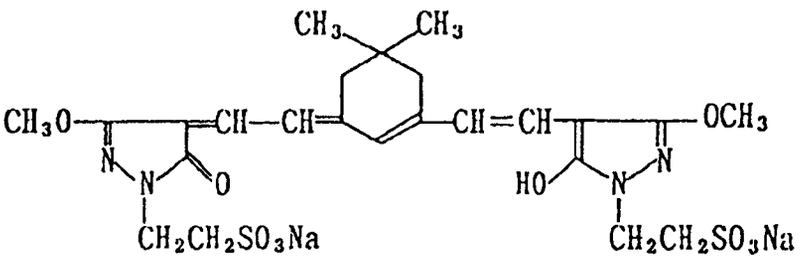

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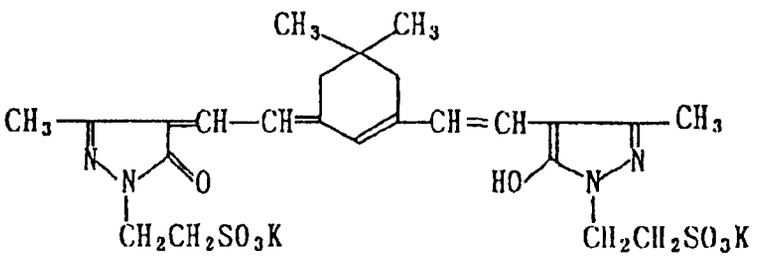
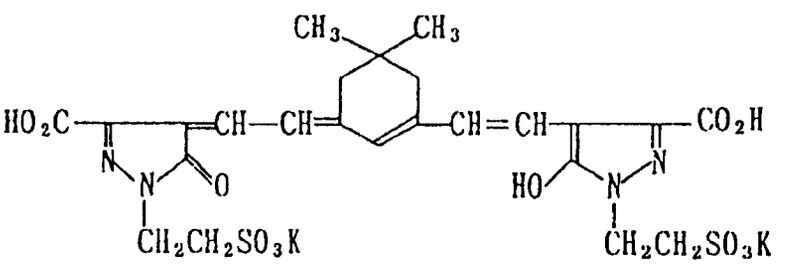
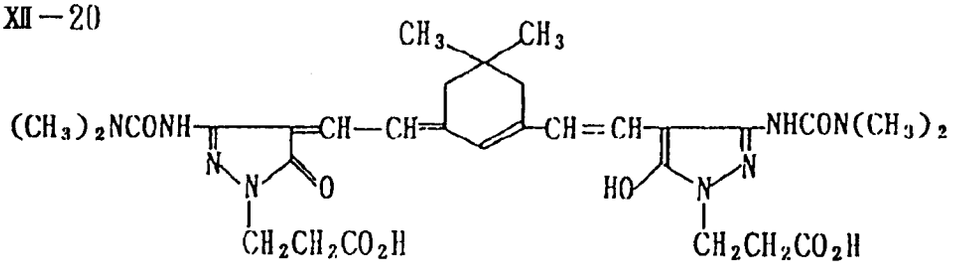


XII－19



XII－20



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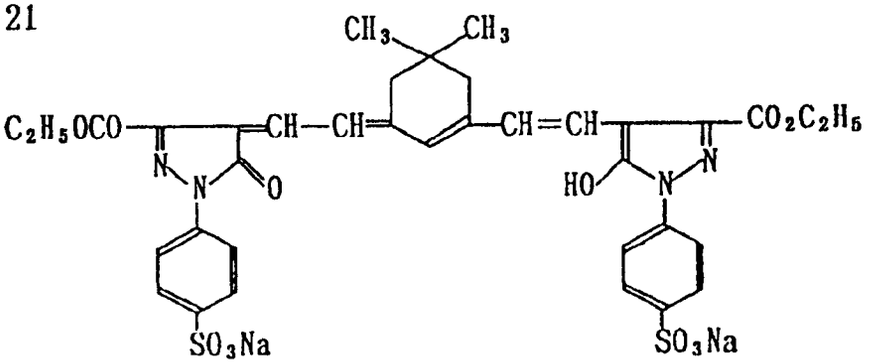

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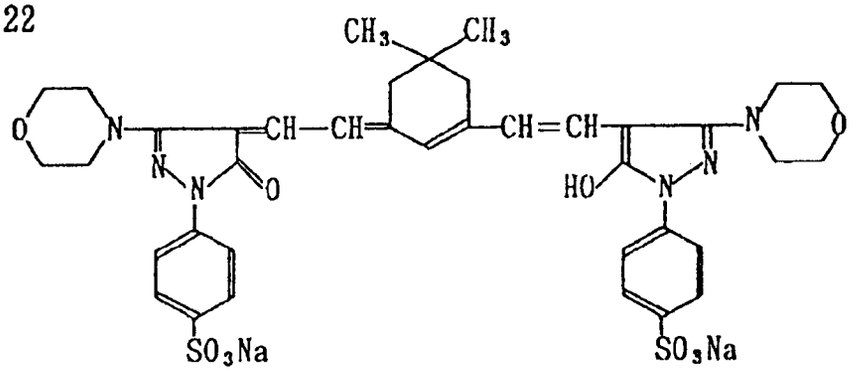

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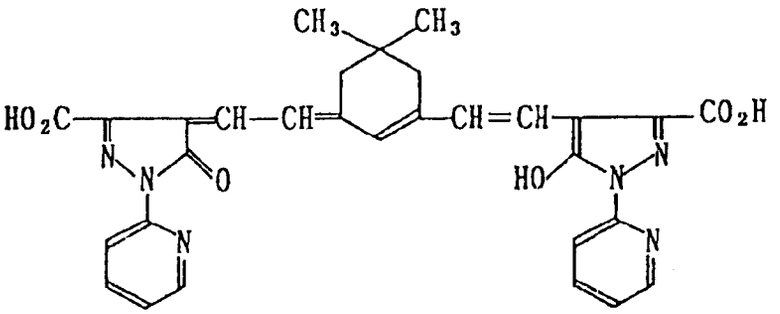
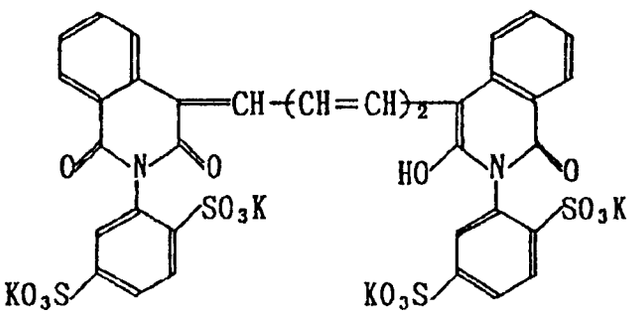
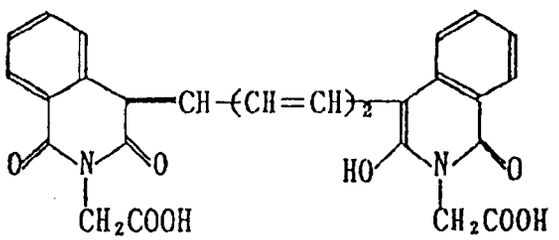


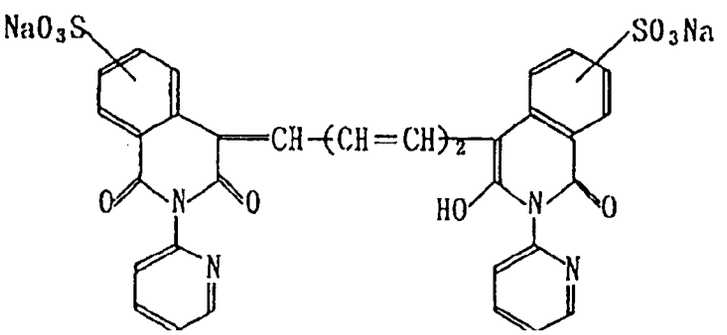
XIII－1



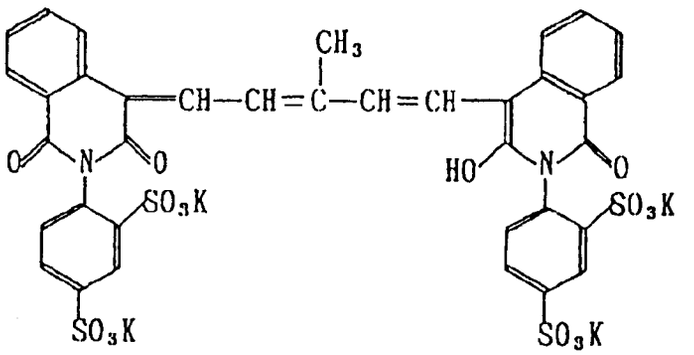
XIII－2



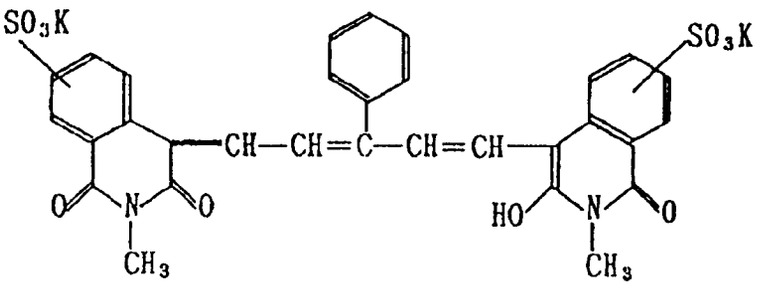
XIII－3



XIII－4



XIII－5



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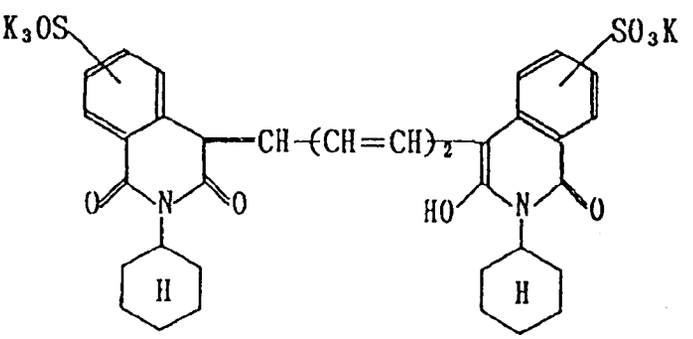

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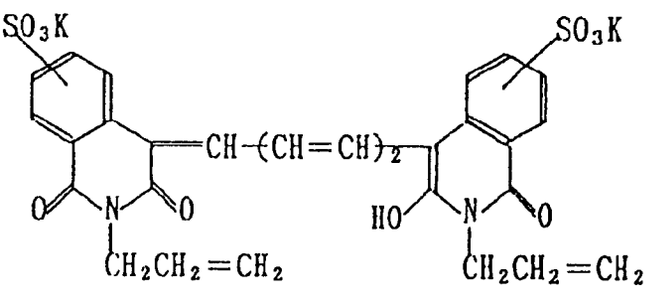

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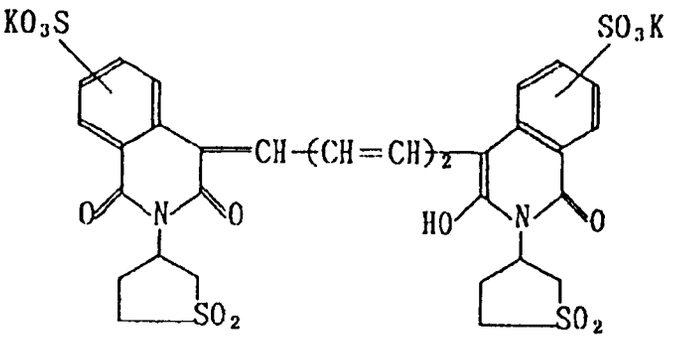

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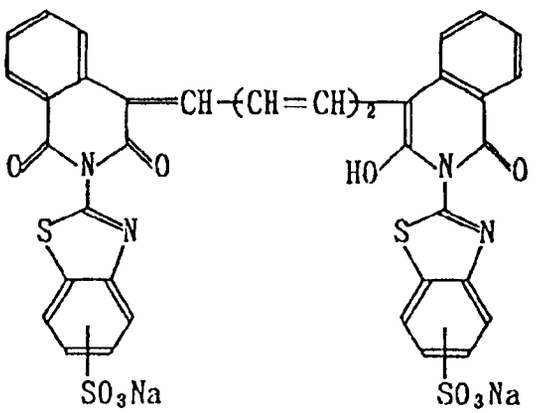
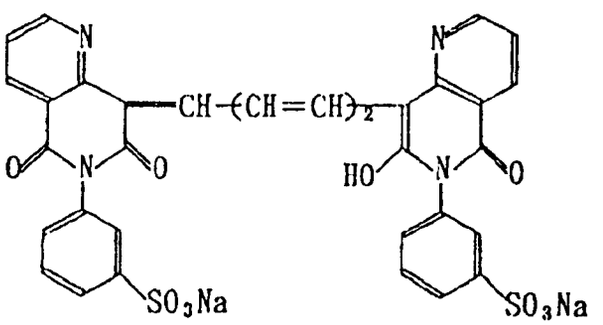
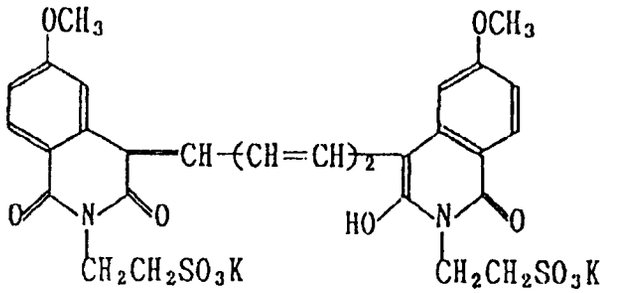


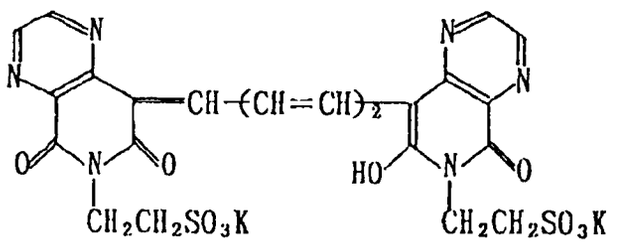
XIII－10



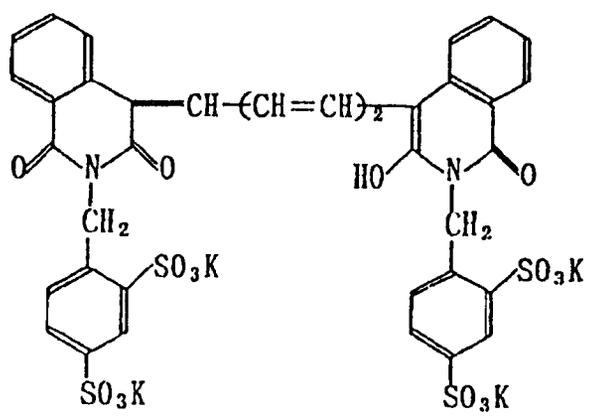
XIII－11



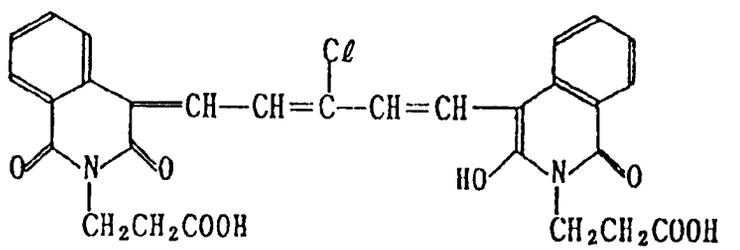
XIII－12



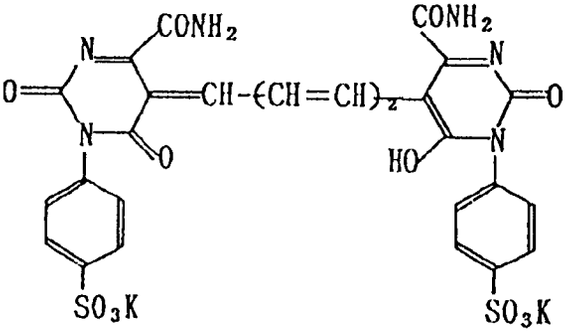
XIII－13



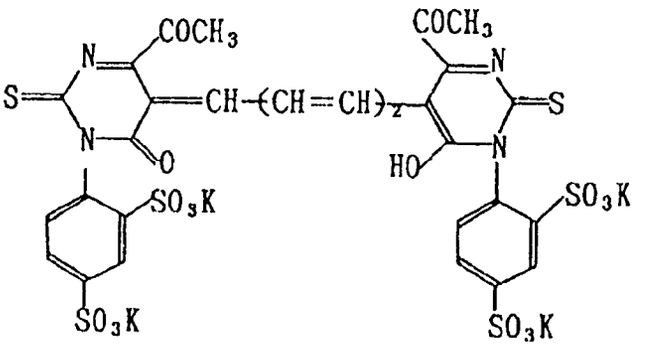
XIII－14



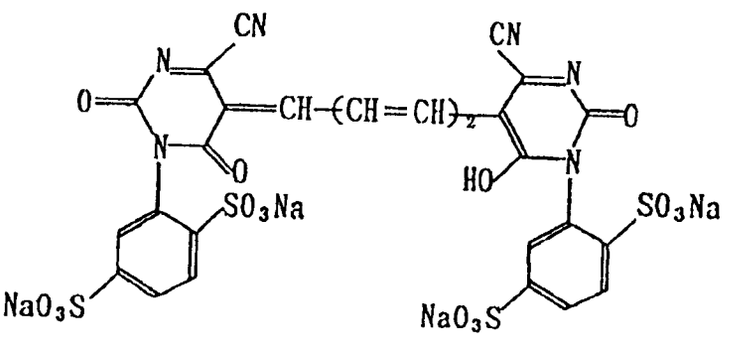
XIV－1



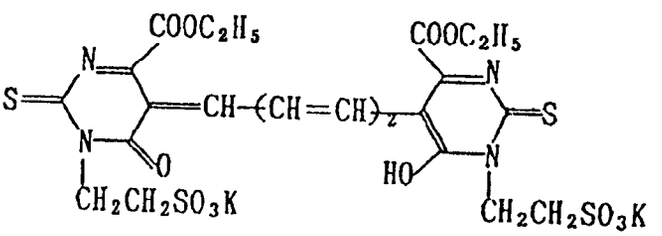
XIV－2



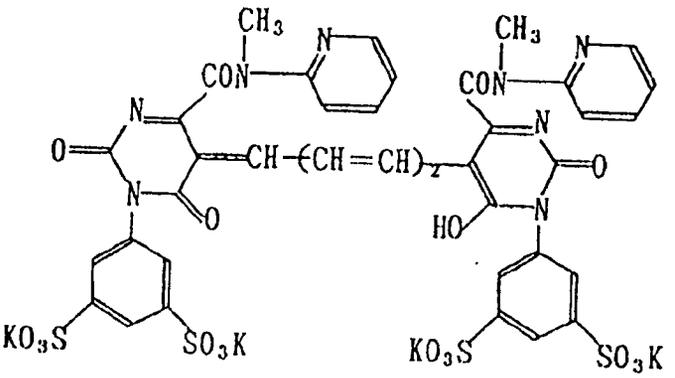
XIV－3



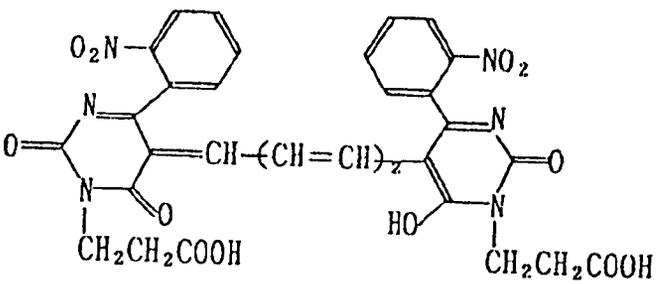
XIV－4



XIV－5



XIV－6



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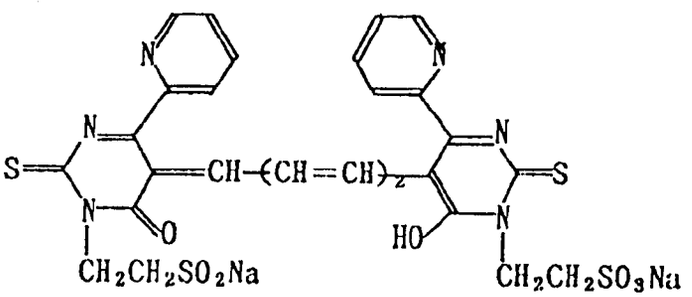

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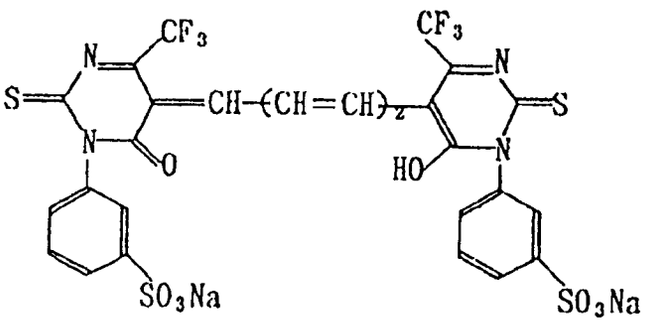

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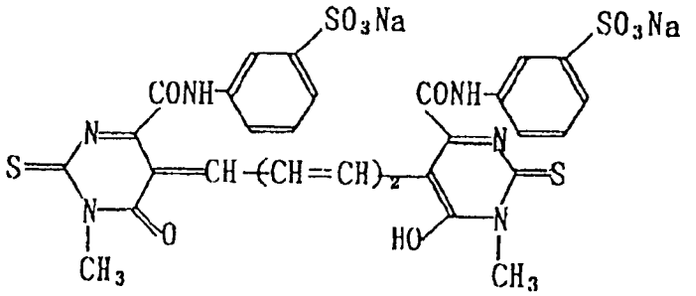

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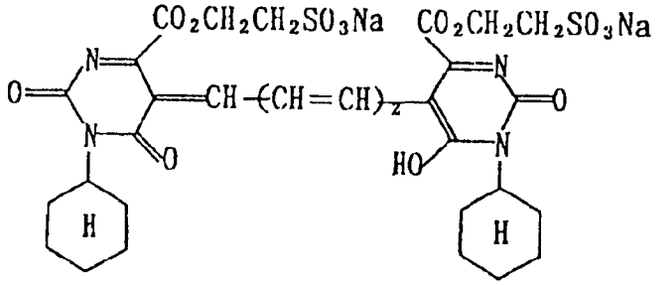

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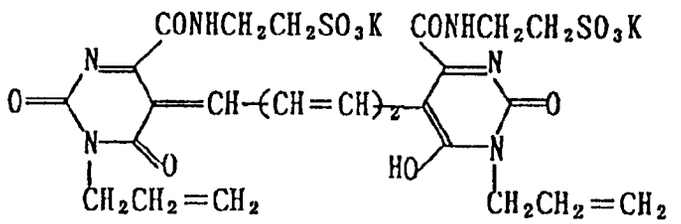

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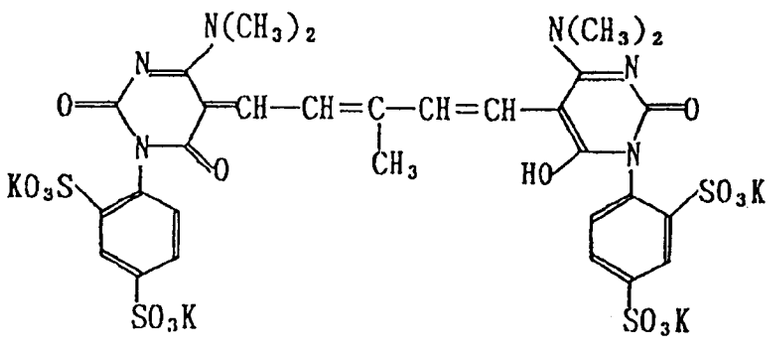
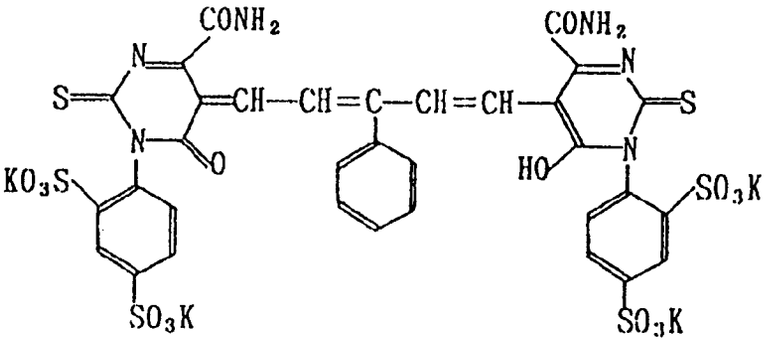
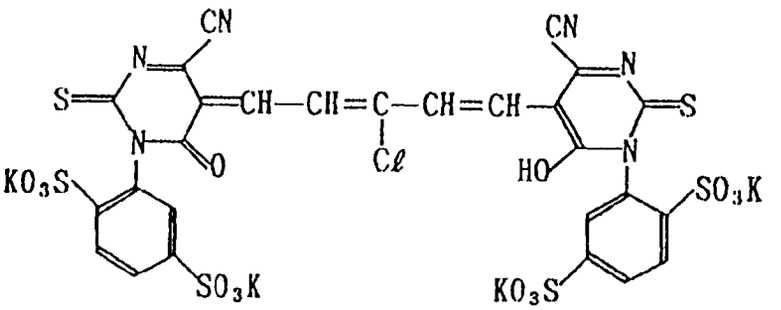


XIV－13



XIV－14



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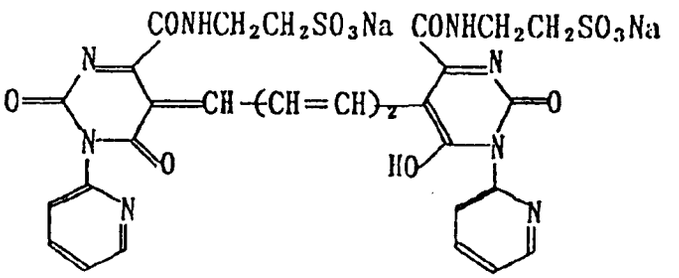

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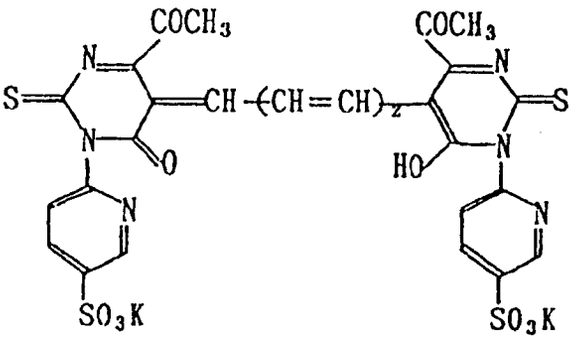

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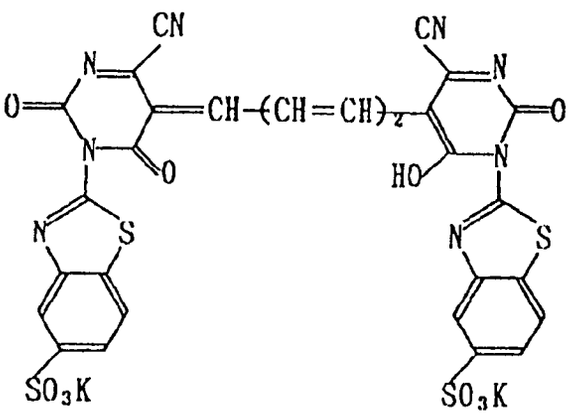

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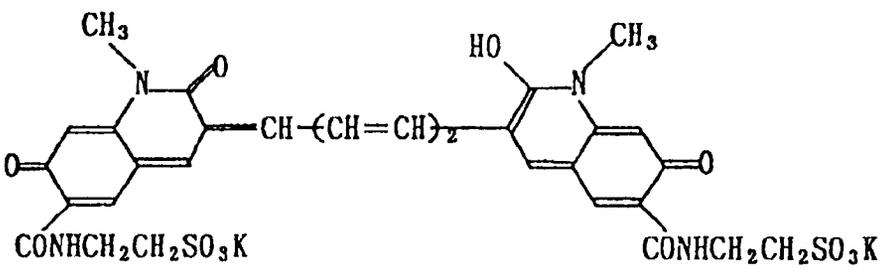

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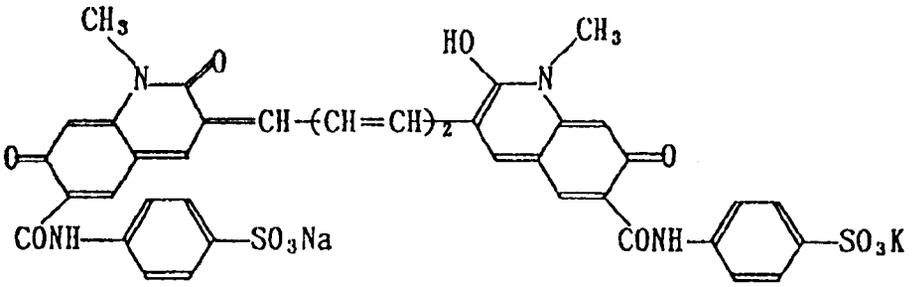
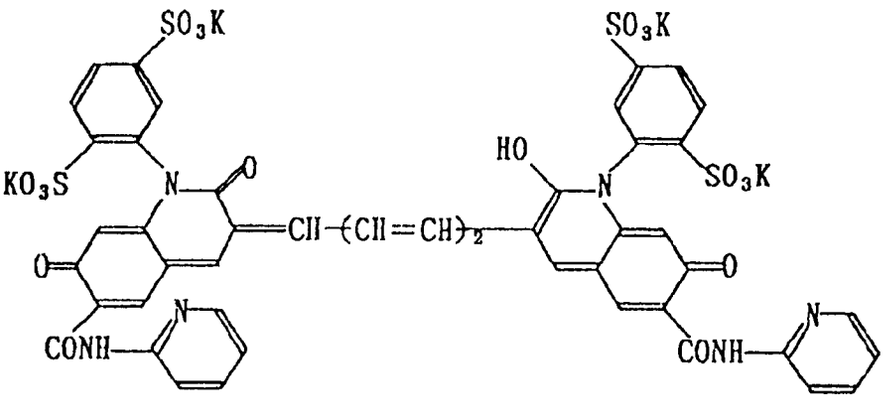


XV－3



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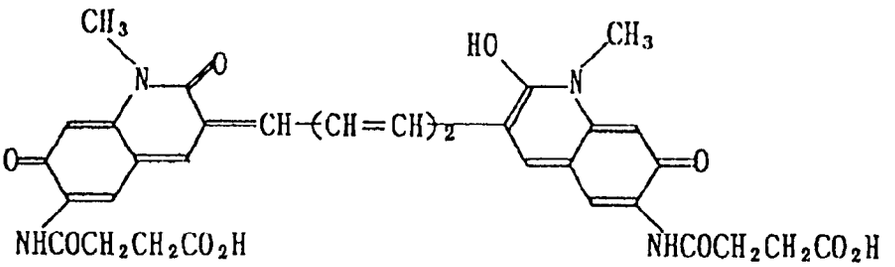

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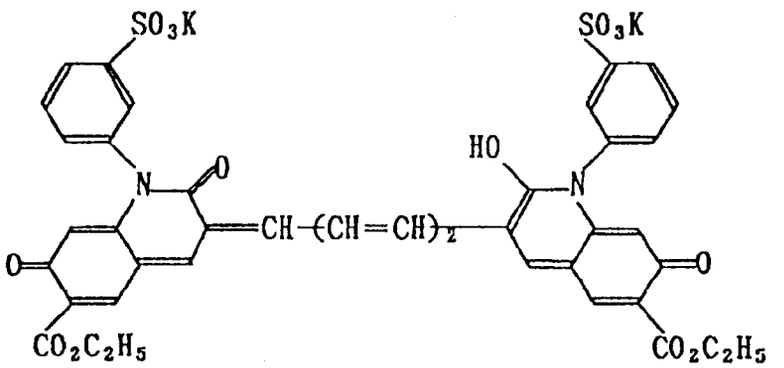

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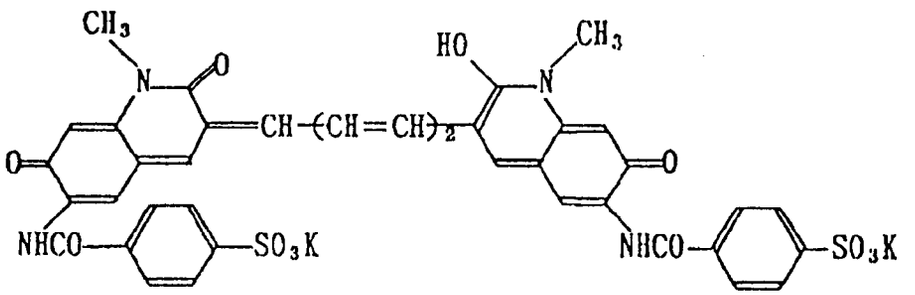

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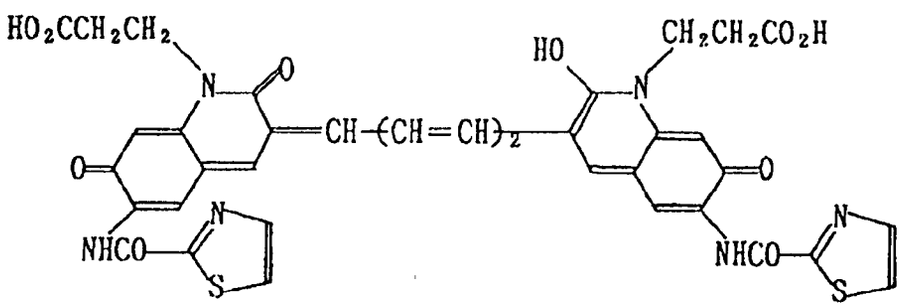

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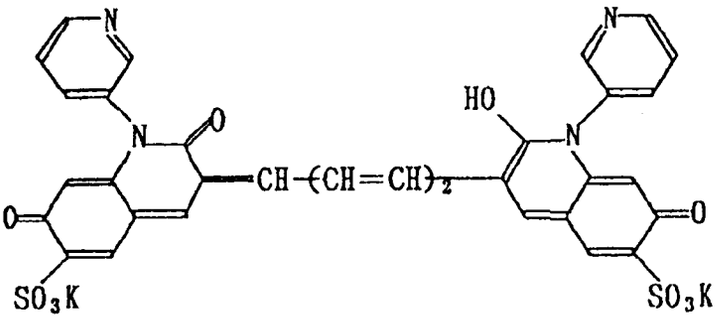

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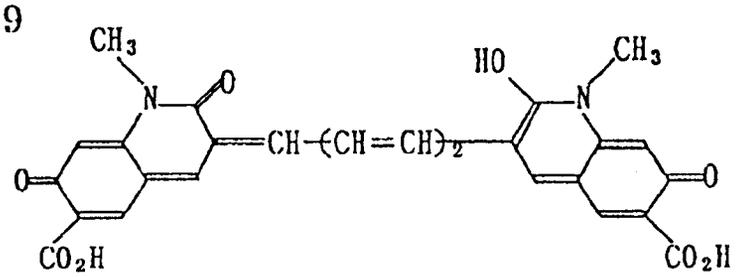

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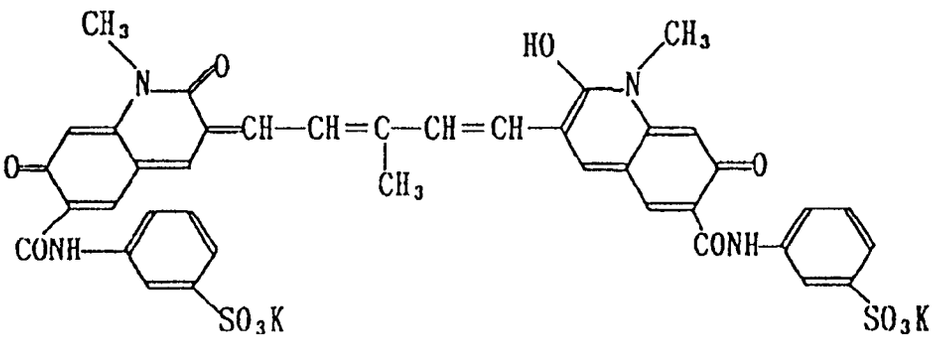

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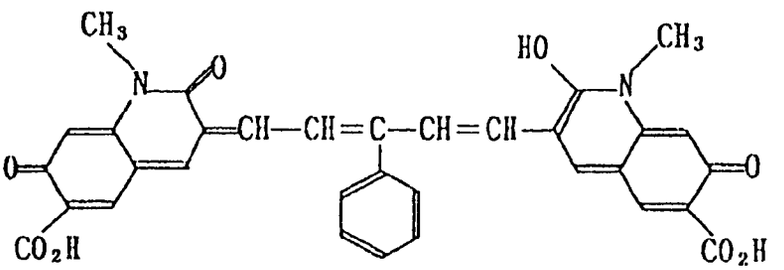
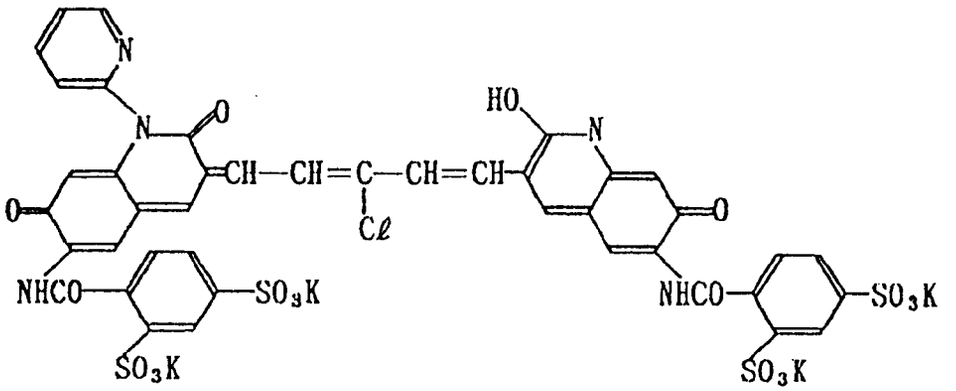
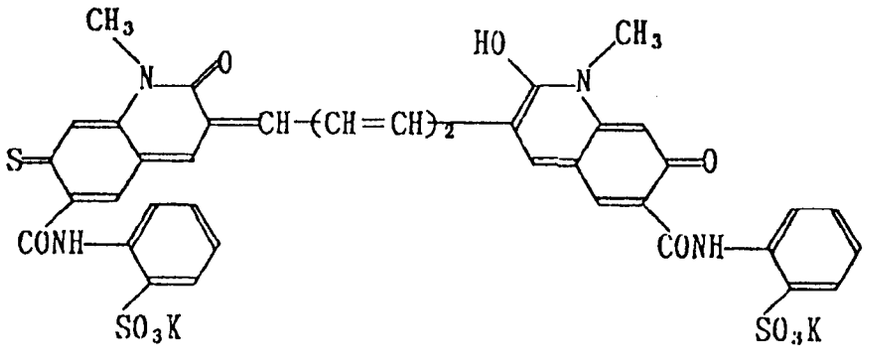


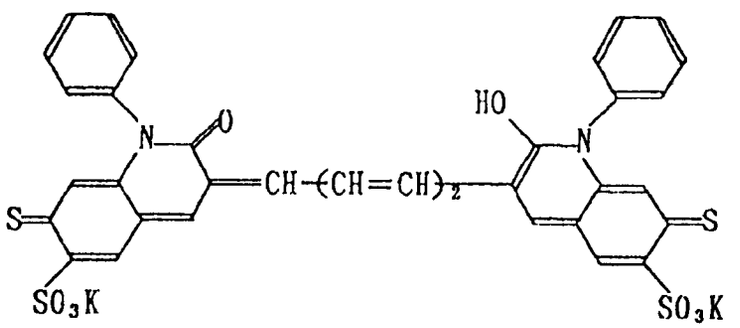
XV-12



XV-13



XV-14



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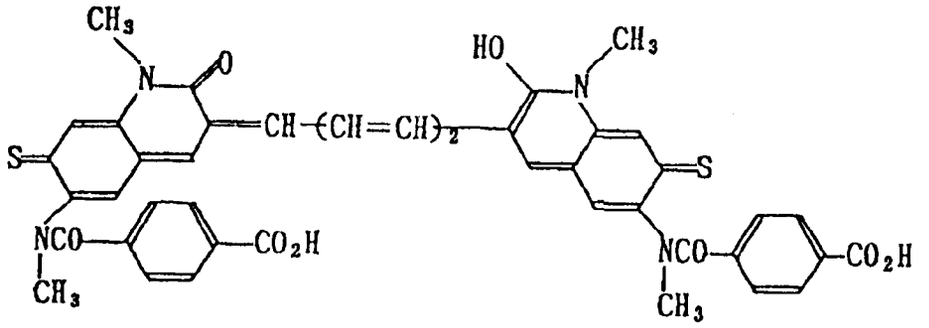
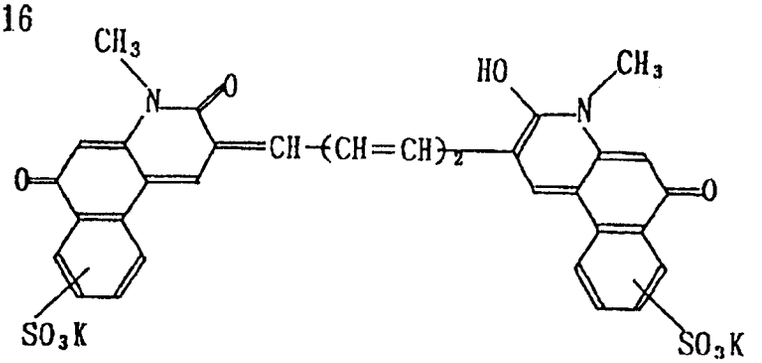
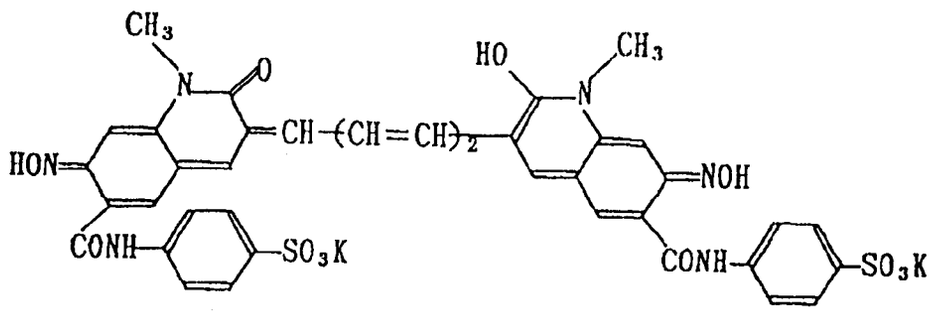


XV−16



XV−17



The first dye of the invention is characterized in that it has an absorption maxima, as measured when contained in a gelatin film, at 630 to 680 nm, preferably 640 to 670 nm. The second dye of the invention is characterized in that it has an absorption maxima, as measured when contained in a gelatin film, at 680 to 750 nm, preferably 690 to 740 nm.

It is preferred that the maximum absorption wavelength of the second dye should be longer than that of the first dye by 20 to 100 nm.

The dyes of the invention are contained in a silver halide emulsion layer or in a hydrophilic colloidal layer other than the emulsion layer. Good results can be obtained when these dyes are contained in a layer adjacent to a red-sensitive emulsion layer. If the dyes are diffusible, good results can also be obtained even when they

are added to a layer far away from a red-sensitive layer (e.g. an intermediate layer, a protective layer).

The amounts of the dyes are not limitative, but preferably 1 to 200 mg/m^2 for the first dye, and 3 to 100 mg/m^2 for the second dye.

The first and second dyes may be added either simultaneously or at an interval. They may be added in the form of two different solutions or dispersions, or in the form of a mixture.

The amount ratio of the first dye to the second dye is not limitative, but preferably 1:10 to 5:1.

The dyes of the invention are contained in a silver halide emulsion layer or in a hydrophilic colloidal layer other than the emulsion layer by the following method: A dye or its organic or inorganic salt is dissolved in an aqueous solution or an organic solvent (e.g. alcohols, glycols, cellosolves, dimethylformamide, dibutyl phthalate, tricresyl phosphate), and emulsified, if necessary. The resultant is added to a coating composition.

Silver halides usable in the invention include silver iodide, silver iodobromide, silver iodochloride, silver bromide, silver chlorobromide and silver chloride, which have been widely employed in the photographic industry. It is preferable to use silver halide grains having a silver chloride content of 95 mo% or more, a silver bromide content of 5 mol% or less and a silver iodide content of 0.5 mol% or less.

It is possible to employ two or more kinds of silver halide grain differing in halide composition.

If a silver halide emulsion layer comprises silver halide grains with a silver chloride content of 95 mol% or more, the amount of such grains accounts for 60 wt% or more, preferably 80 wt% or more, of the total amount of silver halide grains contained therein.

The halide composition of a silver halide grain may be uniform within the entire grain. Alternatively, the halide composition may change, either continuously or discontinuously, with the distance from the center of the grain.

The size of a silver halide grain is not limitative, but preferably 0.2 to 1.6 μm, still preferably 0.25 to 1.2 μm, for the attainment of rapid processing and improved sensitivity. Grain size measurement can be conducted by a known method, such as that described in Labrand: Grain Size Analysis Method (A.S.T.M. Symposium on Light Microscopy, 1955, pp. 94 to 122) or in Mees & James: Theory of Photographic Process (3rd ed., MacMillan Company, 966, Chapter 2).

A grain size can be measured by using the area of a projected image of a grain or the approximate value of a grain diameter. An accurate grain size distribution can be obtained based on the project image area or the diameter, as long as grains are in substantially the same shape.

The size distribution of silver halide grains to be used in the invention may be either monodispersed or polydispersed. In the invention, monodispersed silver halide grains having a variation coefficient of 0.22 or less are preferable. Still preferable are monodispersed silver halide grains with a variation coefficient of 0.15 or less.

Variation coefficient represents the width of size distribution, and is defined by the following equation: Variation coefficient=Standard deviation of grain size distribution/average grain size Grain size represents the diameter of a grain when the grain is spherical. In the case of a grain which is cubic or in other shapes, grain size represents the diameter of a circle having the same area as that of the projected image of the grain.

Silver halide grains to be employed in the invention can be prepared by any of the neutral method, the acid method or the ammonia method. Use of seed grains is permissible. Formation of seed grains and growing of silver halide grains may be performed by the same method.

The shape of a silver halide grain is not limitative. Preferred is a cubic grain having a (100) face as a crystal face. Octahedral, tetradecahedral and dodecahedral silver halide grains may also be employed. Methods of preparing these grains are described in U.S. Patent Nos. 4,183,756, 4,225,666, Japanese Patent O.P.I. Publication No. 26589/1980, Japanese Patent Examined Publication No. 42737/1980 and The Journal of Photographic Science, 21, 39 (1973). Also usable are silver halide grains with a twin crystal face. Silver halide grains may be either identical or different in shape.

In the invention, it is possible to add a metal ion to a silver halide grain during forming and/or growing the grain so that the metal ion can be contained in its inside and/or on its surface. For this purpose, use can be made of cadmium salts, zinc salts, lead salts, thallium salts, iridium salts (or complex salts), rhodium salts (or complex salts) or iron salts (or complex salts). A reduction sensitization nucleous can be formed in the inside and/or on the surface of a grain in a reductive atmosphere.

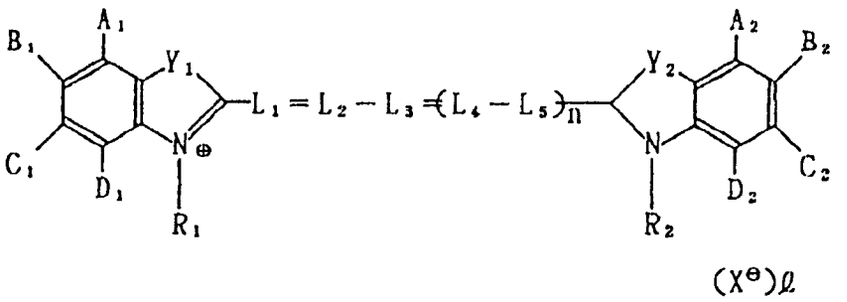
A latent image may be formed in the inside of or on the surface of a silver halide grain.

A silver halide emulsion is chemically sensitized by a known method, including the sulfur sensitization method (activated gelatin or a compound containing sulfur which is reactive to a silver ion is used as a sensitizer), the selenium sensitization method, the reduction sensitization method and the noble metal sensitization method. These sensitization methods can be applied either alone or in combination.

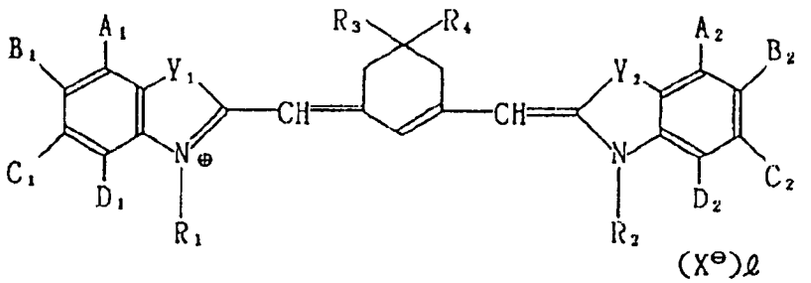
A silver halide emulsion can be spectrally sensitized to a prescribed wavelength region with a sensitizing dye such as a cyanine dye, a merocyanine dye, a composite cyanine dye, a composite merocyanine dye, a holopolar cyanine dye, a hemicyanine dye, a styryl dye and a hemioxanol dye.

In the invention, it is preferred that a silver halide emulsion for forming a red-sensitive emulsion layer be spectrally sensitized with a sensitizing dye represented by the following Formula RSI or RSII.

Formula RSI



Formula RSII

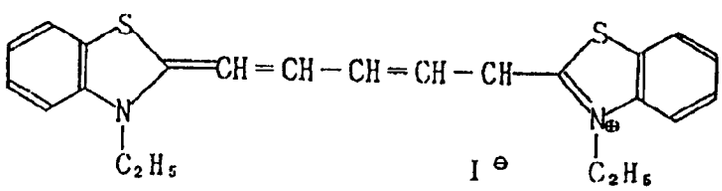


wherein R_1 and R_2 each represent an alkyl group or an aryl group; L_1, L_2, L_3, L_4 and L_5 each represent a methine group; Y_1 and Y_2 each represent an oxygen atom, a sulfur atom or a selenium atom; R_3 and R_4 each represent a lower alkyl group; A_1, A_2, B_1, B_2, C_1, C_2, D_1 and D_2 each represent a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group, a phenyl group, a cyano group, a nitro group or an alkoxycarbonyl group; X^+ represents an acid anion; and n and 1 each represent 0 or 1, provided that 1 is 0 when the compound forms an intramolecular salt. At least one combination selected from A_1 and B_1, B_1 and C_1, C_1 and D_1, A_2 and B_2, B_2 and C_2, and C_2 and D_2 may form a benzene ring by condensation.

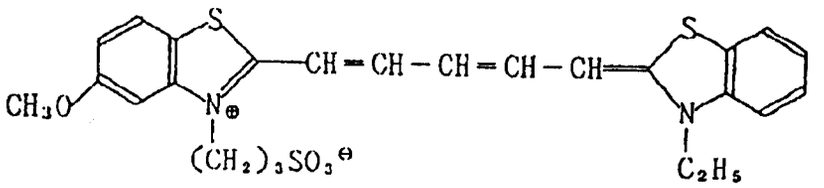
Specific examples of the above groups are given in Japanese Patent Application Specification No. 305532/1990, page 33, line 3 to page 34, line 19.

Examples of the sensitizing dye represented by Formula RSI or RSII are given below:

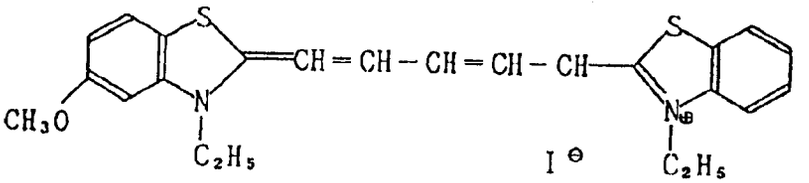
R S - 1



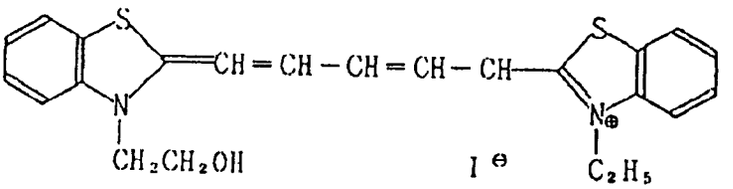
RS－2



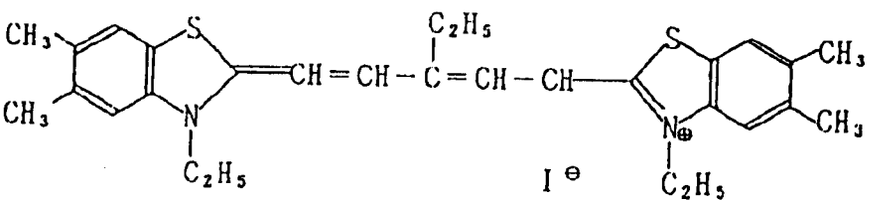
RS－3



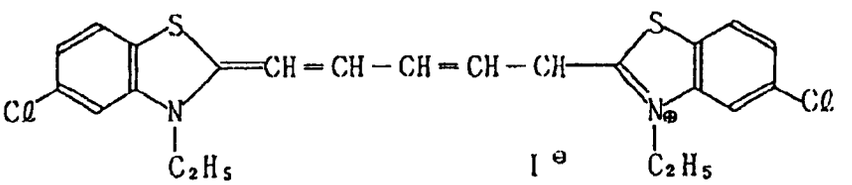
RS－4



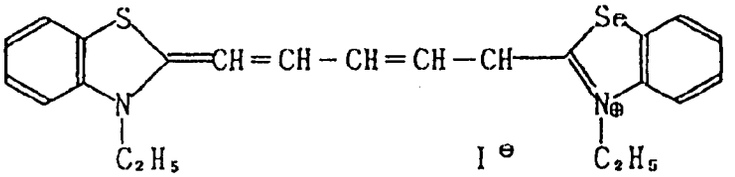
RS－5



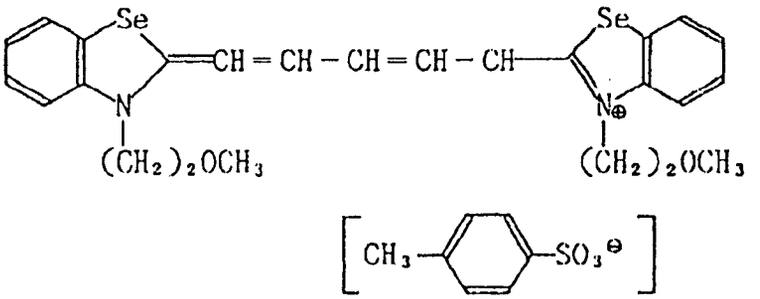
RS－6



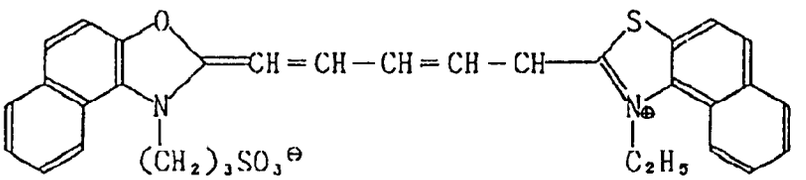
RS－7



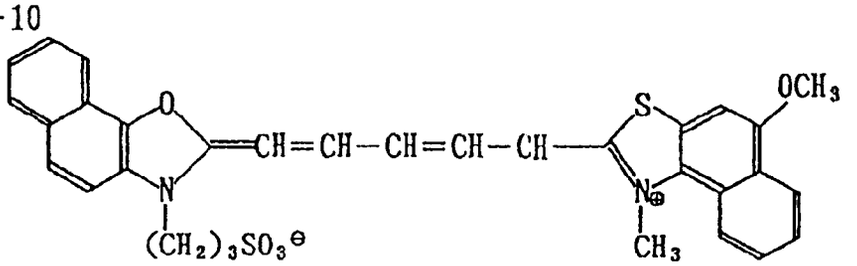
RS－8



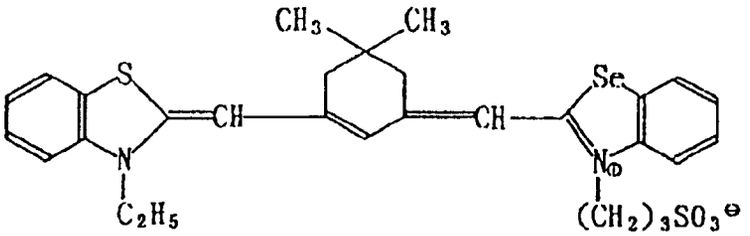
RS－9



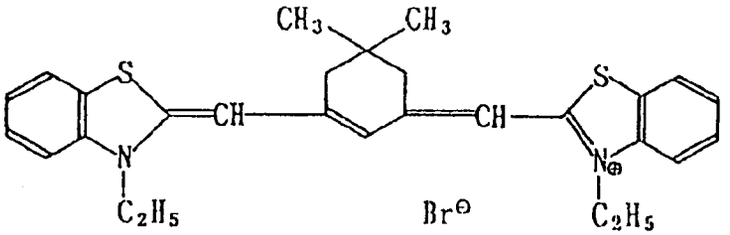
RS－10



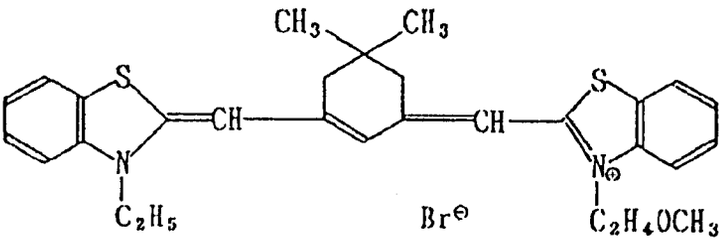
R S −11



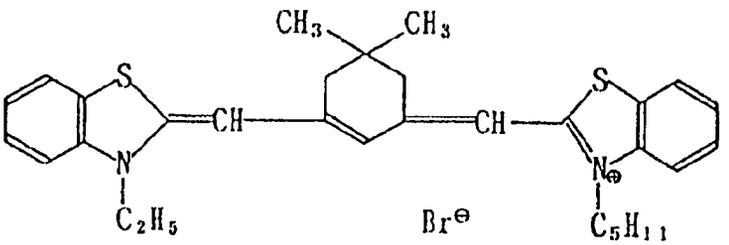
R S −12



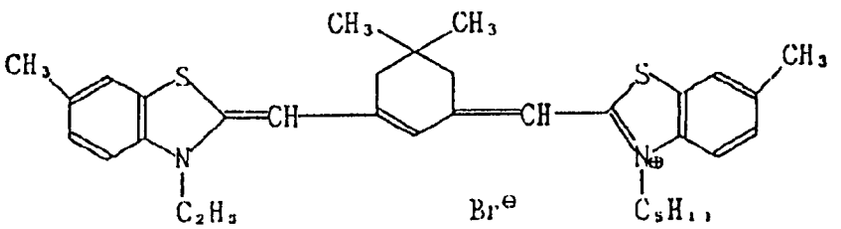
R S −13



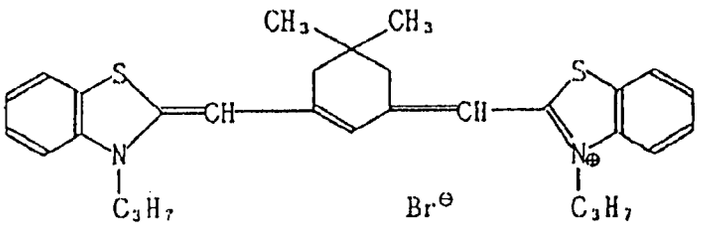
R S −14



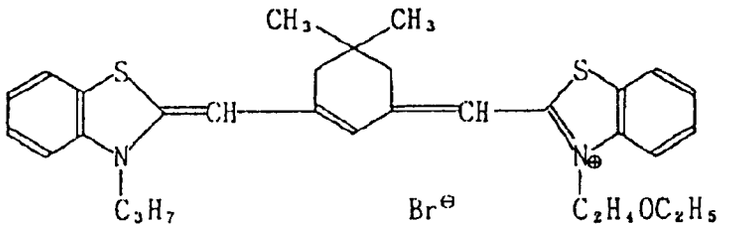
R S −15



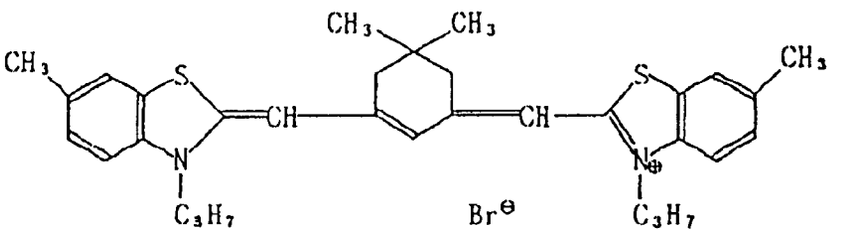
RS-16



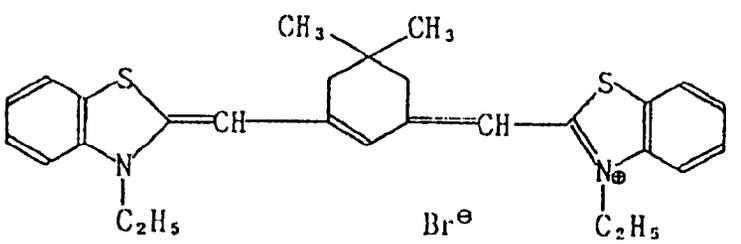
RS-17



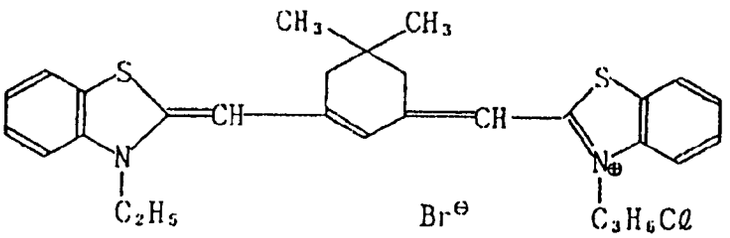
RS-18



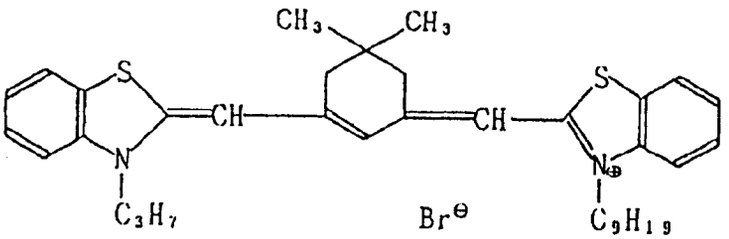
RS-19



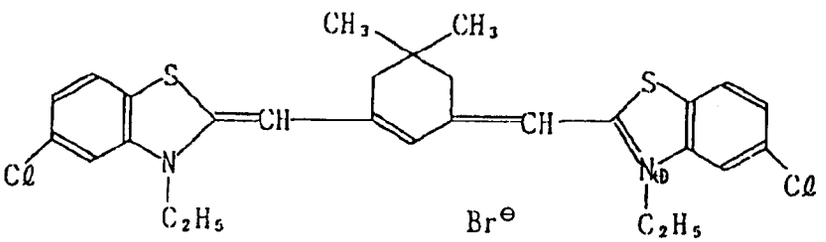
RS-20



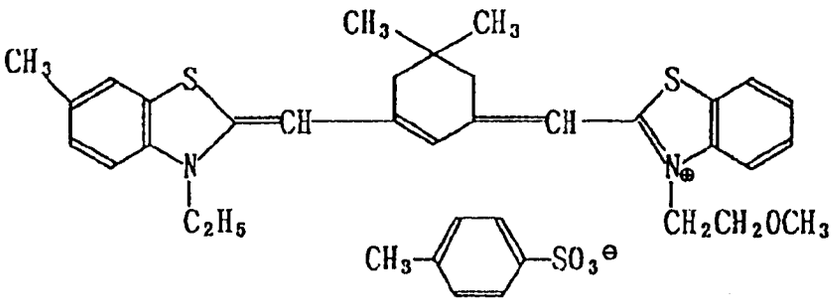
RS-21



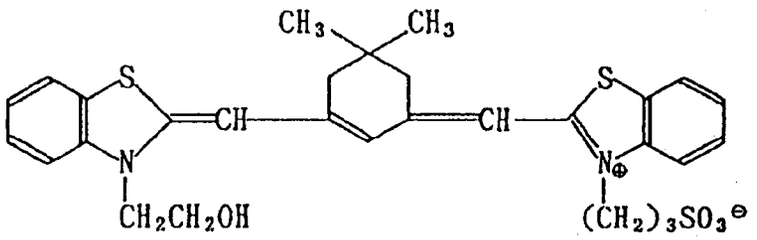
RS-22



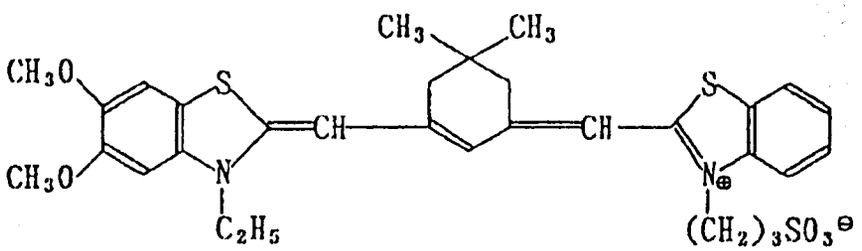
RS-23



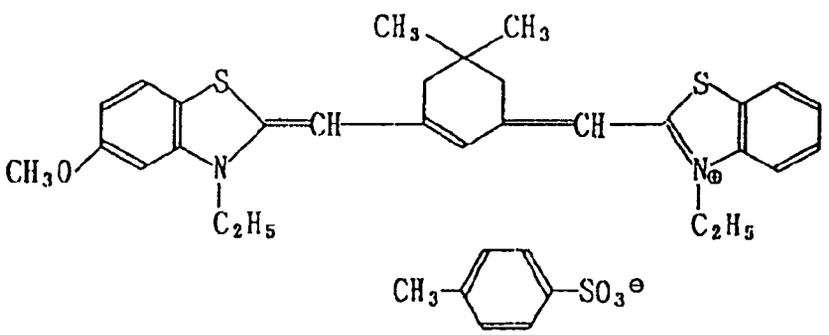
RS-24



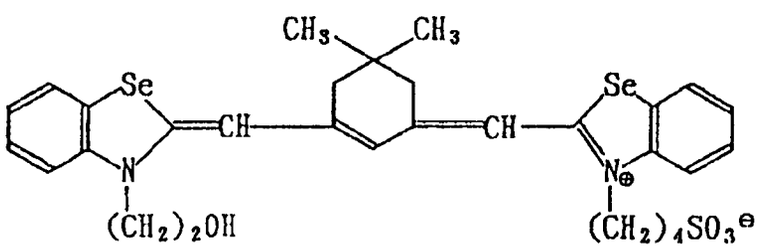
RS-25



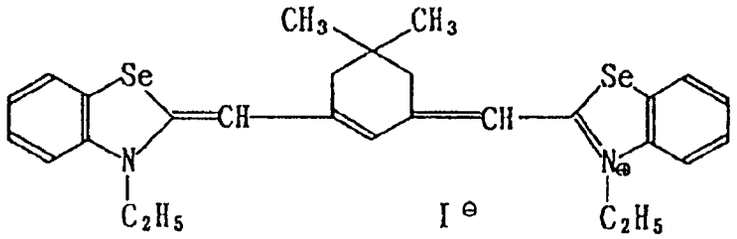
RS-26



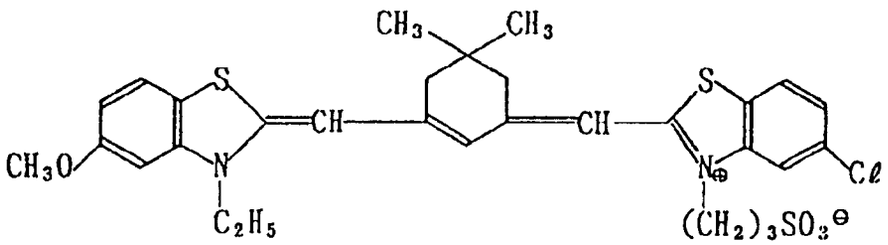
RS-27



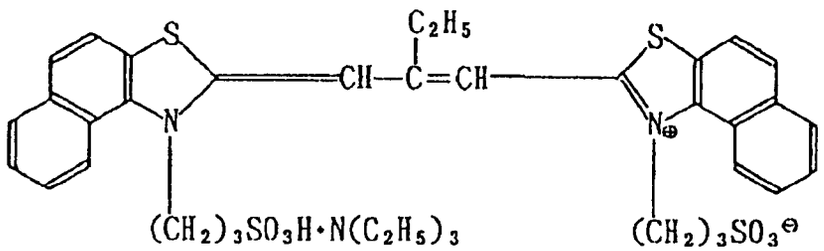
RS−28



RS−29



RS−30



These sensitizing dyes may be employed either singly or in combination. They also may be used together with a dye which does not have a sensitizing effect or with a supersensitizer consisting of a compound which does not absorb UV rays, which serves to enhance the sensitizing effect of a sensitizing dye.

The amount of a sensitizing dye is not limitative, but preferably 1×10^{-7} to 1×10^{-3} mol, still preferably 5×10^{-6} to 5×10^{-4} mol, per mol silver halide.

A sensitizing dye may be added by a known method.

For example, a sensitizing dye may be added in the form of a solution obtained by dissolving it in a water-soluble solvent such as pyridine, methyl alcohol, ethyl alcohol, methyl cellusolve, acetone or a mixture thereof, and optionally, diluting with water. Water may be used instead of a water-solubloe solvent. Use of ultrasonic vibration is advisable to facilitate dissolving. Alternatively, as described in U.S. Patent No. 3,469,987, a dye may be added in the form of a dispersion obtained by dissolving it in a volatile organic solvent and dispersing the resulting solution in a hydrophilic colloid. In the case of a water-insoluble dye, the dye may be added in the form of a dispersion obtained by dispersing it in a water-soluble solvent (see Japanese Patent Examined Publication No. 24185/1971).

It is also possible to add a sensitizing dye in the form of a dispersion prepared by the acid dissolving dispersion method. Also applicable are methods described in U.S. Patent Nos. 2,912,345, 3,342,605, 2,996,287

and 3,425,835.

When two or more sensitizing dyes are employed, it is possible to dissolve them separately in different solvents, and mix the resulting solutions before adding to an emulsion. The dye solutions may be added separately without mixing, in which case the order of addition, timing and interval are determined according to the purpose.

A sensitizing dye may be added to a silver halide emulsion at any time during the process of preparing the emulsion, but preferably immediately before, during or immediately after the chemical ripening.

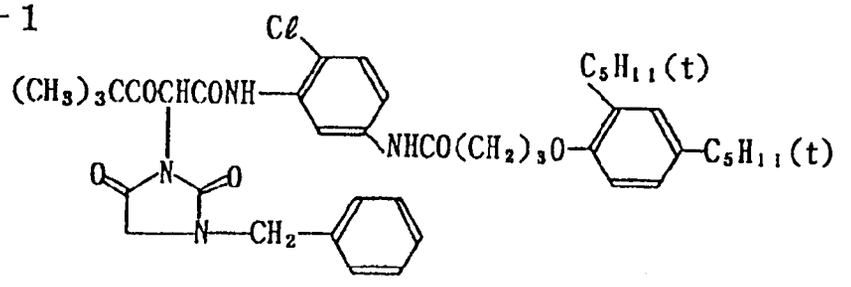
The present invention can be applied to both single-colored and multi-colored light-sensitive materials including color negative films, color positive films, color printing paper, light-sensitive materials for display, and the like. The effects of the invention, however, can be produced most satisfactorily when applied to light-sensitive materials for direct appreciation.

When the invention is applied to a color photographic light-sensitive material, a dye-forming coupler is normally employed. Normally, a silver halide emulsion layer contains a dye-forming coupler which can absorb spectral light to which the emulsion layer is sensitive. Therefore, a yellow dye-forming coupler, a magenta dye-forming coupler and a cyan dye-forming coupler are generally contained in a blue-sensitive emulsion layer, a green-sensitive emulsion layer and a red-sensitive emulsion layer, respectively. Combination of a coupler and an emulsion layer, however, is not limited thereto.

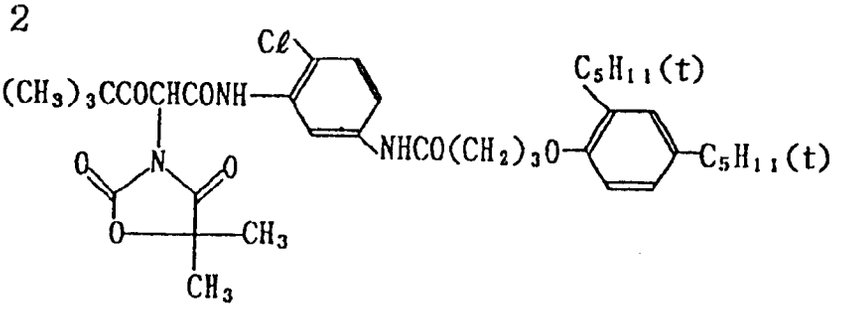
In the invention, acylacetoanilide-based couplers are preferable as a yellow dye-forming coupler. Of acylacetoanilide-based couplers, benzoylacetoanilide-based compounds and pivaloylacetoanilide-based compounds, in particular, example compound Nos. Y-1 to Y-146 described in Japanese Patent O.P.I. Publication No. 85631/1988, example compound Nos. Y-1 to Y-98 described in Japanese Patent O.P.I. Publication No. 97951/1988, example compound Nos. I-1 to I-50 described in Japanese Patent O.P.I. Publication No. 298943/1990 and example compound Nos. Y-1 to Y-24 described in Japanese Patent O.P.I. Publication No. 156748/1989 are advantageous.

Preferred examples of a usable yellow dye-forming coupler are given below.

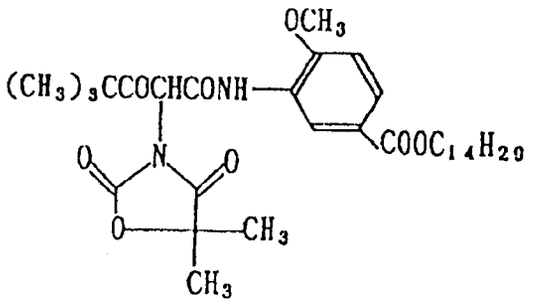
YC−1



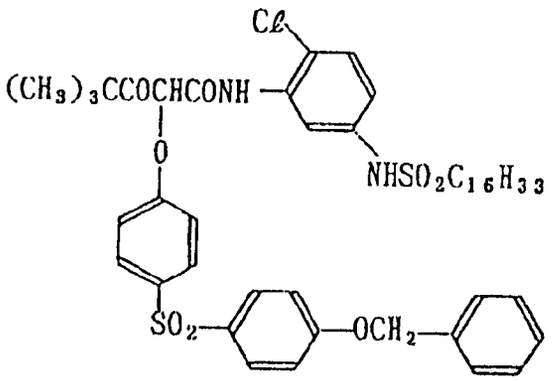
YC−2



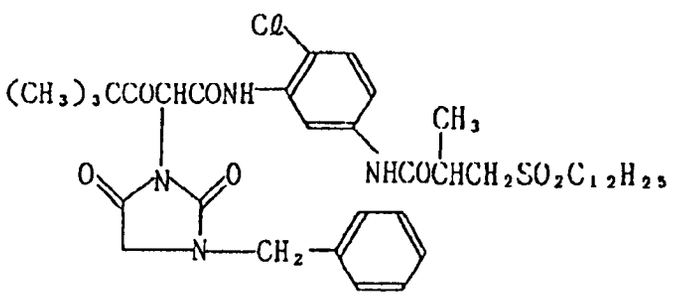
YC－3



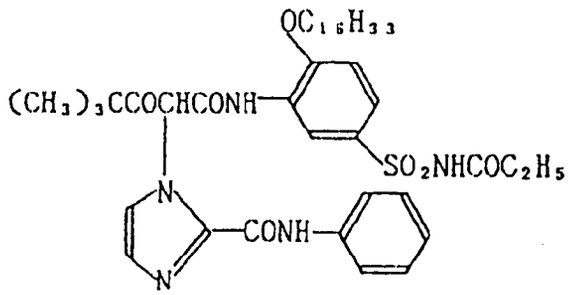
YC－4



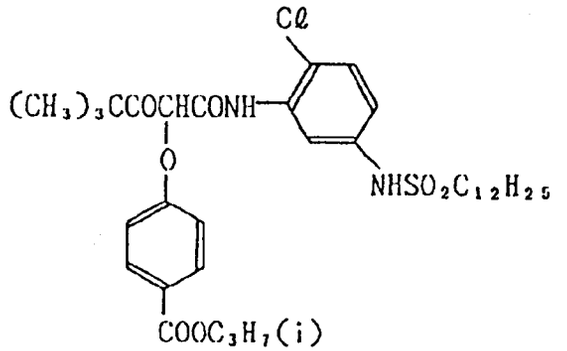
YC－5



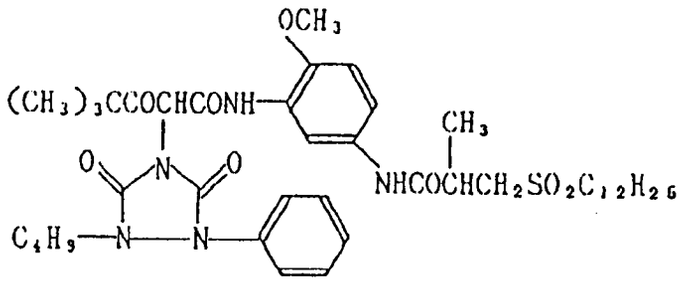
YC－6



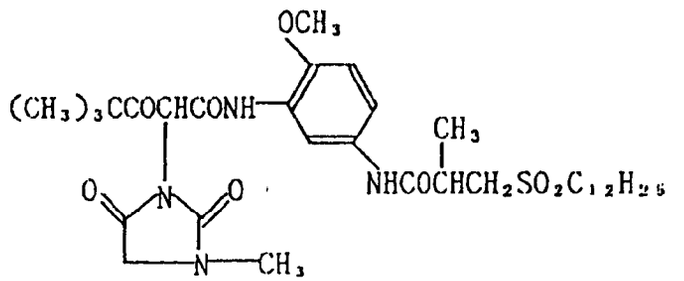
YC－7



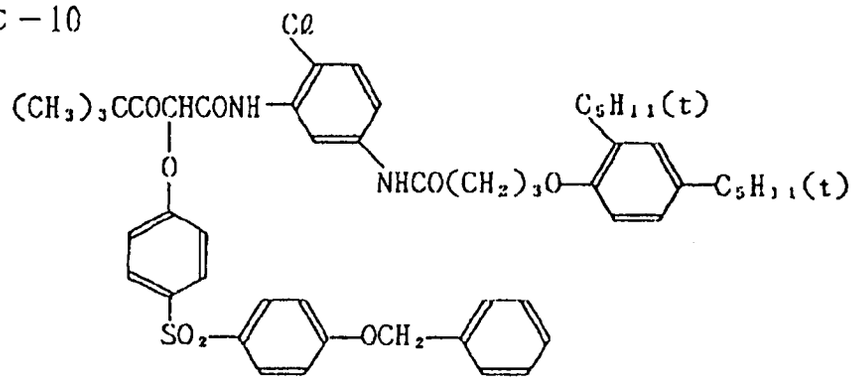
YC－8



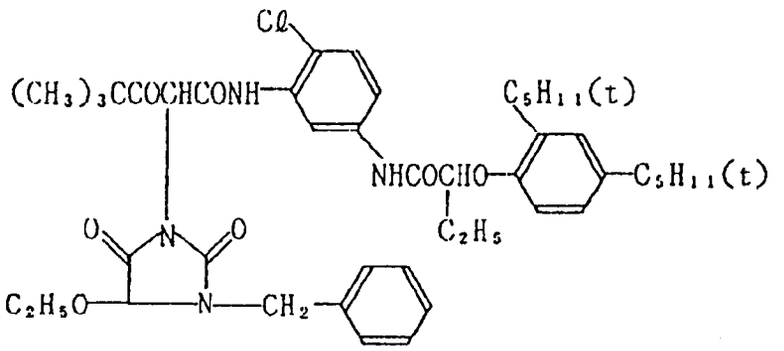
YC－9



YC－10



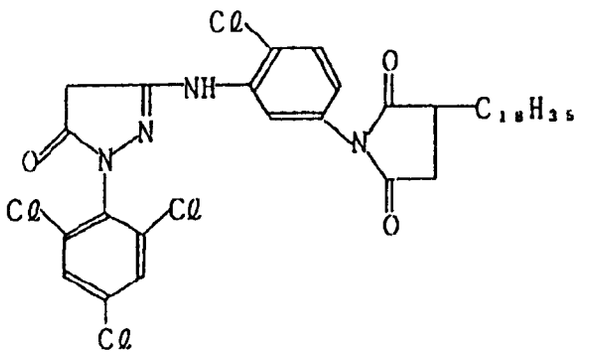
YC-11



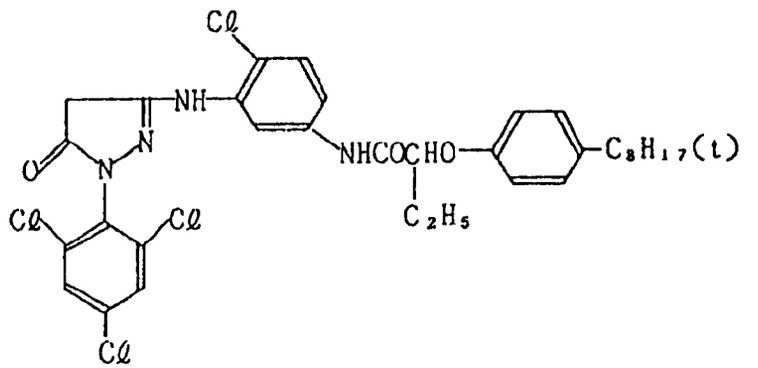
As a magenta dye-forming coupler, 5-pyrazolone-based compounds, pyrazoloazole-based compounds and pyrazolobenzimidazole-based compounds can be preferably employed.

Preferred examples of a usable magenta dye-forming coupler are given below.

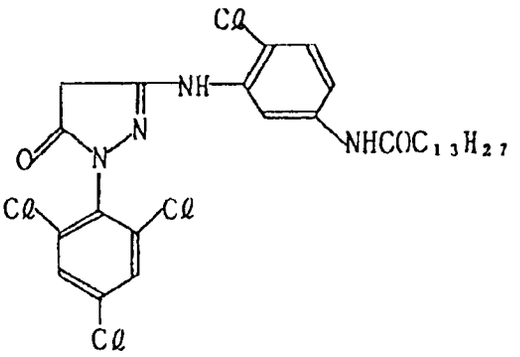
MC-1



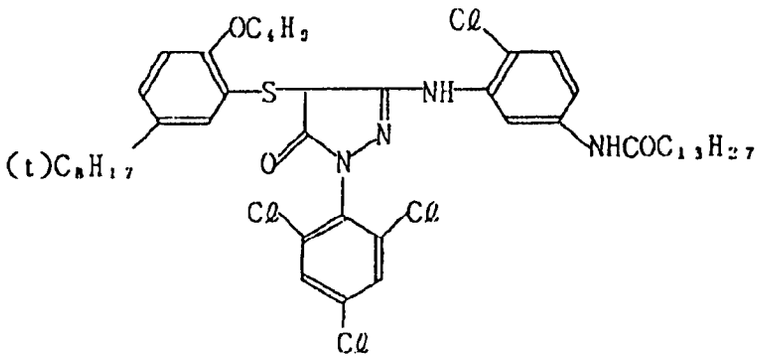
MC-2



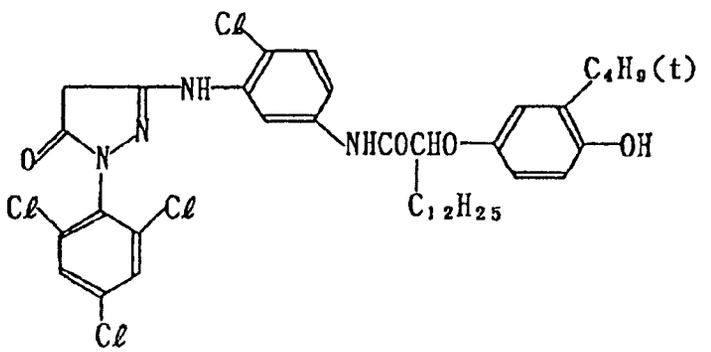
MC—3



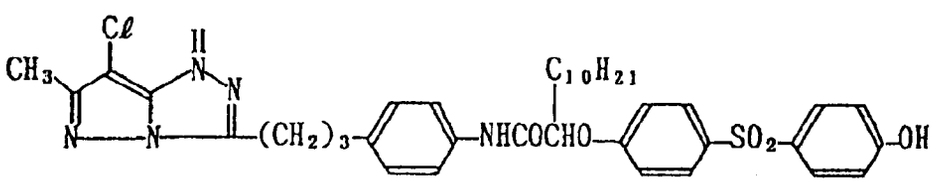
MC—4



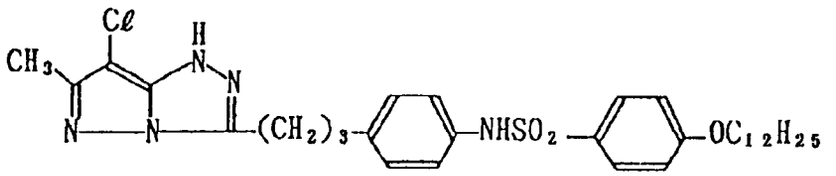
MC—5



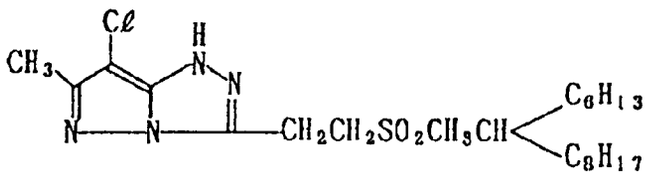
MC—6



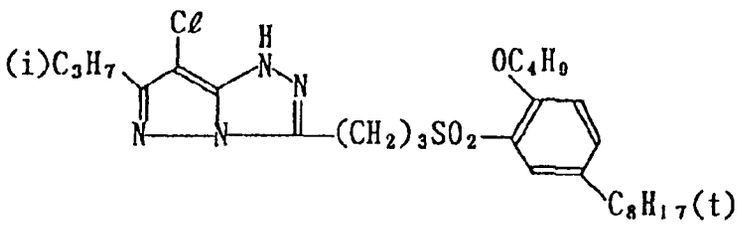
MC—7



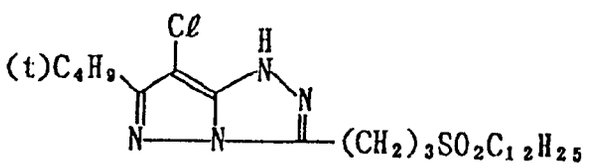
MC—8



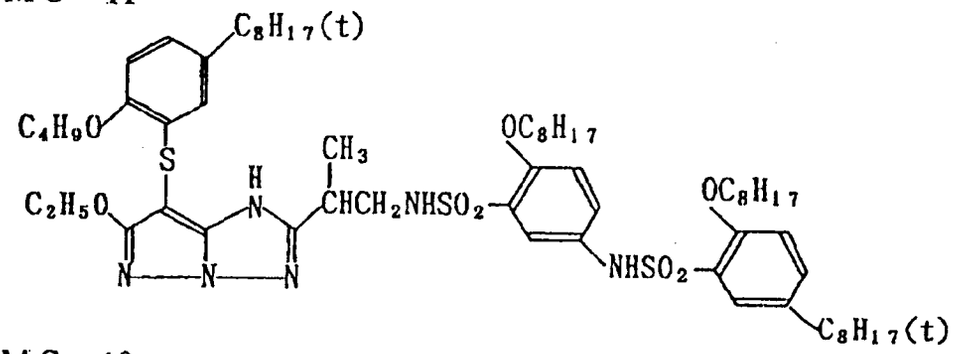
MC—9



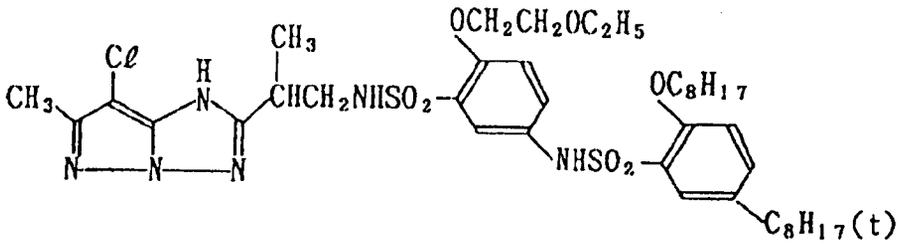
MC—10



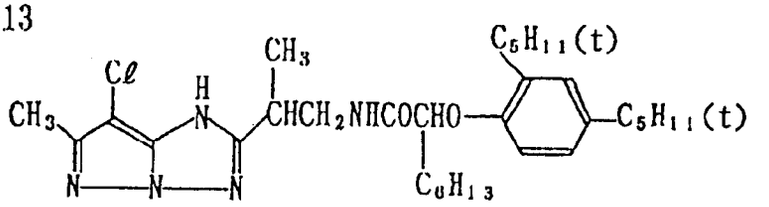
MC—11



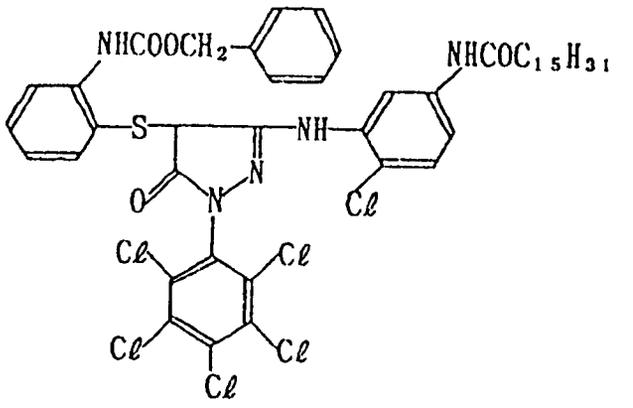
MC—12



MC—13



MC—14



Also usable are compound Nos. 1 to 4, 8 to 17, 19 to 24, 26 to 43, 45 to 59, 61 to 104, 106 to 121, 123 to 162, 164 to 233 described from page 18, upper right column to page 32, upper right column of Japanese Patent O.P.I. Publication No. 166339/1987, and compound Nos. M-1 to M-29 described in pages 5 to 6 of Japanese Patent O.P.I. Publication No. 100048/1990.

As a cyan dye-forming coupler, naphthol-based compounds and phenol-based compounds are preferable.

In the case of a light-sensitive material for direct appreciation (e.g. color printing paper), for improved fastness of a dye image and color reproducibility, it is advisable to employ a 2,5-diacylaminophenol-based compound described in U.S. Patent No. 2,895,826, Japanese Patent O.P.I. Publication Nos. 112038/1975,

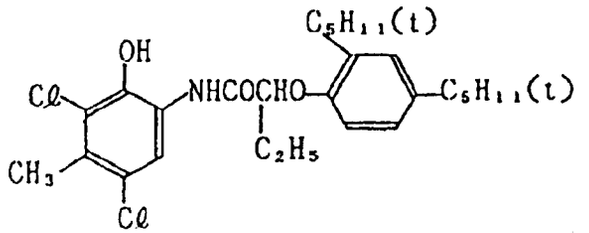
109630/1978, 163537/1980 and 96656/1988 and a phenol-based compound containing an alkyl group with 2 or more carbon atoms at the 5th position.

Examples of a 2,5-diacylaminophenol-based compound include example compound Nos. C-1 to C-25 described in Japanese Patent O.P.I. Publication No. 96656/1988 and examples of a phenol-based compound include example compound Nos. IV-1 to IV-19 described in Japanese Patent O.P.I. Publication No. 196048/1989.

Also usable are phenol-based compounds described in Japanese Patent O.P.I. Publication No. 132437/1990, pages 31 to 32, in each of which a nitrogen-containing heterocyclic ring is condensed to a phenol nucleous, and phenylimidazole-based compounds.

Specific examples of a usable cyan coupler are given below:

CC—1



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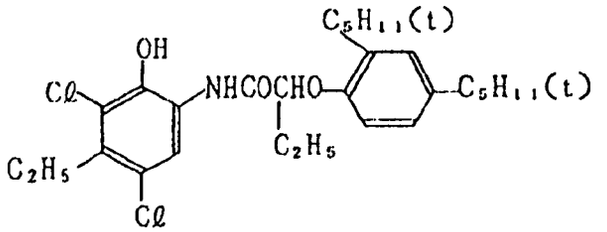

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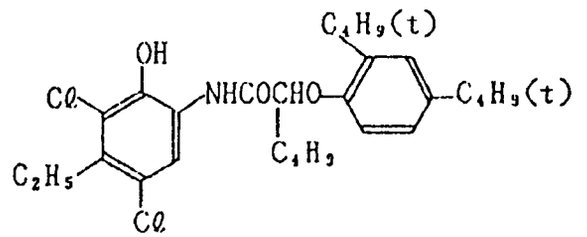

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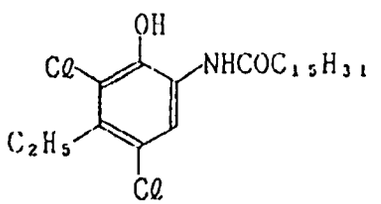

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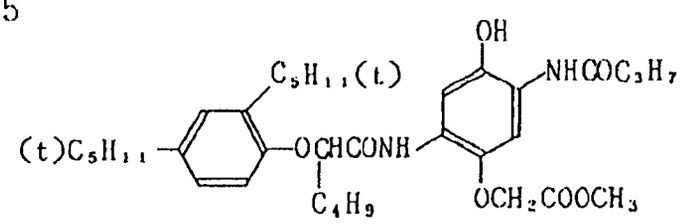

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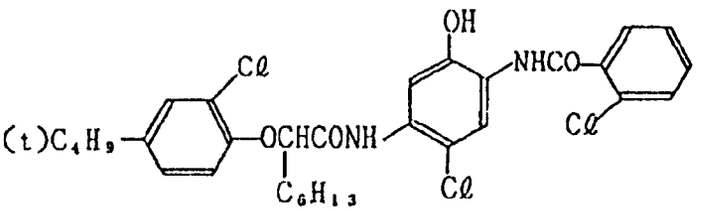

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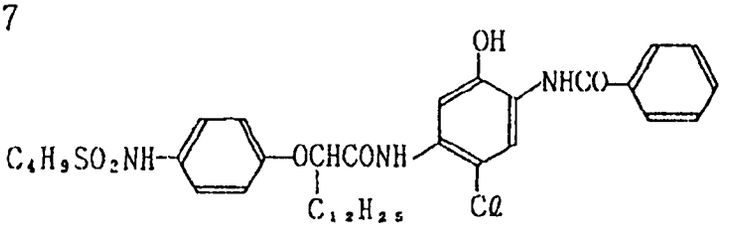

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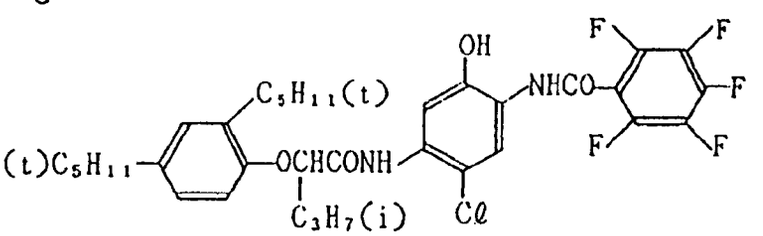

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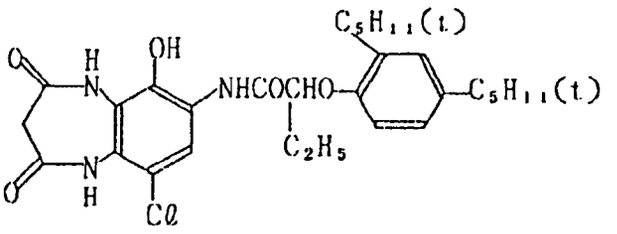

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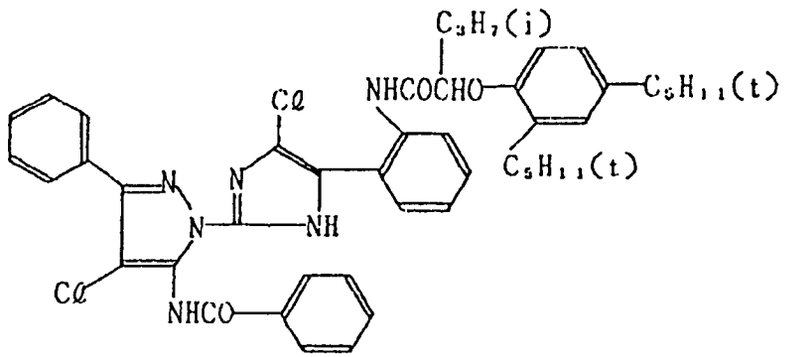

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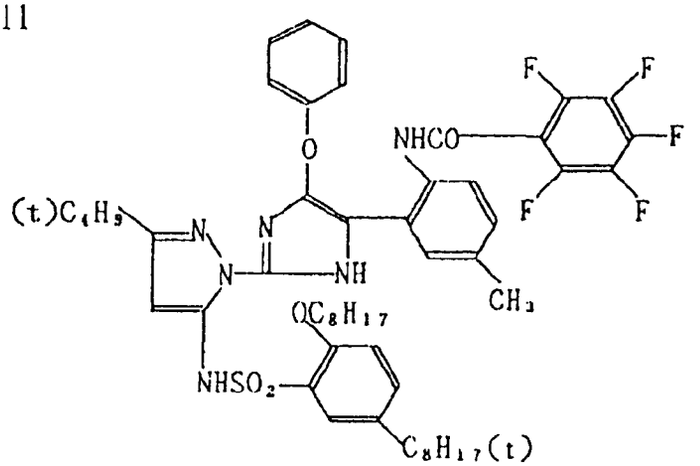

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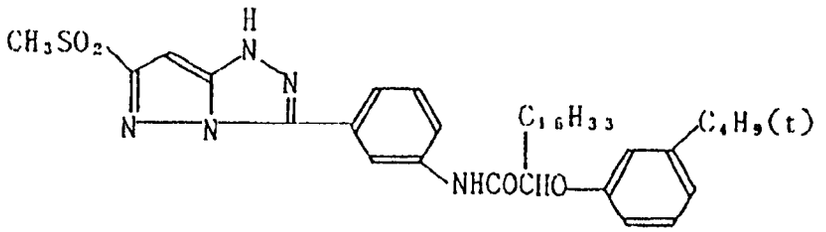
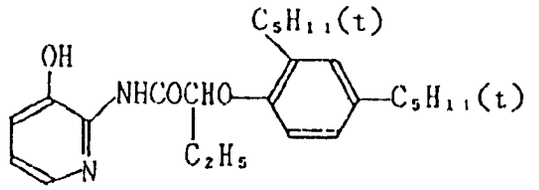


CC-13



A dye-forming coupler is normally added to a hydrophilic colloidal layer in the form of a dispersion obtained by dissolving it in a high-boiling solvent (boiling point: 150°C or more) or a water-insoluble high-molecular substance (if need arises, a low-boiling and/or a water-soluble organic solvent are used in combination), and dispersing the resulting solution in a hydrophilic binder such as an aqueous gelatin solution in the presence of a surfactant. When a low-boiling solvent is employed, it may be removed at the time of dispersing a coupler solution in a binder.

As a high-boiling solvent, a compound with a dielectric constant (at 30°C) of 6.5 or less, such as esters including phosphoric esters, organic acid amides, ketones and hydrocarbons, are preferable. Combined use of two or more different types of high-boiling solvent is possible.

A high-boiling solvent is employed in an amount of 0 to 400 wt%, preferably 10 to 100 wt%, based on the amount of a coupler.

Gelatin is preferable as a binder.

Either lime-treated gelatin or acid-treated gelatin is usable, and there is no restrictions on the raw material (a bone or hide of a cow, a hide of a pig) of gelatin. In the invention, however, it is preferable to use a lime-treated gelatin made from a bone of a cow.

Silver halide emulsion layers and other hydrophilic colloidal layers may be hardened by the addition of one or more hardeners. Hardeners serve to allow molecules of a binder (or protective colloid) to be cross-linked, thus making these layers tougher.

Hydrophilic colloidal layers such as a protective layer and an intermediate layer may contain a UV absorber, which serves to prevent fogging caused by electric discharge which is generated when a light-sensitive material is electrified by friction, as well as to prevent UV rays from adversely affecting the quality of a photographic image.

A light-sensitive material of the invention may contain auxiliary layers such as a filter layer, an antihalation layer and/or an anti-irradiation layer. These layers and/or silver halide emulsion layers each may contain a dye other than the dye of the invention, which can be released from a light-sensitive material or can be bleached during processing.

A light-sensitive material of the invention may contain a fluorescent brightener, such as those described in Japanese Patent O.P.I. Publication No. 71049/1984 and 71050/1984. By the addition of a fluorescent brightener, it is possible to obtain a visually clear photographic image. In the case of a water-soluble fluorescent brightener, a fluorescent brightener trapping agent may be added to prevent the brightener from flowing out.

Any type of compound may be employed as long as it can trap a fluorescent brightener. Advantageous are hydrophilic polymers, such as polyvinyl pyrrolidone, a copolymer containing vinyl pyrrolidone as a repeating unit, a hydrophilic polymer containing a cationic nitrogen-containing active group (described in Japanese Patent O.P.I. Publication No. 42732/1973) and a copolymer of vinyl alcohol and vinyl pyrrolidone (described in Japa-

nese Patent Examined Publication No. 20738/1972).

Silver halide emulsion layers and/or other hydrophilic colloidal layers each may contain a matting agent, which serves to make a light-sensitive material less glossy, two improve writability and to prevent a light-sensitive material from adhering to other light-sensitive materials.

A light-sensitive material of the invention may contain a lubricant which serves to minimize slide abrasion.

A light-sensitive material of the invention may contain an anti-static agent. An anti-static agent may be contained in an anti-static layer provided on the opposite side of a support (where no emulsion layer is provided), or in a silver halide emulsion layer and/or a protective colloidal layer other than an emulsion layer provided on the emulsion layer side of a support.

Silver halide emulsion layers and/or other. hydrophilic colloidal layers each may contain a surfactant as a coating aid, an anti-static agent, a lubricant, an emulsifier, and to prevent a light-sensitive material from adhering to other light-sensitive materials, as well as to improve photographic properties (e.g. to accelerate development, to harden the layers of a light-sensitive material, to sensitize emulsions).

Silver halide emulsion layers and other component layers of a light-sensitive material of the invention are provided on a variety of supports, in particular, a film of a semisynthetic or synthetic polymer such as cellulose acetate, cellulose nitrate, polystyrene, polyvinyl chloride, polyethylene terephthalate, polycarbonate and polyamide, as well as on paper supports, such as those which coated with baryta or a polymer of an α-olefin (an α-olefin layer may be one which can be removed readily), flexible reflective supports such as synthetic paper, and a rigid material such as glass, metals and ceramics. An extremely thin reflective support of 120 to 160 μm in thickness is also usable.

A support to be employed in the invention may be either reflective or transparent. To make a support reflective, a white pigment may be contained in the support, or, a white pigment-containing hydrophilic colloidal layer may be provided on the support. Preferable white pigments include barium sulfate and titanium oxide.

If need arises, a support may be subjected to corona discharge treatment or flame treatment, or exposed to UV rays prior to the provision of layers. Between a support and layers, an undercoating layer may be formed to increase adhesion between the support and the layers, to prevent a light-sensitive material from getting electrified, as well as to improve the dimensional stability, abrasion resistance, hardness, anti-halation property, frictional characteristics and/or other photographic characteristics of a light-sensitive material. Provision of two or more undercoating layers is possible.

In the invention, conventional color developing agents can be employed.

Examples include aminophenol-based compounds and p-phenylenediamine-based compounds. These compounds are normally employed in the form of a salt (e.g. hydrochloride, sulfate), since they are more stable in a salt form than in a free state. The amounts of these compounds are preferably 0.1 to 30 g, still preferably 1 to 15 g, per 1 l of a color developer.

The most effective primary aromatic amine-based developing agent is an N,N-dialkyl-p-phenylenediamine-based compound. In this compound, the alkyl group and the phenyl group each may be substituted with a substituent.

In addition to a primary aromatic amine-based color developing agent, a color developer may also contain various known additives, such as an alkalizing agent (e.g. sodium hydroxide, sodium carbonate, potassium carbonate), an alkali metal sulfite, an alkali metal bisulfite, an alkali metal thiocyanate, an alkali metal halide, benzyl alcohol, a water softener and a thickener.

The pH of a color developer is 7 or more, normally 10 to 13.

Color developing is performed at 15°C or more, normally 20°C to 50°C. For rapid processing, 30°C or more is preferable. Color developing is performed preferably for 20 to 60 seconds, still preferably 30 to 50 seconds.

A light-sensitive material of the invention is subjected to bleaching and fixing after color developing Bleaching may be performed simultaneously with fixing.

After fixing, a light-sensitive material is normally rinsed. Rinsing may be replaced by or performed simultaneously with stabilization. A stabilizer may contain a pH controller, a chelating agent, a fungicide or other additives.

Conditions of color developing are described in Japanese Patent O.P.I. Publication No. 134636/1983.

EXAMPLES

The present invention will be described in more detail according to the following examples.

Example 1

One side of a paper support was coated with polyethylene, and the other side thereof was coated with poly-

ethylene containing titanium oxide. Then, layers of the following compositions were provided on the polyethylene layer side of the support, whereby a multilayer silver halide color photographic light-sensitive material was obtained (Sample Nos. 1-1). Coating compositions were prepared by the method described below.

Sample Nos. 1-2 to 1-25 were prepared in substantially the same manner as in the preparation of Sample No. 1-1, except that the type and amount (mg/m^2) of dyes contained in the 4th layer were changed to those shown in Table 1. In the table, dyes having an absorption maxima at 580 to 630 nm, dyes having an absorption maxima at 630 to 680 nm and dyes having an absorption maxima at 680 to 750 nm are designated as group A, group B and group C, respectively.

Preparation of Coating Compositions

Coating Composition for the 1st Layer

Sixty (60) ml of ethyl acetate was dissolved in a mixture of 26.7 g of a yellow coupler (YC-8), 10.0 g of a dye image stabilizer (ST-1), 6.67 g of another dye image stabilizer (ST-2), 0.67 g of an anti-stain agent (HQ-1) and 6.67 g of a high-boiling solvent (DNP). The resulting solution was dispersed in 220 ml of an aqueous 10% gelatin solution that contained 7 ml of a 20% surfactant (SU-1) by means of a ultrasonic homogenizer, whereby a yellow coupler dispersion was obtained. The dispersion was mixed with a blue-sensitive silver halide emulsion (silver content: 10 g) that had been prepared by the method described below, thereby to obtain a coating composition for the 1st layer.

Coating compositions for the 2nd to 7th layers were prepared in substantially the same manner as in the preparation of the 1st layer coating composition except for ingredients.

As a hardener, H-1 and H-2 were added to the 2nd layer coating composition and the 4th layer coating composition, respectively. Surfactants SU-1 and SU-2 were added to each coating composition to adjust the surface tension.

Table 1

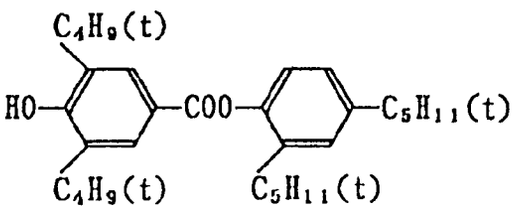
Layer	Ingredient	Amount (g/m^2)
7th layer (protective layer)	Gelatin	1.00
	Anti-stain agent HQ-2	0.002
	Anti-stain agent HQ-3	0.002
	Anti-stain agent HQ-4	0.004
	Anti-stain agent HQ-5	0.02
	DIDP	0.005
	Fungicide F-1	0.002
6th layer (UV absorbing layer)	Gelatin	0.40
	UV absorber UV-1	0.10
	UV absorber UV-2	0.04
	UV absorber UV-3	0.16
	Anti-stain agent HQ-5	0.04
	DNP	0.20
	PVP	0.03
5th layer (red-sensitive layer)	Gelatin	1.30
	Red-sensitive silver chlorobromide emulsion Em-R	0.21
	Cyan coupler CC-8	0.17
	Cyan coupler CC-2	0.25
	Dye image stabilizer ST-1	0.20
	Anti-stain agent HQ-1	0.01
	HBS-1	0.20
	DOP	0.20
4th layer (UV absorbing layer)	Gelatin	0.94
	UV absorber UV-1	0.28
	UV absorber UV-2	0.09
	UV absorber UV-3	0.38
	Anti-stain agent HQ-5	0.10
	DNP	0.40
	Dye (shown in Table 1)	

Table 2

Layer	Ingredient	Amount (g/m^2)
3rd layer (green-sensitive layer)	Gelatin	1.40
	Green-sensitive silver chlorobromide emulsion Em-G	0.17
	Magenta coupler MC-10	0.23
	Dye image stabilizer ST-3	0.20
	Dye image stabilizer ST-4	0.17
	DIDP	0.13
	DBP	0.13
2nd layer (intermediate layer)	Gelatin	1.20
	Anti-stain agent HQ-2	0.03
	Anti-stain agent HQ-3	0.03
	Anti-stain agent HQ-4	0.05
	Anti-stain agent HQ-5	0.23
	DIDP	0.06
	Compound F-1	0.002
1st layer (blue-sensitive layer)	Gelatin	1.20
	Gelatin, Blue-sensitive silver chlorobromide emulsion Em-B	0.26
	Yellow coupler YC-8	0.80
	Dye image stabilizer ST-1	0.30
	Dye image stabilizer ST-2	0.20
	Anti-stain agent HQ-1	0.02
	DNP	0.20
Support	Polyethylene-coated paper	

The amount of each silver halide emulsion was indicated as the amount of silver contained therein.

S T − 1



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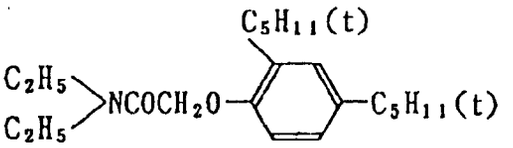

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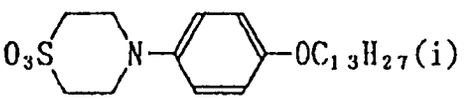

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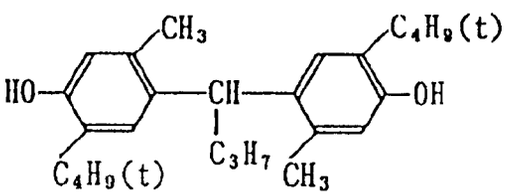

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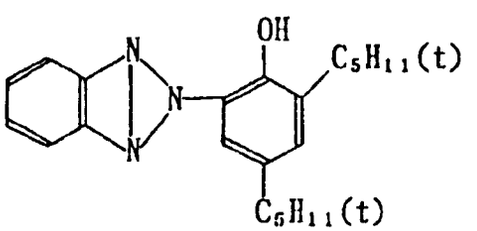

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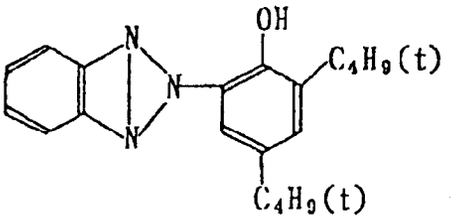

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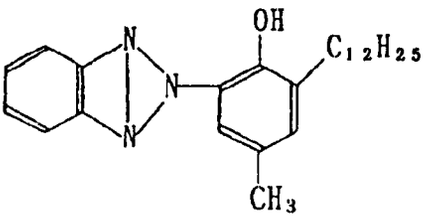
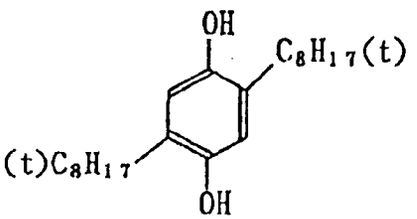


DBP: Dibutyl phthalate
DOP: Dioctyl phthalate
DNP: Dinonyl phthalate
DIDP: Diisodecyl phthalate
PVP: Polyvinyl pyrrolidone

H Q − 1



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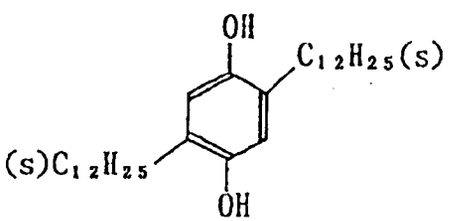

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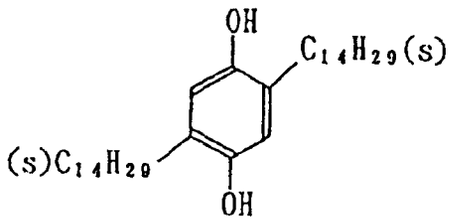

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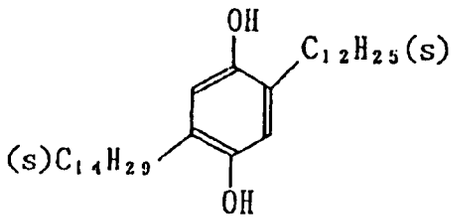
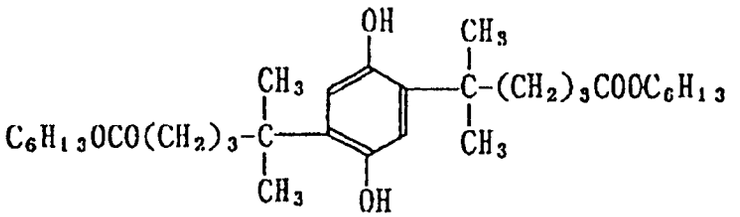
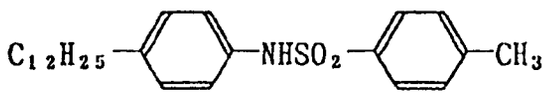


H Q − 5



H B S − 1



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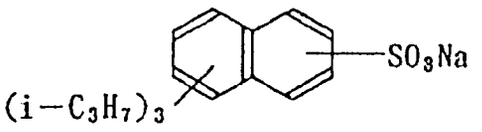

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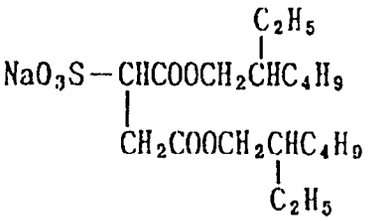
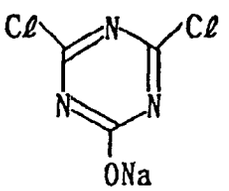


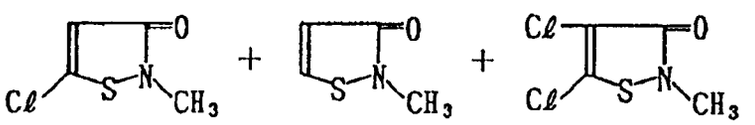
H - 1

$C(CH_2SO_2CH=CH_2)_4$

H − 2



F − 1



(50%) (46%) (4%) molar ratio

Preparation of Blue-sensitive Silver Halide Emulsion

To 1,000 ml of an aqueous 2% gelatin solution that had been heated to 40°C, liquids A and B were added by the double-jet method over a period of 30 minutes, while controlling pAg and pH to 6.5 and 3.0, respectively. Then, liquids C and D were added over a period of 180 minutes, while controlling pAg and pH to 7.3 and 5.5,

respectively. pAg was controlled according to the method described in Japanese Patent O.P.I. Publication No. 45437/1983, and pH was controlled by using an aqueous solution of sulfuric acid or sodium hydroxide.

Liquid A

Sodium chloride	3.42 g
Potassium bromide	0.03 g

Water was added to make the total quantity 200 ml.

Liquid B

Silver nitrate	10 g

Water was added to make the total quantity 200 ml.

Liquid C

Sodium chloride	102.7 g
Potassium bromide	1.0 g

Water was added to make the total quantity 600 ml.

Liquid D

Silver nitrate	300 g

Water was added to make the total quantity 600 ml.

After the addition, desalting was performed by using an aqueous 5% solution of Demor N (manufactured by Kao Atlas Co., Ltd) and an aqueous 20% solution of magnesium sulfate. The resultant was then mixed with an aqueous gelatin solution to obtain an emulsion consisting of monodispersed cubic grains with an average grain size of 0.85 μm, a variation coefficient of 0.07 and a silver chloride content of 99.5 mol% (EMP-1).

EMP-1 was chemically sensitized to an optimum level by using the following compounds, whereby a blue-sensitive silver halide emulsion was obtained (Em-B).

Sodium thiosulfate	0.8 mg/mol AgX
Chlorauric acid	0.5 mg/mol AgX
Stabilizer STAB-1	6×10^{-4} mol/mol AgX
Sensitizing dye BS-1	4×10^{-4} mol/mol AgX
Sensitizing dye BS-2	1×10^{-4} mol/mol AgX

Preparation of Green-sensitive Silver Halide Emulsion

An emulsion consisting of monodispersed cubic grains with an average grain size of 0.43 μm, a variation coefficient of 0.08 and a silver chloride content of 99.5% (EMP-2) was prepared in substantially the same manner as in the preparation of EMP-1, except that the addition time of liquids A and B and the addition time of liquids C and D were changed.

EMP-2 was then chemically sensitized at 55°C to an optimum level by using the following compounds, whereby a green-sensitive silver halide emulsion (Em-G) was obtained.

Sodium thiosulfate	1.5 mg/mol AgX
Chlorauric acid	1.0 mg/mol AgX
Stabilizer STAB-1	6×10^{-4} mol/mol AgX
Sensitizing dye GS-1	4×10^{-4} mol/mol AgX

Preparation of Red-sensitive Emulsion

An emulsion consisting of monodispersed cubic grains with an average grain size of 0.50 μm, a variation coefficient of 0.08 and a silver chloride content of 99.5% (EMP-3) was prepared in substantially the same manner as in the preparation of EMP-1, except that the addition time of liquids A and B and the addition time of liquids C and D were changed, and that the following metallic compounds were added to liquid C.

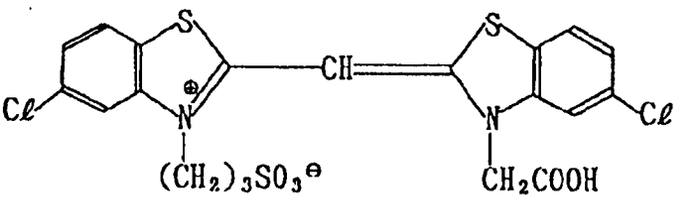
K_2IrC_{16}	3.8×10^{-8} mol/mol AgX
$K_4Fe(CN)_6$	1.2×10^{-5} mol/mol AgX

EMP-3 was then chemically sensitized at 60°C to an optimum level by using the following compounds,

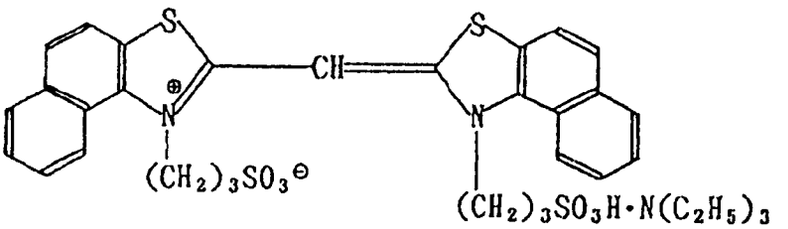
whereby a red-sensitive silver halide emulsion (Em-R) was obtained.

Sodium thiosulfate	1.8 mg/mol AgX
Chlorauric acid	2.0 mg/mol AgX
Stabilizer STAB-1	6×10^{-4} mol/mol AgX
Sensitizing dye RS-12	1×10^{-4} mol/mol AgX

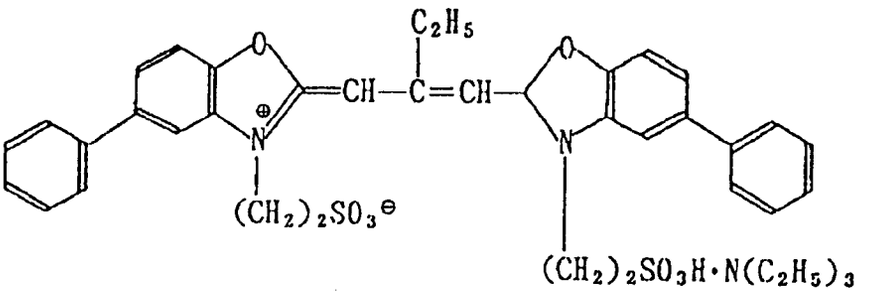
B S − 1



B S − 2



G S − 1



S T A B − 1

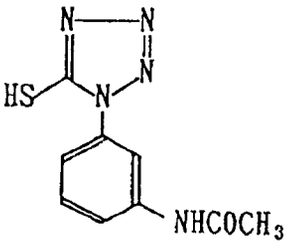


Table 1

Sample No.	Dyes in 4th Layer (mg/m^2)		
	Group A	Group B	Group C
1-1	-	-	-
1-2	-	I-10 (25)	-
1-3	-	I-9 (30)	-
1-4	-	I-5 (30)	-
1-5	-	I-5 (45)	-
1-6	-	-	D-5 (35)
1-7	-	-	XIV-4 (30)
1-8	-	-	XII-3 (40)
1-9	D-2 (33)	-	-
1-10	D-1 (20)	-	-
1-11	D-1 (15)	I-5 (26)	-
1-12	D-3 (12)	I-5 (26)	-
1-13	D-3 (12)	-	XIV-1 (20)
1-14	D-1 (15)	-	D-5 (20)
1-15	D-1 (15)	-	D-4 (25)
1-16	D-1 (25)	-	D-4 (15)
1-17	-	I-1 (12)	XII-18 (20)
1-18	-	I-18 (15)	XIII-1 (23)
1-19	-	VII-2 (12)	XIV-1 (20)
1-20	-	I-5 (15)	XII-8 (23)
1-21	-	VI-7 (15)	XII-8 (23)
1-22	-	IX-4 (15)	XII-8 (30)
1-23	-	X-1 (15)	XII-8 (23)
1-24	-	I-28 (12)	XII-8 (23)
1-25	-	I-28 (18)	XII-8 (23)

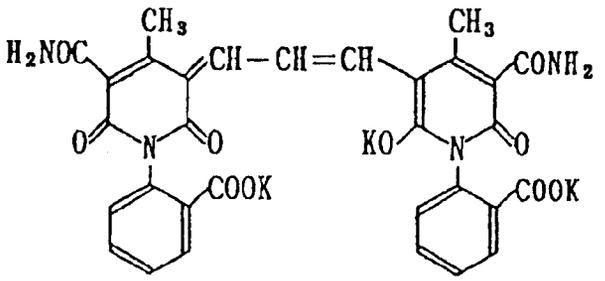
Group A: 580 nm$\leqq\lambda max\leqq$630 nm

Group B: 630 nm$\leqq\lambda max\leqq$680 nm

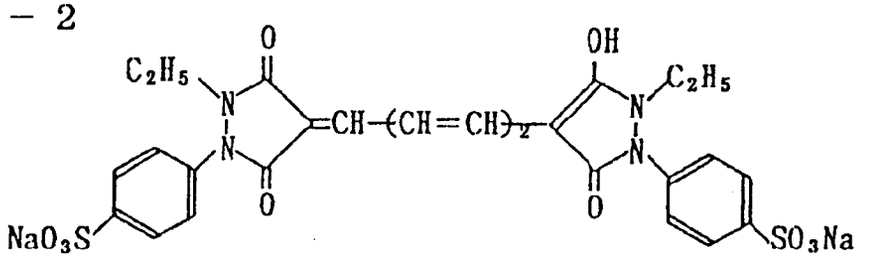
Group C: 680 nm$\leqq\lambda max\leqq$750 nm

Comparative dyes

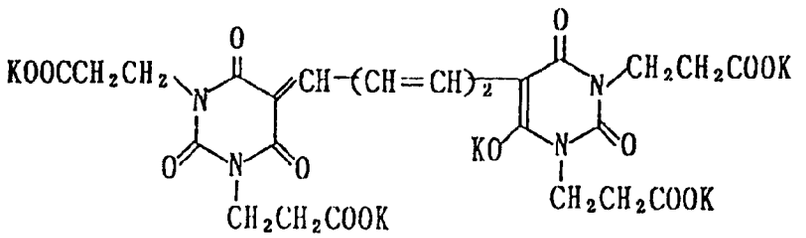
D − 1



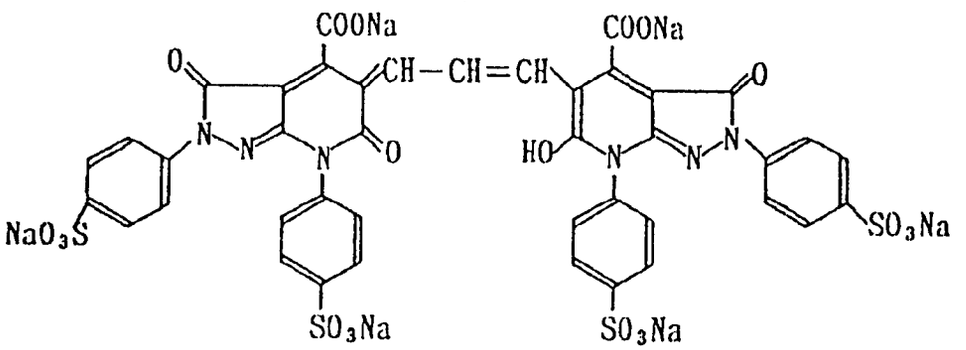
D − 2



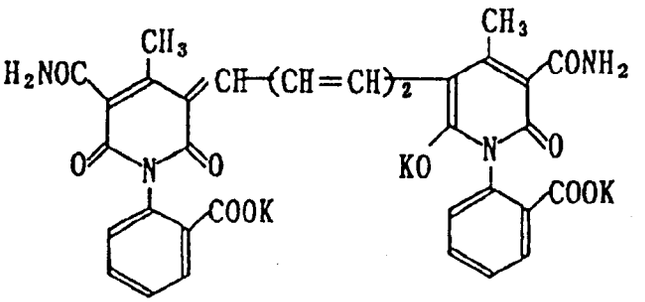
D − 3



D − 4



D – 5



Each of the so-obtained light-sensitive materials was exposed to light in the usual way, and processed according to the following procedure.

Processing procedure	Temperature	Time
Color developing	35.0 ±0.3°C	45 sec
Bleach-fixing	35.0 ±0.5°C	45 sec
Stabilizing	30 to 34°C	90 sec
Drying	60 to 80°C	60 sec

Color developer

Pure water	800 ml
Triethanolamine	10 g
N,N-diethylhydroxylamine	5 g
Potassium bromide	0.02 g
Potassium chloride	2 g
Potassium sulfite	0.3 g
1-hydroxyethylidene-1,1-diphosphonic acid	1.0 g
Ethylenediaminetetracetic acid	1.0 g

Disodium catechol-3,5-disulfonate	1.0 g
N-ethyl-N-β-methanesulfoneamideethyl-3-methyl-4-aminoaniline sulfate	4.5 g
Fluorescent brightener (4,4-diaminostilbene disulfonic acid derivative)	1.0 g
Potassium carbonate	27 g

Water was added to make the total quantity 1 liter, and pH was adjusted to 10.10.

Bleach-fixer

Dihydrate of ferric ammonium ethylenediaminetetracetate	60 g
Ethylenediaminetetracetic acid	3 g
Ammonium thiosulfate (aqueous 70% solution)	100 ml
Ammonium sulfite (aqueous 40% solution)	27.5 ml

Water was added to make the total quantity 1 liter, and pH was adjusted to 5.7 with potassium carbonate or glacial acetic acid.

Stabilizer

5-chloro-2-methyl-4-isothiazoline-3-one	1.0 g
Ethylene glycol	1.0 g
1-hydroxyethylidene-1,1-diphosphonic acid	2.0 g
Ethylenediaminetetracetic acid	1.0 g
Ammonium hydroxide (aqueous 20% solution)	3.0 g
Fluorescent brightener (4,4-diaminostilbene disulfonic acid derivative)	1.5 g

Water was added to make the total quantity 1 liter, pH was adjusted to 7.0 with sulfuric acid or potassium hydroxide.

Then, each light-sensitive material was evaluated for sensitivity, gradation, sharpness, whiteness of background and safe light suitability.

<Sensitivity and Gradation>

Sensitivity and gradation (γvalue) were examined by means of a densitometer (PDA-65, manufactured by Konica Corp.).

Sensitivity (S): Reciprocal of an exposure which gives a reflectance density of 0.8.
Gradation (γ) : Gradient of a straight line connecting a point (log. exposure) at which the reflectance density becomes 0.5 and a point at which the reflectance density becomes 1.5.

<Sharpness>

Using each light-sensitive material, a resolving power testing chart was photographed using red light, and the same processing as mentioned above was performed. Each of the resulting cyan dye image was examined for density by means of a microdensitometer (PDM-5, manufactured by Konica Corp.).

Sharpness (%): (Difference between the maximum density and the minimum density of a portion of an image which contains 5 lines per mm)/(Difference between the maximum density and the minimum density of a portion of an image which contains no lines)

Larger values mean higher sharpness.

<Whiteness of background>

Each light-sensitive material was subjected to continuous processing using a color printer processor (CL-PP1701QA, manufactured by Konica Corp.). CPK-2-20 (manufactured by Konica Corp.) was employed as a processing liquid. The processing was continued until the amount of a replenisher exceeded that immediately after the start. The red light reflectance density (D_R) of the non-exposed area was measured by the same method as mentioned above.

Smaller D_R values represent higher whiteness. D_R should be 0.02 or less. If it exceeds 0.02, users notice the deteriorated whiteness of the non-exposed area. A D_R value exceeding 0.025 makes the photographic image practically unusable.

<Safe light suitability>

A safe light glass for color printing paper (No. 9B, manufactured by Konica Corp.) was fixed to a tungsten light bulb. The resultant was employed as a light source. Each of the light-sensitive materials was exposed to this safe light through an optical wedge for 20 minutes, followed by the same processing as mentioned above.

Each light-sensitive material was then examined for red light reflectance density by means of the same densitometer as mentioned above (PDA-65). Safe light sensitivity (S_{SL}):
Reciprocal of the amount of safe light exposure that gives a reflectance density higher than the minimum density by 0.1.

Safe light suitability:

$$SF = \log(S_{SL}/S_R)$$

where S_{SL} represents safe light sensitivity, and SR represents sensitivity obtained by exposing to red light through a red filter (KodakülLs wratten filter No. 29) for 0.1 sec.

Safe light suitability is indicated as a value relative to that of a control sample (set at 0). Smaller rel. SF values represent higher safe light suitability.

The results are shown in Table 2.

Table 2

Sample No.	Relative sensitivity	Sharpness	Safe light suitability (rel. SF)	Whiteness of background
1-1 (Comparative)	188	0.39	+0.31	0.014
1-2 (Comparative)	101	0.69	+0.02	0.015
1-3 (Comparative)	97	0.68	+0.03	0.016
1-4 (Comparative)	100	0.67	0	0.018
1-5 (Comparative)	70	0.74	-0.05	0.021
1-6 (Comparative)	117	0.72	+0.21	0.022
1-7 (Comparative)	112	0.74	+0.19	0.019
1-8 (Comparative)	120	0.73	+0.23	0.017
1-9 (Comparative)	159	0.47	-0.05	0.018
1-10 (Comparative)	175	0.44	-0.03	0.017
1-11 (Comparative)	94	0.68	-0.02	0.019
1-12 (Comparative)	95	0.67	-0.01	0.019
1-13 (Comparative)	108	0.72	+0.02	0.018
1-14 (Comparative)	111	0.71	+0.03	0.023
1-15 (Comparative)	106	0.71	+0.02	0.021
1-16 (Comparative)	107	0.60	-0.01	0.020
1-17 (Invention)	103	0.75	-0.03	0.017
1-18 (Invention)	101	0.80	-0.02	0.016
1-19 (Invention)	99	0.82	-0.02	0.017
1-20 (Invention)	107	0.79	-0.01	0.017
1-21 (Invention)	116	0.77	-0.05	0.017
1-22 (Invention)	104	0.84	-0.03	0.015
1-23 (Invention)	105	0.84	-0.02	0.017
1-24 (Invention)	107	0.80	-0.04	0.015
1-25 (Invention)	100	0.83	-0.03	0.016

Sensitivity was indicated as a value relative to that of sample No. 1-4 which was set at 100. Also, safe light suitability was indicated as a value relative to that of sample No. 1-4 which was set at 0.

From the results, it is understood that the combined use of a dye of group B (630 nm$\leqq\lambda$max$\leqq$680 nm) and a dye of group C (630 nm$\leqq\lambda$max$\leqq$750 nm) (sample Nos. 17-25) resulted in significantly improved sharpness and safe light suitability. Comparative sample Nos. 1 to 16, in each of which dyes were employed in the combination manner falling outside the scope of the invention, were not satisfactory in sharpness, safe light suitability, sensitivity and whiteness. The samples of the invention were also found to be excellent in sensitivity and whiteness of background.

Example 2

Light-sensitive materials (Sample Nos. 2-1 to 17) were prepared in substantially the same manner as in the preparation of Sample No. 1-1, except that the yellow coupler Y-8, the magenta coupler MC-10 in the 3rd layer and the cyan coupler in the 5th layer were replaced by YC-10, MC-13 and CC-3 (equimolar), respectively, a dye AI-2 was added to the intermediate layer in an amount of 7 mg/m^2, the red-sensitive emulsion Em-R in

the 5th layer was replaced by those shown in Table 3, and the dye in the 4th layer was changed to those shown in Table 3.

Preparation of Red-sensitive Silver Halide Emulsion

To 1,000 ml of an aqueous 2% gelatin solution that had been heated to 40°C, liquids A and B were added by the double-jet method over a period of 15 minutes, while controlling pAg and pH to 6.5 and 3.0, respectively. Then, liquids C and D were added also by the double-jet method over a period of 110 minutes, while controlling pAg and pH to 7.5 and 5.5, respectively.

Liquid A

Sodium chloride	3.18 g
Potassium bromide	0.35 g

Water was added to make the total quantity 200 ml.

Liquid B

Silver nitrate	10 g

Water was added to make the total quantity 200 ml.

Liquid C

Sodium chloride	95.9 g
Potassium bromide	13.7 g
K_2IrC_{16}	0.03 mg
$K_4Fe(CN)_6$	8.0 mg

Water was added to make the total quantity 600 ml.

Liquid D

Silver nitrate	300 g

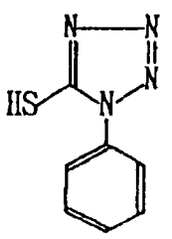
Water was added to make the total quantity 600 ml.

After the addition, desalting was performed by using an aqueous 5% solution of Demor N (manufactured by Kao Atlas, Co., Ltd.) and an aqueous 20% solution of magnesium sulfate. The resultant was then mixed with an aqueous gelatin solution, whereby an emulsion consisting of cubic monodispersed grains with an average grain size of 0.52 μm, a variation coefficient of 0.08 and a silver chloride content of 93.0 mol% (EMP-4).

EMP-4 was then subjected to chemical ripening to an optimum level at 60°C by using the following compounds, thereby to obtain a red-sensitive silver halide emulsion (Em-R-11).

Sodium thiosulfate	2.2 mg/mol AgX
Chlorauric acid	2.0 mg/mol AgX
Stabilizer STAB-2	5×10^{-4} mol/mol AgX
Sensitizing dye SR-15	1.5×10^{-4} mol/mol AgX

STAB-2



A I − 1

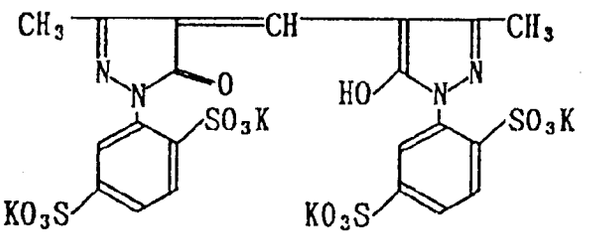


Table 3

Sample No.	Red-sensitive emulsion in the 5th layer	Dyes in the 4th layer (mg/m^2)		
		Group A	Group B	Group C
2-1	Em-R-II	-	I-24 (30)	-
2-2	Em-R-II	D-1 (25)	-	-
2-3	Em-R-II	D-1 (15)	I-24 (25)	-
2-4	Em-R-II	D-1 (15)	-	D-4 (20)
2-5	Em-R-II	-	I-9 (15)	D-4 (20)
2-6	Em-R-II	-	VII-2 (12)	XII-3 (20)
2-7	Em-R-II	-	I-7 (15)	XV-1 (20)
2-8	Em-R-II	-	I-22 (15)	XII-18 (20)
2-9	Em-R	-	I-24 (30)	-
2-10	Em-R	D-1 (25)	-	-
2-11	Em-R	D-1 (15)	I-24 (25)	-
2-12	Em-R	D-1 (15)	-	D-4 (20)
2-13	Em-R	-	I-9 (15)	D-4 (20)
2-14	Em-R	-	VII-2 (12)	XII-3 (20)
2-15	Em-R	-	I-7 (15)	XV-1 (20)
2-16	Em-R	-	I-22 (15)	XII-18 (20)
2-17	Em-R	-	I-6 (15)	XII-18 (20)

Group A: 580 nm$\leqq\lambda max\leqq$630 nm

Group B: 630 nm$\leqq\lambda max\leqq$680 nm

Group C: 680 nm$\leqq\lambda max\leqq$750 nm

Each of the samples was exposed, processed and evaluated in the same manner as in Example 1, and the results obtained are shown in Table 4.

Table 4

Sample No.	Relative sensitivity	Sharpness	Safe light suitability (rel. SF)	Whiteness of background
2-1	82	0.64	-0.05	0.014
2-2	135	0.43	-0.17	0.013
2-3	77	0.66	-0.12	0.014
2-4	86	0.69	-0.09	0.017
2-5	83	0.78	-0.08	0.017
2-6	86	0.80	-0.08	0.014
2-7	84	0.84	-0.09	0.014
2-8	85	0.82	-0.11	0.014
2-9	100	0.63	0	0.015
2-10	167	0.43	-0.05	0.014
2-11	95	0.65	-0.02	0.015
2-12	106	0.68	+0.02	0.020
2-13	102	0.78	-0.01	0.021
2-14	107	0.79	-0.04	0.017
2-15	104	0.83	-0.05	0.018
2-16	106	0.81	-0.07	0.016
2-17	103	0.83	-0.05	0.016

Sensitivity was indicated as a value relative to that of Sample No. 2-9 which was set at 100. Also, safe light suitability was indicated as a value relative to that of Sample No. 2-9 which was set at 0.

The results shown in Table 4 reveal that sensitivity, sharpness and safe light suitability could be improved most significantly when use was made of a red-sensitive silver halide emulsion with a silver chloride content of 95 mol% or more.

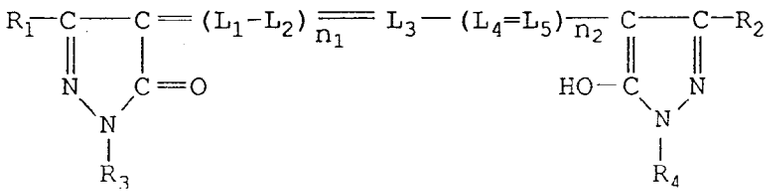
Claims

1. A silver halide photographic light-sensitive material comprising a support and provided thereon at least one silver halide light-sensitive emulsion layer, wherein at least one layer selected from said light-sensitive emulsion layer and other hydrophilic colloidal layers contains at least one dye having an absorption maxima at 630-680 nm (the first dye) and at least one dye having an absorption maxima at 680-750 nm (the second dye), as measured when they are present in a gelatin film.

2. A silver halide photographic light-sensitive material of claim 1, wherein said first dye is a dye selected from

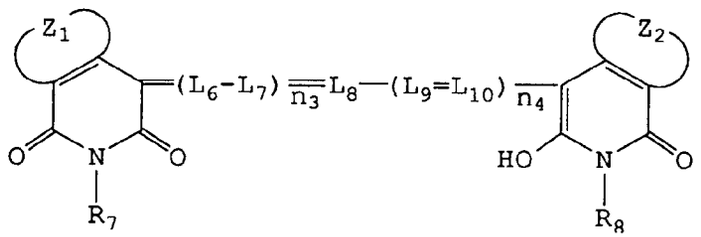
the group consisting of Formula I, Formula II, Formula III, Formula IV, Formula V, Formula VI, Formula VII, Formula VIII, Formula IX, Formula X and Formula XI;

Formula I



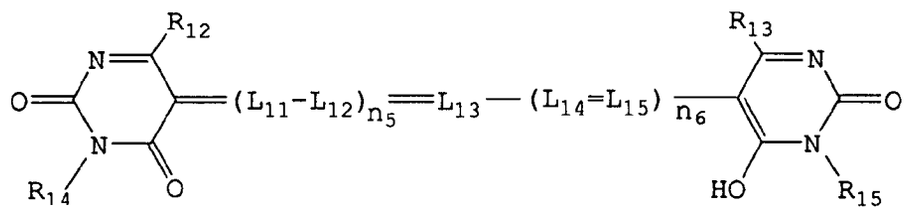
wherein R_1 and R_2 each independently represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_5$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_6$, $-SOR_5$ or a cyano group; R_3 and R_4 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; L_1, L_2, L_3, L_4 and L_5 each represent a methine group; n_1 and n_2 each represent 0 or 1; and R_5 and R_5 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_5 and R_6 may combine with each other to form a 5- or 6-membered ring,

Formula II



wherein R_7 and R_8 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Z_1 and Z_2 each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_6, L_7, L_8, L_9 and L_{10} each represent a methine group; n_3 and n_4 each represent 0 or 1; and R_9, R_{10} and R_{11} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_9 and R_{10} may combine with each other to form a 5- or 6-membered ring, R_{10} and R_{11} may combine with each other to form a 5- or 6-membered ring,

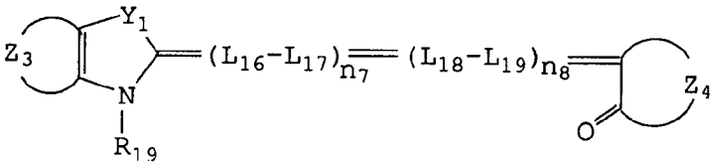
Formula III



wherein R_{12} and R_{13} each represent an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_{16}R_{17}$,$-OR_{16}$, $-N(R_{16})COR_{17}$, $-N(R_{16})SO_2R_{17}$, $-N(R_{16})CONR_{17}R_{18}$, $-COR_{16}$, $-CONR_{16}R_{17}$, $-SO_2R_{16}$, $-SO_2NR_{16}R_{17}$, $-COOR_{16}$ or a cyano group; R_{14} and R_{15} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; R_{16}, R_{17} and R_{18} each-represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_{16} and R_{17} may combine with each other to form a 5- or 6-membered ring,

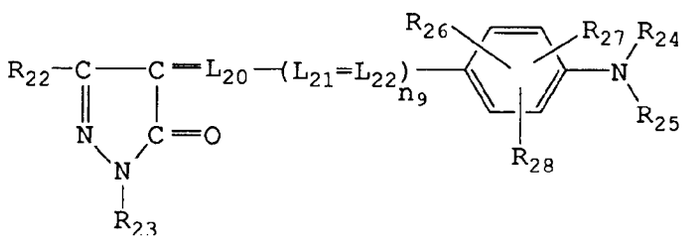
R_{17} and R_{18} may combine with each other to form a 5- or 6-membered ring; L_{11}, L_{12}, L_{13}, L_{14} and L_{15} each represent a methine group; n_3 and n_4 each represent 0 or 1,

Formula IV



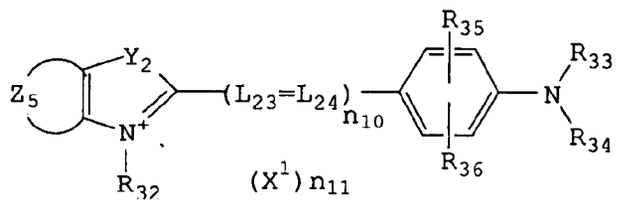
wherein R_{19} represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Y_1 represents an oxygen atom or $=CR_{20}R_{21}$; R_{20} and R_{21} each represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; Z_3 and Z_4 each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_{16}, L_{17}, L_{18} and L_{19} each represent a methine group; n_7 and n_8 each represent 0 or 1; R_{20} and R_{210} may combine with each other to form a 5- or 6-membered ring, R_{10} and R_{11} may combine with each other to form a 5- or 6-membered ring,

Formula V



wherein R_{22} represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_6$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_5$, $-SOR_5$ or a cyano group; R_{23} represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_{24} and R_{25} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_{24} and R_{25} may combine with each other to form a 5- or 6-membered ring; R_{26}, R_{27} and R_{28} each represent a hydrogen atom, a halogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a cyano group, $-COR_{29}$, $-CON_{29}R_{30}$, $-NR_{29}R_{30}$, $-OR_{29}$, $-SO_2R_{29}$, $-N(R_{29})COR_{30}$, $-N(R_{29})SO_2R_{30}$, $-N(R_{29})CONR_{30}R_{31}$, $-SR_{29}$, $-COOR_{29}$ or $-SO_2NR_{29}R_{30}$; L_{20}, L_{21} and L_{22} each represent a methine group; and n_9 each represent 0 or 1;

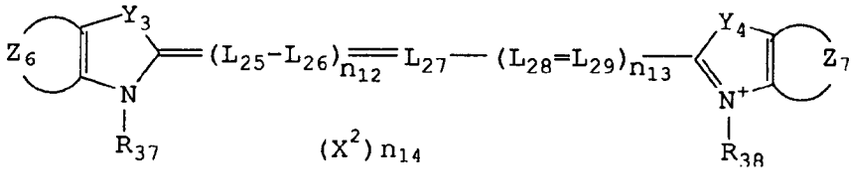
Formula VI



wherein R_{32} represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; R_{33} and R_{34} each represent a hydrogen

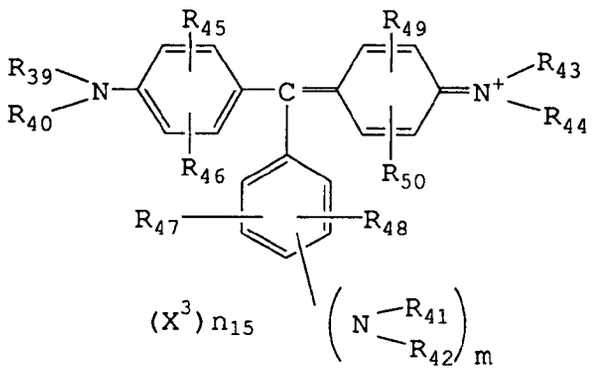
atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_{33} and R_{34} may combine with each other to form a 5- or 6-membered ring; R_{35} and R_{36} each represent a hydrogen atom, a halogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a cyano group, $-COR_{29}$, $-CON_{29}R_{30}$, $-NR_{29}R_{30}$, $-OR_{29}$, $-SO_2R_{29}$, $-N(R_{29})COR_{30}$, $-N(R_{29})SO_2R_{30}$, $-N(R_{29})CONR_{30}R_{31}$, $-SR_{29}$, $-COOR_{29}$ or $-SO_2NR_{29}R_{30}$; Y_2 represents an oxygen atom or $=CR_{20}R_{21}$; R_{20} and R_{21} each represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; Z_5 represents a group of non-metallic atoms which are necessary to form a 5-or 6-membered ring; L_{23} and L_{24} each represent a methine group; n_{10} represents 0 or 1; X^1 represents a group capable of being dissociated into anions; and n_{11} represents 0, 1 or 2; R_{33} and R_{34} may combine with each other to form a 5- or 6-membered ring,

Formula VII



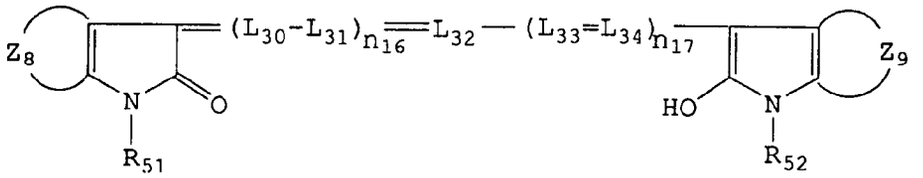
wherein R_{37} and R_{38} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Y_3 and Y_4 each represent an oxygen atom or $=CR_{20}R_{21}$; R_{20} and R_{21} each represents a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; Z_6 and Z_7 each represent a group of non-metallic atoms which are necessary to form a 5-or 6-membered ring; L_{25}, L_{26}, L_{27}, L_{28} and L_{29} each represent a methine group; n_{12} and n_{13} each represent 0 or 1; X^2 represents a group capable of being dissociated into anions; and n_{14} represents 0, 1 or 2,

Formula VIII



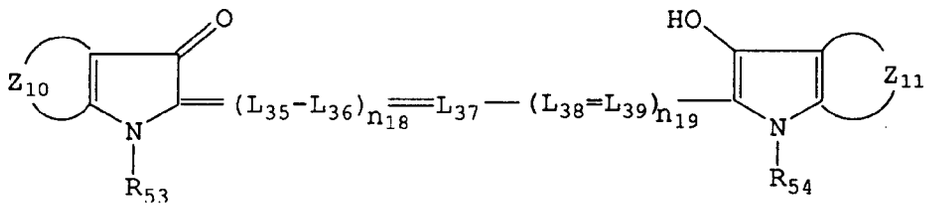
wherein R_{39}, R_{40}, R_{41}, R_{42}, R_{43} and R_{44} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; R_{39} and R_{40} may combine with each other to form a 5- or 6-membered ring, R_{41} and R_{42} may combine with each other to form a 5- or 6-membered ring, R_{43} and R_{44} may combine with each other to form a 5- or 6-membered ring, R_{45}, R_{46}, R_{47}, R_{48}, R_{49} and R_{50} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a cyano group, $-COR_{29}$, $-CON_{29}R_{30}$, $-NR_{29}R_{30}$, $-OR_{29}$, $-SO_2R_{29}$, $-N(R_{29})COR_{30}$, $-N(R_{29})SO_2R_{30}$, $-N(R_{29})CONR_{30}R_{31}$, $-SR_{29}$, $-COOR_{29}$ or $-SO_2NR_{29}R_{30}$; X^3 represents a group capable of being dissociated into anions; and n_{15} represents 0, 1 or 2, m represents 0 or 1;

Formula IX



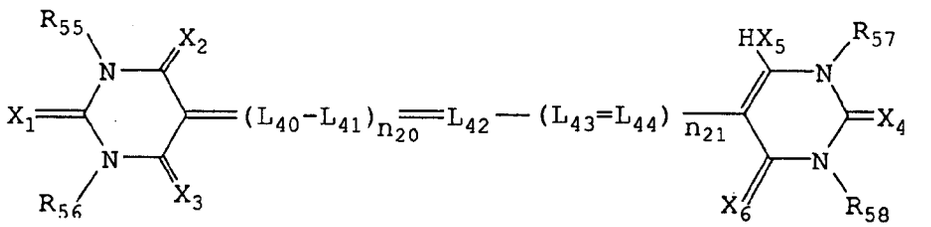
wherein R_{51} and R_{52} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Z8 and Z_9 each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_{30}, L_{31}, L_{32}, L_{33} and L_{34} each represent a methine group; n_{16} and n_{17} each represent 0 or 1;

Formula X



wherein R_{53} and R_{54} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; Z_{10} and Z_{11} each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring; L_{35}, L_{36}, L_{37}, L_{38} and L_{39} each represent a methine group; n_{18} and n_{19} each represent 0 or 1;

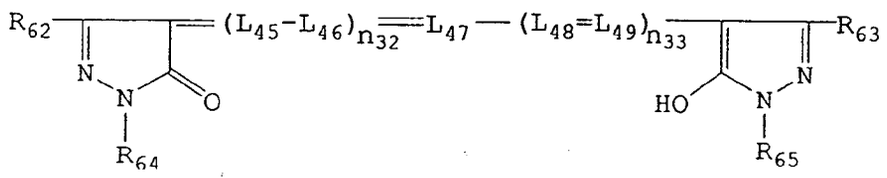
Formula XI



wherein R_{55}, R_{56}, R_{57} and R_{58} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_9R_{10}$, $-N(R_9)CONR_{10}R_{11}$, $-N(R_9)COR_{10}$ or $-N(R_9)SO_2R_{10}$; X_1, X_2, X_3, X_4, X_5 and X_6 each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a hydroxy group or $-OR_{61}$; R_{51} represents an alkyl group or an aryl group; and n_{20} and n_{21} each represent 0 or 1.

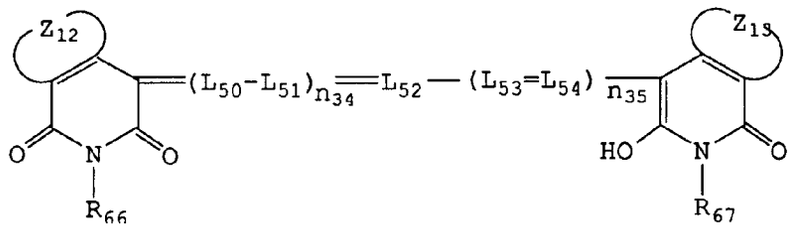
3. A silver halide photographic light-sensitive material of claim 1, wherein said second dye is a dye selected from the group consisting of Formula XII, Formula XIII, Formula XIV and Formula XV;

Formula XII



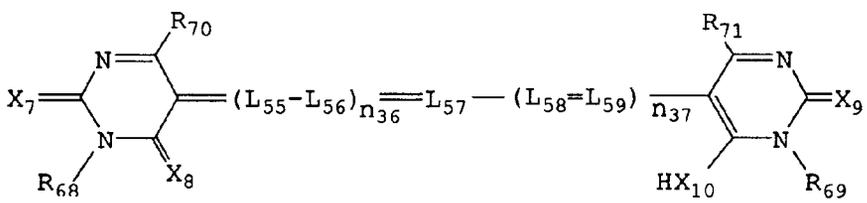
wherein R_1 and R_2 each independently represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_5$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_6$, $-SOR_5$ or a cyano group; R_{64} and R_{65} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group; L_{45}, L_{46}, L_{47}, L_{48} and L_{49} each represent a methine group; n_{32} and n_{33} each represent 1 or 2;

Formula XIII



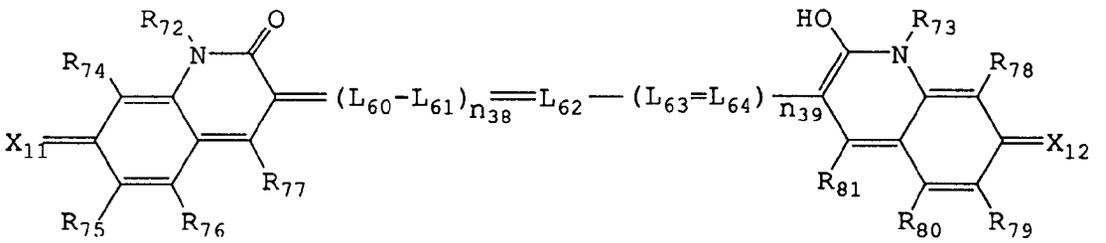
wherein R_{66} and R_{67} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_6$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_6$, $-SOR_5$ or a cyano group; Z_{12} and Z_{13} each represent a group of non-metallic atoms which are necessary to form a 5- or 6-membered ring: L_{50}, L_{51}, L_{52}, L_{53} and L_{54} each represent a methine group; n_{34} and n_{35} each represent 1 or 2;

Formula XIV



wherein R_{68} and R_{69} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_5$, $-OR_5$, $-NR_5R_6$, $-SR_5$, $-SO_2R_5$, $-COR_5$, $-SO_2NR_5R_6$, $-SOR_5$ or a cyano group; R_{70} and R_{71} each represent an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-NR_{16}R_{17}$, $-OR_{16}$, $-N(R_{16})COR_{17}$, $-N(R_{16})SO_2R_{17}$, $-N(R_{16})CONR_{17}R_{18}$, $-COR_{16}$, $-CONR_{16}R_{17}$, $-SO_2R_{16}$, $-SO_2NR_{16}R_{17}$, $-COOR_{16}$ or a cyano group; X_7,X_8, X_9, and X_{10} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a hydroxy group or $-OR_{61}$; L_{55}, L_{56}, L_{57}, L_{58} and L_{59} each represent a methine group; n_{36} and n_{37} each represent 1 or 2;

Formula XV



wherein R_{72} and R_{73} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, $-CONR_5R_6$, $-OR_6$, $-NR_5R_6$, $-SR_6$, $-SO_2R_5$, $-COR_6$, $-SO_2NR_6R_6$, $-SOR_6$ or a cyano group; R_{74}, R_{75}, R_{76}, R_{77}, R_{78}, R_{79}, R_{60} and R_{61} each represent a hydrogen atom, a halogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a cyano group, $-COR_{29}$, $-CON_{29}R_{30}$, $-NR_{29}R_{30}$, $-OR_{29}$, $-SO_2R_{29}$, $-N(R_{29})\ COR_{30}$, $-N(R_{29})\ SO_2R_{30}$, $-N(R_{29})\ CONR_{30}R_{31}$, $-SR_{29}$, $-COOR_{29}$ or $-SO_2NR_{29}R_{30}$; X_{11} and X_{12} each represent a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, a heterocyclic group, a hydroxy group or $-OR_{61}$; R_{61} represents an alkyl group or an aryl group; L_{60}, L_{61}, L_{62}, L_{63} and L_{64} each represent a methine group; n_{38} and n_{39} each represent 0, 1 or 2.

4. A silver halide photographic light-sensitive material of claim 1, wherein at least one of said silver halide light-sensitive emulsion layers comprises a silver halide emulsion with a silver chloride content of 95 mol % or more.

5. A silver halide photographic light-sensitive material of claim 1, wherein the total amount of binders contained in said silver halide light-sensitive emulsion layers and other hydrophilic colloidal layers is 8.0 g/m^2 or less.

6. A silver halide photographic light-sensitive material comprising a support and provided thereon at least one silver halide light-sensitive emulsion layer, wherein at least one layer selected from said light-sensitive emulsion layer and other hydrophilic colloidal layers contains at least one dye having an absorption maxima at 630-680 nm (the first dye) and at least one dye having an absorption maxima at 680-750 nm (the second dye), as measured when they are present in a gelatin film, at least one of said silver halide light-sensitive emulsion layers comprises a silver halide emulsion with a silver chloride content of 95 mol % or more, the total amount of binders contained in said silver halide light-sensitive emulsion layers and other hydrophilic colloidal layers is 8.0 g/m^2 or less.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 3642

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 362 734 (KONICA) * page 10; example 54 * * page 15, line 33 - line 34 * * page 22, line 3 - page 23, line 40 * ---	1-6	G03C1/83
Y	US-A-4 801 525 (MIHARA ET AL.) * column 3, line 52 - line 56 * * column 5; example I1 * * column 13, line 57 - line 64 * ---	1-6	
Y	US-A-4 215 030 (OKITA ET AL.) * claim 1 * ---	1-6	
D,Y	PATENT ABSTRACTS OF JAPAN vol. 14, no. 551 (P-1139)(4494) 7 December 1990 & JP-A-2 235 046 (FUJI) 18 September 1990 * abstract * ---	1-6	
Y	DE-A-2 951 789 (FUJI) * page 15, line 13 - page 22 * ---	2	
Y	EP-A-0 342 939 (KONICA) * page 4; example 1 * ---	2	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
Y	US-A-4 078 933 (SUGIYAMA ET AL.) * column 4, line 1 - column 8, line 13; claim 1 * ---	2	G03C
Y	PATENT ABSTRACTS OF JAPAN vol. 7, no. 32 (P-174)(1177) 8 February 1983 & JP-A-57 185 038 (KONISHIROKU) 15 November 1982 * abstract * ---	2	
Y	PATENT ABSTRACTS OF JAPAN vol. 9, no. 299 (P-408)(2022) 27 November 1985 & JP-A-60 135 936 (KONISHIROKU) 19 July 1985 * abstract * ---	2	
	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 JUNE 1992	MAGRIZOS S.

CATEGORY OF CITED DOCUMENTS

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Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	PATENT ABSTRACTS OF JAPAN vol. 13, no. 185 (P-865)(3533) 2 May 1989 & JP-A-1 013 543 (KONICA) 18 January 1989 * abstract * ---	2	
Y	PATENT ABSTRACTS OF JAPAN vol. 14, no. 1 (P-985)(3944) 8 January 1990 & JP-A-1 253 735 (KONICA) 11 October 1989 * abstract * -----	3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 JUNE 1992	MAGRIZOS S.

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