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(54) **Process for developing silver halide colour reversal photograhic material.**

(57) Disclosed is a process for developing a silver halide color reversal photographic material comprising a support having provided thereon at least one red-sensitive silver halide emulsion layer, green-sensitive silver halide emulsion layer and blue-sensitive silver halide emulsion layer, wherein at least one silver halide emulsion layer contains tabular silver halide grains having an aspect ratio of at least 5 occupying at least 50% of all silver halide grains existing in the same layer as a projected area, and having a mean sphere-corresponding grain size of 0.30 μm or less, which comprises developing said color reversal photographic material with a black-and-white developing solution for 100 seconds or less, thereby giving the sufficient multilayer effect even in processing in which the black-and-white developing time is short.

EP 0 426 181 A2

PROCESS FOR DEVELOPING SILVER HALIDE COLOR REVERSAL PHOTOGRAPHIC MATERIAL

FIELD OF THE INVENTION

The present invention relates to a process for developing silver halide color reversal photographic materials excellent in color reproducibility.

BACKGROUND OF THE INVENTION

Usually, a color reversal photographic material has a plurality of silver halide emulsion layers different in color sensitivity such as a red sensitive layer, a green sensitive layer and a blue sensitive layer on a support. The color reversal photographic material which has been image exposed to a polychromatic object is first subjected to black-and-white silver development at a first developing stage, and then the residual silver halide is color developed at a second developing stage through a chemical or optical fogging stage to form cyan, magenta and yellow color images. A dye image usually formed on each color sensitive layer by polychromatic exposure is different from a dye image produced by monochromatic exposure. In the case of the color reversal photographic material, this difference is mainly caused by the transfer of a development restrainer such as iodine ions generated between the emulsion layers different in color sensitivity at the black-and-white developing stage. The dye image difference between the polychromatic exposure and the monochromatic exposure caused by such development is called a multilayer effect or an inter image effect as described in Hudson and Horton, Journal of the Optical Society of America 42 (No. 9), pp. 663 to 669 (1976), and known to be available for improving sharpness and color reproducibility.

As a technique to enhance the multilayer effect, JP-A-51-128528 (the term "JP-A" as used herein means an "unexamined published Japanese patent application") discloses a process for enhancing the multilayer effect given to a sensitive silver halide emulsion layer by introducing an emulsion which has fogged the surfaces of silver halide grains into the sensitive silver halide emulsion layer.

Research Disclosure No. 13553 (1975) also discloses a process for application of the preferable multilayer effect by iodine ions in a color reversal photographic material, which comprises adding an emulsion containing a silver halide so as to release the iodine ion such as AgBrI, AgClI or AgBrClI to at least one layer to which the multilayer effect is applied, adding a hydrophilic colloid as well as usual emulsion grains to at least one layer to which the multilayer effect is given, and further adding another surface fogging emulsion. However, the above-described references do not fully disclose the features of the more preferred sensitive silver halide emulsion in enhancing the multi layer effect utilizing the fogging emulsion.

At the black-and-white developing stage of the color reversal photographic materials the sensitive silver halide emulsion is developed depending on the amount of exposure. At that time, the silver halide emulsion grains not developed are subjected to the color developing processing through the fogging stage. This color developing stage is required to develop all the residual silver halide to develop color, so that its developing activity is designed to be high. For this reason, it is substantially almost impossible to make the multilayer effect function at the color developing stage, and, in the color reversal photographic materials, the multilayer effect is substantially determined by the black-and-white developing stage.

At this black-and-white developing stage, the developing solution has the effect of dissolving the emulsion grains. This solubility is controlled by the iodine ions diffused by the development of the other layers, whereby the multilayer effect is obtained. Although the multilayer effect is produced according to many mechanisms, the most important mechanism of them is the above one.

The emulsion dissolving effect of this developing solution is enhanced with increasing the developing time. Hence, when the processing time of the black-and-white developing stage is short, it is difficult to apply the sufficient multilayer effect to the conventional color reversal photographic materials, compared to the case in which the processing time is long.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a process giving the sufficient multilayer effect even in processing in which the black-and-white developing time is short.

The object of the present invention is attained by a process for developing a silver halide color reversal photographic material comprising a support having provided thereon at least one red-sensitive silver halide emulsion layer, green-sensitive silver halide emulsion layer and blue-sensitive silver halide emulsion layer, wherein at least one silver halide emulsion layer contains tabular silver halide grains having an aspect ratio of at least 5 occupying at least 50% of all silver halide grains existing in the same layer as a projected area, and having a mean sphere-corresponding grain size of 0.30 μm or less, which comprises developing said color reversal photographic material with a black-and-white developing solution for 100 seconds or less.

DETAILED DESCRIPTION OF THE INVENTION

It is preferred that the mean sphere-corresponding grain size of the silver halide emulsion grains contained in at least one emulsion layer is 0.25 μm or less. The lower limit thereof is preferably 0.1 μm from the view point of sensitivity.

The measuring methods of the mean sphere-corresponding grain size of silver halide grains are described in detail, for example, in James, The Theory of Photographic Process , the 4th edition, page 100. Such methods include methods using an optical microscope, an electron microscope and a coulter counter. When the size of such a degree as the size of the emulsion grains of the present invention is measured, a method is preferably used in which the thickness of the grains is determined from the projected area of the grains and the length of shadows obtained by shadowing, using an electron microscope, the volume of each grain is determined therefrom, and the mean sphere- corresponding grain size is determined from the mean value thereof.

As the silver halide grains used in the present invention, monodisperse emulsions narrow in grain size distribution or polydisperse emulsions wide in grain size distribution may be used.

In the present invention, at least one sensitive emulsion layer contains the tabular silver halide emulsion grains having a mean sphere-corresponding grain size of 0.30 μm or less and an aspect ratio of at least 5 so as to occupy at least 50% of all silver halide grains existing in the same layer as a projected area. It is further preferred that at least one layer contains tabular silver halide emulsion grains having an aspect ratio of at least 8 so as to occupy at least 50% of all silver halide grains existing in the same layer as a projected area. The aspect ratio called here means the ratio of diameter to thickness of the emulsion grain.

Further, the diameter of the silver halide grain means the diameter of a circle whose area is the same as the projected area of the grain. In general, the tabular silver halide grain has two planes parallel to each other, and the thickness called here is represented by the distance between the two parallel planes constituting the tabular silver halide grain.

Any of silver bromide, silver iodide, silver iodobromide, silver chlorobromide, silver chloroiodobromide and silver chloride may be used as the tabular silver halide grains. However, silver bromide and silver iodobromide are preferably used. In particular, it is preferred that silver iodobromide having a silver iodide content of 0.01 to 30 mol%, more preferably 0.5 to 10 mol%, is used.

Methods for preparation of the tabular silver halide grains are hereinafter described.

The tabular silver halide grains can be prepared by suitable combinations of methods known in the art.

For example, the tabular silver halide grains can be obtained by simultaneous addition of silver and a halogen solution with maintaining the pBr value as relatively low as 1.3 or less.

The size of the tabular silver halide grains can be adjusted by temperature control, selection of the kind or amount of solvent, selection of the kind of silver salt used on grain growth and control of the addition rate of the halide.

When the tabular silver halide grains of the present invention is prepared, solvents for silver halides can be used as required.

The solvents for silver halides frequently used include ammonia, thioethers and thiourea compounds. For the thioethers, reference can be made to U.S. Patents 3,271,157, 3,790,387 and 3,574,628.

In addition, methods for preparation of the tabular silver halide grains are described in Gutoff, Photographic Science and Engineering , Vol. 14, pages 248 to 257 (1970), U.S. Patents 4,434,226, 4,414,310, 4,433,048 and 4,439,520 and British patent 2,112,157.

The above-described at least one sensitive emulsion layer means at least one layer of the red-sensitive emulsion layer, the green-sensitive emulsion layer and the blue-sensitive emulsion layer. Each of the above-described emulsion layers may consist of a plurality of layers having a similar spectral sensitivity as long as

at least one of those layers meets the above-described requirements. However, a low-sensitive emulsion layer is preferably used from the viewpoint of sensitivity. When a layer having yellow colloidal silver is contained, it is preferred that an emulsion layer in most close proximity thereto meets the above-described requirements.

This yellow colloidal silver is known to be prepared by various methods.

S. Inoue, Preparative Experiments of Inorganic Chemistry , page 647 discloses the method of reducing silver nitrate with dextrin under alkaline conditions, the method of reducing silver nitrate with tannin under alkaline conditions, the method of reducing silver nitrate with hydrazine and the method of reducing silver oxide with sodium carbonate and hydrogen peroxide in the presence of a silver sol reduced with phosphorus.

Silver halide grains used in the present invention, other than the tabular silver halide grains which have a mean sphere-corresponding grain size of 0.30 μm or less and an aspect ratio of at least 5, are hereinafter described. The silver halide grains may have a regular crystal form such as a cubic, an octahedral or a tetradecahedral form, an irregular crystal form such as a spherical or a tabular form, crystalline defects such as a twin plane, or a composite form thereof.

The silver halide grains may be fine grains having a grain size of about 0.2 micron or less or large sized grains having a projected area diameter of up to about 10 microns. The silver halide grains may be used as a monodisperse emulsion or a polydisperse emulsion. A monodisperse emulsion having a coefficient of variation of not more than 20% is preferably used.

Such photographic silver halide emulsions can be prepared by using the methods described in Research Disclosure No. 17643, pages 22 and 23, I. "Emulsion Preparation and Types" (December, 1978), ibid. , No. 18716 (November, 1979), P. Glafkides, Chimie et Physique Photographique , (Paul Montel, 1967), G.F. Duffin, Photographic Emulsion Chemistry (Focal Press, 1966) and V.L. Zelikman et al, Making and Coating Photographic Emulsion (Focal Press, 1964).

The monodisperse emulsions described in U.S. Patents 3,574,628 and 3,655,394 and British Patent 1,413,748 are also preferably used.

The silver halide emulsions used in the photographic materials of the present invention are generally subjected to physical ripening, chemical ripening and spectral sensitization, and then used. The above-described emulsion grains may be of a so-called surface latent image type in which latent images are mainly formed on the surface of the grains or of a so-called internal latent image type in which the latent images are mainly formed in the insides of the grains. Additives used in such stages are described in Research Disclosure No. 17643 and ibid. , No. 18716, and the corresponding portions are summarized in a table shown later.

The crystal structure may be uniform, or the interior and the exterior of the grain may be composed of different halogen compositions, respectively. The crystal structure may also be a laminar structure. Silver halides different in composition may be joined together by epitaxial junction. Further, silver halides may be joined to compounds other than silver halides, such as silver rhodanine and lead oxide.

Mixtures of grains of various crystal forms may be used.

Known photographic additives which can be used in the present invention are also described in the two Research Disclosure references mentioned above, and the corresponding portions are indicated in the table shown later.

Kind of Additive	RD 17643	RD 18716
1. Chemical sensitizers	Page 23	Page 648, right column
2. Sensitivity increasing agents		- ditto -
3. Spectral sensitizers, supersensitizers	Pages 23 to 24	Page 648, right column to page 649, right column
4. Brightening agents	Page 24	
5. Antifoggants and stabilizers	Pages 24 to 25	Page 649 right column
6. Light absorbers, filter dyes, ultraviolet absorbers	Pages 25 to 26	Page 649, right column to page 650, left column
7. Stain inhibitors	Page 25, right column	Page 650, left column to right column
8. Dye image stabilizers	Page 25	
9. Hardeners	Page 26	Page 651, left column
10. Binders	Page 26	- ditto -
11. Plasticizers, lubricants	Page 27	Page 650, right column
12. Coating aids, surfactants	Pages 26 to 27	- ditto -
13. Antistatic agents	Page 27	- ditto -

As preservatives, in addition to phenol, there can be used phenoxyethanol compounds, p-hydroxybenzoic butylate, Proxel (benzoisothiazoline) and sodium salicylate.

Various color couplers can be used in the present invention. Specific examples thereof are described in the patent specifications cited in the above-described Research Disclosure No. 17643, VII-C to G.

As yellow couplers, there can be preferably used the compounds described, for example, in U.S. Patents 3,933,501, 4,022,620, 4,326,024 and 4,401,752, JP-B-58-10739 (the term "JP-B" as used herein means an "examined Japanese patent publication"), British Patents 1,425,020 and 1,476,760.

As magenta couplers, 5-pyrazolone and pyrazoloazole compounds are preferably used, and there are particularly preferred the compounds described in U.S. Patents 4,310,619 and 4,351,987, European Patent 73,636, U.S. Patents 3,061,432 and 3,725,067, Research Disclosure , No. 24220 (June, 1984), JP-A-60-33552, Research Disclosure , No. 24230 (June, 1984), JP-A-60-43659, U.S. Patents 4,500,630 and 4,540,654.

Cyan couplers include phenol and naphthol compounds, and there are preferably used the compounds described in U.S. Patents 4,052,212, 4,146,396, 4,228,233, 4,296,200, 2,369,929, 2,801,171, 2,772,162, 2,895,826, 3,772,002, 3,758,308, 4,334,011 and 4,327,173, West German Patent (OLS) 3,329,729, European Patent 121,365A, U.S. Patents 3,446,622, 4,333,999, 4,451,559 and 4,427,767, and European Patent 161,626A.

As couplers which give formed dyes having appropriate diffusivity, there are preferably used the compounds described in U.S. Patent 4,366,237, British Patent 2,125,570, European Patent 96,570 and West German Patent (OLS) 3,234,533.

Typical examples of polymerized dye-forming couplers are described in U.S. Patents 3,451,820, 4,080,211 and 4,367,282, and British Patent 2,102,173.

Couplers which release photographically useful residues in coupling can also be preferably used in the present invention. As DIR couplers which release development inhibitors, there are preferred the compounds described in JP-A-57-151944, JP-A-57-154234, JP-A-60-184248 and U.S. Patent 4,248,962 cited in the above-described Research Disclosure , No. 17643, Item VII-F.

As couplers which release nucleating agents or development accelerators in the form of images on development, there are preferably used the compounds described in British patents 2,097,140 and 2,131,188, JP-A-59-157638 and JP-A-59-170840.

Other couplers which can be used in the photographic materials in the present invention include the competitive couplers described in U.S. Patent 4,130,427, the multiequivalent couplers described in U.S. Patents 4,283,472, 4,338,393 and 4,310,618, the couplers which release DIR redox compounds described in JP-A-60-185950, and the couplers which release dyes recolored after separation described in European

Patent 173,302A.

The couplers used in the present invention can be incorporated in the photographic materials by various known dispersion methods.

Examples of high boiling solvents which can be used in oil-in-water dispersion methods are described in U.S. Patent 2,322,027.

The stages and effects of latex dispersion methods and specific examples of latexes for impregnation are described in U.S. patent 4,199,363, West German Patents (OLS) 2,541,274 and 2,541,230.

To the photographic materials used in the present invention can be preferably added the development inhibiting compound-releasing hydroquinones described in U.S. Patents 3,379,529 and 3,639,417, and the development inhibiting compound-releasing naphthohydroquinones described in Research Disclosure , No. 18264 (June, 1979).

Appropriate supports which can be used in the present invention are described, for example, in the above-described Research Disclosure , No. 17643, page 28 and ibid. , No. 18716, the right column of page 647 to the left column of page 648.

Processing solutions and processing stages for the color reversal photographic materials of the present invention are hereinafter described.

The first developing (black-and-white developing) stage for the color reversal photographic materials of the present invention is conducted for 100 seconds or less. When this stage is conducted for 60 seconds or less, the effect of the present invention becomes more remarkable. It is preferred from the viewpoint of productivity that the first developing time is shorter.

Of the processing stages for the color reversal photographic materials of the present invention, the stages from black-and-white development (first development) to color development are as follows:

1. Black and white development - Washing - Reversal - Color development
2. Black and white development - Washing - Optical reversal - Color development
3. Black and white development - Washing - Color-development

Each of the washing stages in procedures 1 to 3 can be replaced by the rinsing stage described in U.S. Patent 4,804,616 to simplify the processing and reduce the amount of liquid wastes.

The stages after the color development are hereinafter described.

4. Color development - Compensation - Bleaching -Fixing - Washing - Stabilization
5. Color development - Washing - Bleaching - Fixing - Washing - Stabilization
6. Color development - Compensation - Bleaching -Washing - Fixing - Washing - Stabilization
7. Color-development - Washing - Bleaching -Washing - Fixing - Washing - Stabilization
8. Color development - Bleaching - Fixing - Washing - Stabilization
9. Color development - Bleaching - Bleach-fixing -Washing - Stabilization
10. Color development - Bleaching - Bleach-fixing -Fixing - Washing - Stabilization
11. Color development - Bleaching - Washing - Fixing - Washing - Stabilization
12. Color development - Compensation - Bleach-fixing - Washing - Stabilization
13. Color development - Washing - Bleach-fixing -Washing - Stabilization
14. Color development - Bleach-fixing - Washing -Stabilization
15. Color development - Fixing - Bleach-fixing -Washing - Stabilization

In processing procedures 4 to 15, the washing stages just before the stabilization stages may be eliminated and the final stabilization stages may not be carried out. Any one of procedures 1 to 3 described above is combined with any one of procedures 4 to 15 to form a color reversal procedure.

Processing solutions used in the color reversal procedures of the present invention are hereinafter described.

For the black-and-white developing solutions, known black-and-white developing agents can be used alone or in combination. Such developing agents include dihydroxybenzenes such as hydroquinone; 3-pyrazolidones such as 1-phenyl-3-pyrazolidone; aminophenols such as N-methyl-p-aminophenol; 1-phenyl-3-pyrazoline; ascorbic acid; and heterocyclic compounds such as a condens ed compound of a 1,2,3,4-tetrahydroquinoline ring and an indolene ring described in U.S. Patent 4,067,872.

The black-and-white developing solutions used in the present invention may contain preservatives such as sulfites and bisulfites; buffers such as carbonates, boric acid, borates and alkanolamines; alkali agents such as hydroxides and carbonates; solubilizing auxiliaries such as polyethylene glycol and esters thereof; water softeners such as aminopolycarboxylic acids and organic phosphonic acids; pH regulators, for example, organic acids such as acetic acid; sensitizers such as quaternary ammonium salts; development accelerators; surface active agents; antifoaming agents; hardening agents; antifoggants such as potassium iodide, potassium bromide and benzotriazole; and viscosity imparting agents, if necessary.

Although the black-and-white developing solutions used in the present invention are required to contain

compounds acting as solvents for silver halides, the above-described sulfites added as the preservatives generally play its role. Specific examples of the sulfites include K_2SO_3, Na_2SO_3, $K_2S_2O_5$, $Na_2S_2O_5$, $K_2S_2O_3$ and $Na_2S_2O_3$.

In the present invention, it is preferred that this black-and-white developing solution contains at least one kind of rhodanide. Particularly preferred examples of the rhodanides include potassium thiocyanate, sodium thiocyanate and ammonium thiocyanate. The content of these compounds is preferably 0.01 to 50 g/ℓ, and more preferably 0.05 to 10 g/ℓ.

The pH of the black-and-white developing solutions is selected so as to give a desired density and contrast, and ranges from about 8.5 to about 11.5.

Reversal baths used after the black-and-white development can contain fogging agents known in the art. Such fogging agents include stannous ion complex salts such as stannous ion-organic phosphoric acid complex salts (U.S. Patent 3,617,282), stannous ion-organic phosphonocarboxylic acid complex salts (JP-B-56-32616) and stannous ion-aminopolycarboxylic acid complex salts (British Patent 1,209,050); and boron compounds such as hydrogenated boron compounds (U.S. Patent 2,984,567) and heterocyclic amineborane compounds (British Patent 1,011,000). The pH of the fogging baths (reversal baths) extends over a wide range from an acidic side to a basic side of 2 to 12, preferably 2.5 to 10, and particularly preferably 3 to 9. Instead of the use of the reversal bath, optical reversal processing by reexposure may be carried out. Further, the reversal stage can be omitted by adding the above-described fogging agents to the color developing solutions.

As aromatic primary amine color developing agents used in the color developing solutions in the present invention. p-Phenylenediamine derivatives are preferable. Typical examples thereof are shown below, but the p-phenylenediamine derivatives are not limited thereto.

D-1: N,N-Diethyl-p-phenylenediamine
D-2: 2-Amino-5-diethylaminotoluene
D-3: 2-Amino-5-(N-ethyl-N-laurylamino)toluene
D-4: 4-[N-ethyl-N-(β-hydroxyethyl)amino]aniline
D-5: 2-Methyl-4-[N-ethyl-N-(β-hydroxyethyl)amino]aniline
D-6: 4-Amino-3-methyl-N-ethyl-N-[β-methanesulfonamide)ethyl]aniline
D-7: N-(2-amino-5-diethylaminophenylethyl)methanesulfonamide
D-8: N,N-dimethyl-p-phenylenediamine
D-9: 4-Amino-3-methyl-N-ethyl-N-methoxyethylaniline
D-10: 4-Amino-3-methyl-N-ethyl-N-β-ethoxyethylaniline
D-11: 4-Amino-3-methyl-N-ethyl-N-β-butoxyethylaniline

Of the above-described p-phenylenediamine derivatives, compounds D-2, D-4, D-5 and D-6 are particularly preferable.

These p-phenylenediamine derivatives may be salts such as sulfates, hydrochlorides, sulfites and p-toluenesulfonates. The above aromatic primary amine developing agents are used preferably in an amount of about 0.1 to about 20 g, and more preferably in an amount of about 0.5 to 15 g per liter of developing solution.

In the present invention, a color developing solution substantially free from benzyl alcohol may be used. The color developing solution substantially free from benzyl alcohol means a color developing solution containing benzyl alcohol at a concentration of not more than 3×10^{-2} mol per liter of developing solution, preferably free from benzyl alcohol.

The sulfites contained in the color developing solutions used in the present invention include sodium sulfite, potassium sulfite, sodium bisulfite, potassium bisulfite, sodium metabisulfite and potassium metabisulfite. The amount of the sulfites added to the developing solutions is preferably 1×10^{-5} to 5×10^{-2} mol, more preferably 1×10^{-4} to 5×10^{-2} mol, and further more preferably 1×10^{-4} to 2×10^{-2} mol per liter of developing solution.

In addition, as preservatives, there may be contained various metals described in JP-A-57-44148 and JP-A-57-53749, salicylic acids described in JP-A-59-180588, alkanolamines described in JP-A-54-3532, polyethyleneimines described in JP-A-56-94349 and aromatic polyhydroxy compounds described in U.S. Patent 3,746,544, as required. In particular, the aromatic polyhydroxy compounds are preferably added.

The pH of the color developing solutions used in the present invention is preferably 9 to 14, and more preferably 9 to 13. To the color developing solutions can be added other known constituent compounds of the color developing solutions.

It is preferred to use various buffers to maintain the above-described pH.

Specific examples of the buffers include sodium carbonate, potassium carbonate, sodium bicarbonate, potassium bicarbonate, trisodium phosphate, tripotassium phosphate, disodium phosphate, dipotassium

phosphate, sodium borate, potassium borate, sodium tetraborate (borax), potassium tetraborate, sodium o-hydroxybenzoate (sodium salicylate), potassium o-hydroxybenzoate, sodium 5-sulfo-2-hydroxybenzoate (sodium 5-sulfosalicylate) and potassium 5-sulfo-2-hydroxybenzoate (potassium 5-sulfosalicylate). However, the buffers used in the present invention are not limited to these compounds.

The above-described buffers are added to the color developing solutions preferably in an amount of at least 0.1 mol/ℓ, and particularly preferably in an amount of 0.1 to 0.4 mol/ℓ.

Moreover, various chelating agents can be used in the color developing solutions as suspending agents for calcium or magnesium or to improve the stability of the color developing solutions.

As the chelating agents, organic acid compounds are preferably used. Examples of the chelating agents include aminopolycarboxylic acids, organic phosphonic acids and phosphonooarboxylic acids. Specific examples thereof include, but are not limited to, nitrilotriacetic acid, diethylenetriaminepentaacetic acid, ethylenediaminetetraacetic acid, N,N,N-trimethylenephosphonic acid, ethylenediamine-N,N,N′,N′-tetramethylenediphosphonic acid, trans-cyclohexanediaminetetraacetic acid, 1,2-diaminopropanetetraacetic acid, hydroxyethyliminodiacetic acid, glycoletherdiaminetetraacetic acid, ethylenediamineorthohydroxyphenylacetic acid, 2-phosphonobutane-1,2,4-tricarboxylic acid, 1-hydroxyethylidene-1,1-diphosphonic acid and N,N′-bis(2-hydroxybenzyl)ethylenediamine-N,N′-diacetic acid. Two or more kinds of these chelating agents may be used in combination as required.

These chelating agents may be added in any amount as long as the amount is enough to block metal ions in the color developing solutions. For example, they are added in an amount of about 0.1 to about 10 g/ℓ.

Any development accelerators may be added to the color developing solutions as required. Such development accelerators include p-phenylenediamine compounds described in JP-A-52-49829 and JP-A-50-15554, quaternary ammonium salts described in JP-A-50-137726, JP-B-44-30074, JP-A-56-156826 and JP-A-52-43429, amine compounds described in U.S. Patents 2,494,903, 3,128,182, 4,230,796 and 3,253,919, JP-B-41-11431, U.S. Patents 2,482,546, 2,596,926 and 3,582,346, polyalkylene oxides described in JP-B-37-16088, JP-B-42-25201, U.S. Patent 3,128,183, JP-B-41-11431, JP-B-42-23883 and U.S. Patent 3,532,501, 1-phenyl-3-pyrazolidone compounds and imidazole compounds.

In the present invention, any antifoggants may be added as required. As the antifoggants, there can be used alkaline metal halides such as sodium chloride, potassium bromide and potassium iodide, and organic antifoggants. Typical examples of the organic anti- foggants include nitrogen-containing heterocyclic compounds such as benzotriazole, 6-nitrobenzimidazole, 5-nitroisoindazole, 5-methylbenzotriazole, 5-nitrobenzotriazole, 5-chlorobenzotriazole, 2-thiazolylbenzimidazole, 2-thiazolylmethylbenzimidazole, indazole, hydroxyazaindolizine and adenine.

The color developing solutions used in the present invention may contain fluorescent brightening agents. As the fluorescent brightening agents, 4,4′-diamino-2,2′-disulfostilbene compounds are preferably used. They are added in an amount of 0 to 5 g/ℓ, and preferably in an amount of 0.1 to 4 g/ℓ.

There may be further added various surface active agents such as alkylsulfonic acids, arylphosphonic acids, aliphatic carboxylic acids and aromatic carboxylic acids as so desired.

The processing temperature of the color developing solutions in the present invention is 20 to 50 °C, and preferably 30 to 40 °C. The processing time is 20 seconds to 8 minutes, and preferably 30 seconds to 6 minutes. It is preferred that the replenishment rate of the color developing solutions is minimized. The replenishment rate is however 100 to 3,000 ml/m^2 of photographic material, preferably 100 to 2,500 ml/m^2, and more preferably 100 to 2,000 ml/m^2.

Further, the color developing bath may be divided into two or more baths as required, and the foremost bath or the hindmost bath thereof may be replenished with the color developing solution to shorten the developing time and reduce the replenishment rate.

Furthermore, for the purpose of controlling the gradient, the color developing solutions used in the present invention may contain so-called competitive compounds such as citrazinic acid, J acid and H acid which react with the oxidation product of the color developing agents to form colorless compounds.

In the present invention, the photographic materials are subjected to the bleaching processing or the bleach-fixing processing after color development. These processing may be carried out immediately after color development without any other processing stages, or after processing stages such as termination, compensation and washing after the color developing stage.

Solutions used for the above-described compensation may contain aminopolycarboxylic acids such as ethylenediaminetetraacetlc acid and diethylenetriaminepentaacetic acid; sulfites such as sodium sulfite and ammonium sulfite; and bleaching accelerators such as thioglycerin, aminoethanethiol and sulfoethanethiol. For the purpose of preventing scum formation, it is preferred that the compensating solutions contain sorbitan esters of fatty acids substituted with ethylene oxide described in U.S. Patent 4,839,262 or

polyoxyethylene compounds described in U.S. Patent 4,059,446 and Research Disclosure , Vol. 191, No. 19104 (1980).

Bleaching agents used in bleaching solutions and/or bleach-fixing solutions include ferric complex salts of aminopolycarboxylic acids and peroxide such as sodium persulfate. In particular, the ferric complex salts of aminopolycarboxylic acids are preferably used. Preferred examples of aminopolycarboxylic acids of such ferric complex salts include ethylenediaminetetraacetic acid, 1,3-diaminopropanetetraacetic acid, glycoletherdiaminetetraacetic acid, cyclohexanediaminetetraacetic acid, 1,4-diaminobutanetetraacetic acid, 1,2-propylenediaminetetraacetic acid, thioglycoletherdiaminetetraacetic acid, 1,3-butylenediaminetetraacetic acid and methyliminodiacetic acid.

The above-described bleaching agents are added in an amount of 0.05 to 1 mol per liter of bleaching solution or blech-fixing solution, and preferably in an amount of 0.1 to 0.5 mol. In addition to the above-described complex salts of iron(III) with the amino polycarboxylic acids, aminopolycarboxylates may be added to the bleaching solutions and/or the bleach-fixing solutions used in the present invention.

The aminopolycarboxylates are added preferably in an amount of 0.0001 mol to 0.1 mol/ℓ, and more preferably in an amount of 0.003 to 0.05 mol/ℓ.

It is preferred that the aminopolycarboxylates and the ferric complex salts thereof are usually used in the form of alkali metal salts or ammonium salts. In particular, the ammonium salts are preferable because of their excellent solubility and bleaching ability.

Various bleaching accelerators may be added to the bleaching solutions and/or the bleach-fixing solutions used in the present invention.

As such bleaching accelerators, there are preferably used, for example, mercapto group- or disulfide group-containing compounds described in U.S. Patent 3,893,858, West German Patent 1,290,812, British Patent 1,138,842, JP-A-53-95630 and Research Disclosure , No. 17129 (July, 1978).

The bleaching accelerators are added in an amount of 0.01 to 20 g per liter of solution having bleaching ability, and preferably in an amount of 0.1 to 10 g.

The bleaching solutions and/or the bleach-fixing solutions used in the present invention may contain rehalogenating agents such as bromides (for example, potassium bromide, sodium bromide and ammonium bromide) and chlorides (for example, potassium chloride, sodium chloride and ammonium chloride) in addition to the bleaching agents and the above-described compounds. The concentration of the rehalogenating agents is 0.1 to 5 mols per liter of bleaching solution, and preferably 0.5 to 3 mols. In addition, there can be added known additives which can be usually used in the bleaching solutions, for example, nitrates such as sodium nitrate and ammonium nitrate; and one or more kinds of inorganic acids, organic acids and salts thereof having pH buffering ability such as boric acid, borax, sodium metaborate, acetic acid, sodium acetate, sodium carbonate, potassium carbonate, phosphorous acid, phosphoric acid, sodium phosphate, citric acid, sodium citrate and tartaric acid.

The bleach-fixing solutions and/or fixing solutions used in the present invention may contain thiosulfates as fixing agents. The thiosulfates are added in an amount of 0.1 to 3 mols/ℓ, and preferably in an amount of 0.3 to 2 mols/ℓ.

The thiosulfate compounds include ammonium thiosulfate, sodium thiosulfate, potassium thiosulfate, calcium thiosulfate and magnesium thiosulfate. In particular, ammonium thiosulfate is preferably used because of its good solubility and highest rate of fixing.

In addition to the above-described thiosulfate compounds, there can be used thiocyanic acid compounds (particularly the ammonium salt thereof), thiourea, thioethers, urea and the like as the fixing agents or fixing accelerators of the bleach-fixing solutions and/or the fixing solutions used in the present invention. The total concentration of these supplementary fixing agents or fixing accelerators and the thiosulfate compounds is 1.11 to 3.0 mols/ℓ, and preferably 1.4 to 2.8 mols/ℓ.

The bleach-fixing solutions and/or the fixing solutions used in the present invention may contain sulfites such as sodium sulfite, potassium sulfite and ammonium sulfite, hydroxylamine and hydrazine as preservatives. Further, they may contain various fluorescent brightening agents, antifoaming agents, surface active agents and organic solvents such as polyvinyl pyrrolidone and methanol. In particular, it is preferred that the sulfinic acid compounds described in JP-A-62-143048 are used as the preservatives.

Further, for the purpose of stabilizing the solution, various aminopolycarboxylic acids and organic phosphonic acids are preferably added to the solutions. In particular, 1-hydroxyethylidene-1,1-diphosphonic acid is effective. These compounds are added in an amount of 0.01 to 0.3 mol/ℓ, and preferably in an amount of 0.05 to 0.2 mol/ℓ, which is particularly effective in the fixing solutions.

The pH of the bleaching solutions and/or the bleach-fixing solutions used in the present invention is generally 1 to 9, preferably 1.5 to 7.5, and more preferably 2.0 to 7.0. In particular, it is preferred that the pH of the bleaching solutions is 2.0 to 5.0. Within the preferred range of pH, little fogging takes place in

bleaching and the silver removal property is also excellent.

The pH of the fixing solutions used in the present invention is usually 5.0 to 9.0, and particularly preferably 5.5 to 7.5.

Known additives may be added to rinsing water used in the washing stage as so desired. For example, there can be used water softeners such as inorganic phosphoric acid compounds, aminopolycarboxylic acids and organic phosphoric acid compounds; disinfectants and antifungal agents to prevent various bacteria and duckweeds from proliferating such as isothiazolone, organic chlorine disinfectants and benzotriazole; and surface active agents to prevent dry load and unevenness. There can also be used the compounds described in L.E. West, "Water Quality Criteria", Phot. Sci. and Eng. 9 , No. 6, 343-359 (1965).

Processing solutions for stabilizing dye images are used as stabilizing solutions used in the stabilization stage. For example, there can be used solutions having a pH of 3 to 6 and buffering ability, and solutions containing aldehydes such as glutaraldehyde. Formalin is unfavorable in terms of environmental pollution. In the stabilizing solutions can be used ammonium compounds, metal compounds such as Bi and Al, fluorescent brightening agents, chelating agents such as EDTA and 1-hydroxyethylidene-1,1-diphosphonic acid, disinfectants, antifungal agents, hardening agents, surface active agents and the like. Thiazolone compounds such as 5-chloro-2-mwethylisothiazoline-3-one and 1,2-benzisothiazoline-3-one are effective as the antifungal agents.

In order to prevent thiosulfate ions brought into the stabilizing solutions with the photographic materials from sulfurating, alkanolamines are preferably added to the stabilizing solutions.

The pH of the stabilizing solutions used in the present invention is 3 to 8, and preferably 5 to 7. The temperature of the stabilizing solutions is preferably 5 to 45 °C, and more preferably 10 to 40 °C. It is preferred that a multistage countercurrent process is used as the washing stage or the stabilization stage. The number of stages is preferably 2 to 4. Two or more kinds of stabilizing solutions may be used in multiple stage. The replenishment rate is 1 to 50 times, preferably 2 to 30 times, and more preferably 2 to 15 times the amount of the solution brought in from the preceding bath per unit area.

As water used in the washing stage or the stabilization stage are preferred water deionized with an ion-exchange resin to Ca and Mg concentrations of 5 mg/ℓ or less, respectively, and water sterilized with a halogen bactericidal lamp or an ultraviolet bactericidal lamp, in addition to tap water.

The present invention will be further illustrated in greater detail with reference to the following example, which are however not to be construed as limiting the invention.

EXAMPLE 1

(Emulsion A)

Cubic grains of silver iodobromide (silver iodide: 2.5 mol%) were prepared by the controlled double jet process in the presence of ammonia. The mean sphere-corresponding grain size of the resulting grains was 0.35 μm. The grains were subjected to chemical sensitization simultaneously using gold and sulfur. The emulsion thus obtained was named Emulsion A. 60% by weight of the emulsion grains had grain sizes within 18% from the mean grain size.

(Emulsion B)

A cubic grain emulsion having a mean sphere-corresponding grain size of 0.27 μm was prepared by adjusting the temperature in forming the grains of Emulsion A. The resulting grains were silver iodobromide grains containing 2.5 mol% of silver iodide.

60% by weight of the emulsion grains had grain sizes within 15% from the mean grain size.

(Emulsion C)

To 1 ℓ of water were added 30 g of gelatin and 10.3 g of potassium bromide, and then Solutions I and II shown in Table 1 were simultaneously added thereto with stirring for 15 minutes in a vessel maintained at 60 °C.

In the resulting tabular silver halide grains, 53% of all grains as a projected area were composed of grains having an aspect ratio of at least 5, and the content of silver iodide was 2.5 mol%.

This emulsion was subjected to chemical sensitization simultaneously using gold and sulfur. The tabular silver halide emulsion thus obtained was named Emulsion C. The grains of Emulsion C had a mean sphere-corresponding grain size of 0.35 μm.

TABLE 1

	Solution I	Solution II
$AgNO_3$ (g)	100.0	-
H_2O (cc)	561	542
KBr (g)	-	72.8
KI (g)	-	2.5

(Emulsion D)

By adjusting the temperature in forming grains of Emulsion C, there was obtained Emulsion D which had a mean sphere-corresponding grain size of 0.28 μm, in which 53% of all grains as a projected area were composed of grains having an aspect ratio of at least 5, and which contained 2.5% of silver iodide.

(Emulsion E)

By adjusting the temperature in forming grains of Emulsion D, there was obtained Emulsion E which had a mean sphere-corresponding grain size of 0.21 μm, in which 53% of all grains as a projected area were composed of grains having an aspect ratio of at least 5, and which contained 2.5% of silver iodide.

(Emulsion F)

By adjusting the temperature in forming grains of Emulsion E, there was obtained Emulsion F which had a mean sphere-corresponding grain size of 0.21 μm, in which 55% of all grains as a projected area were composed of grains having an aspect ratio of at least 8, and which contained 2.5% of silver iodide.

Phenoxyethanol was added to Emulsions A to F as a preservative in an amount of 40,000 ppm based on gelatin.

(Preparation of Photographic Material)

A paper support both sides of which had been laminated with polyethylene was coated with the following first to twelfth layers to prepare a multilayer color photographic material, which was named Sample 101. Polyethylene on the side of the first layer to be coated contained titanium oxide as a white pigment and a slight amount of ultramarine as a bluing dye.

The composition of each sensitive layer is shown below. Numerals for the components indicate coated amounts represented in g/m^2. Numerals for the silver halides indicate coated amounts converted to silver.

First Layer (Gelatin Layer)	
Gelatin	1.30

Second Layer (Antihalation Layer)	
Black colloidal silver	0.10
Gelatin	0.70

Third Layer (Low Sensitivity Red-Sensitive Layer)	
Silver iodobromide EM1 (silver iodide: 4 mol%, mean grain size: 0.4 μm, cubic) spectrally sensitized with red-sensitizing dyes (ExS-1, ExS-2 and ExS-3)	0.06
Silver iodobromide EM2 (silver iodide: 5 mol%, mean grain size: 0.50 μm, cubic) spectrally sensitized with red-sensitizing dyes (ExS-1, ExS-2 and ExS-3)	0.10
Gelatin	1.00
Cyan coupler (ExC-1)	0.14
Cyan coupler (ExC-2)	0.07
Antifading agent (Cpd-2, Cpd-3, Cpd-4 and Cpd-9 in equivalent amounts)	0.12
Dispersion medium (Cpd-5) for coupler	0.03
Solvent (Solv-1, Solv-2 and Solv-3) for coupler	0.06

Fourth Layer (High Sensitivity Red-Sensitive Layer)	
Silver iodobromide EM3 (silver iodide: 6 mol%, mean grain size: 0.75 μm, twin) spectrally sensitized with red-sensitizing dyes (ExS-1, ExS-2 and ExS-3)	0.15
Gelatin	1.00
Cyan coupler (ExC-1)	0.20
Cyan coupler (ExC-2)	0.10
Antifading agent (Cpd-2, Cpd-3, Cpd-4 and Cpd-9 in equivalent amounts)	0.15
Dispersion medium (Cpd-5) for coupler	0.03
Solvent (Solv-1, Solv-2 and Solv-3) for coupler	0.10

Fifth Layer (Intermediate Layer)	
Yellow colloidal silver	0.02
Gelatin	1.00
Color mixing inhibitor (Cpd-6 and Cpd-7)	0.08
Solvent (Solv-4 and Solv-5) for color mixing inhibitor	0.16
Polymer latex (Cpd-8)	0.10

Sixth Layer (Low Sensitivity Green-Sensitive Layer)	
Emulsion A spectrally sensitized with green-sensitizing dye (ExS-4)	0.10
Gelatin	0.80
Magenta coupler (ExM-1)	0.05
Magenta coupler (ExM-2)	0.05
Antifading agent (Cpd-9)	0.10
Stain inhibitor (Cpd-10)	0.01
Stain inhibitor (Cpd-11)	0.001
Stain inhibitor (Cpd-12)	0.01
Dispersion medium (Cpd-5) for coupler	0.05
Solvent (Solv-4 and Solv-6) for coupler	0.15

Seventh Layer (High Sensitivity Green-Sensitive Layer)	
Silver iodobromide EM4 (silver iodide: 3.5 mol%, mean grain size: 0.6 μm, twin) spectrally sensitized with green-sensitizing dye (ExS-4)	0.10
Magenta coupler (ExM-1)	0.05
Magenta coupler (ExM-2)	0.05
Antifading agent (Cpd-9)	0.10
Stain inhibitor (Cpd-10)	0.01
Stain inhibitor (Cpd-11)	0.001
Stain inhibitor (Cpd-12)	0.01
Dispersion medium (Cpd-5) for coupler	0.05
Solvent (Solv-4 and Solv-6) for coupler	0.15

Eighth Layer (Yellow Filter Layer)	
Yellow colloidal silver	0.20
Gelatin	1.00
Color mixing inhibitor (Cpd-7)	0.06
Solvent (Solv-4 and Solv-5) for color mixing inhibitor	0.15
Polymer latex (Cpd-8)	0.10

Ninth Layer (Low Sensitivity Blue-Sensitive Layer)	
Silver iodobromide EM5 (silver iodide: 2.5 mol%, mean grain size: 0.40 μm, cubic) spectrally sensitized with blue-sensitizing dyes (ExS-5 and ExS-6)	0.07
Silver iodobromide EM6 (silver iodide: 2.5 mol%, mean grain size: 0.45 μm, cubic) spectrally sensitized with blue-sensitizing dyes (ExS-5 and ExS-6)	0.10
Gelatin	0.50
Yellow coupler (ExY-1)	0.20
Stain inhibitor (Cpd-11)	0.001
Antifading agent (Cpd-6)	0.10
Dispersion medium (Cpd-5) for coupler	0.05
Solvent (Solv-2) for coupler	0.05

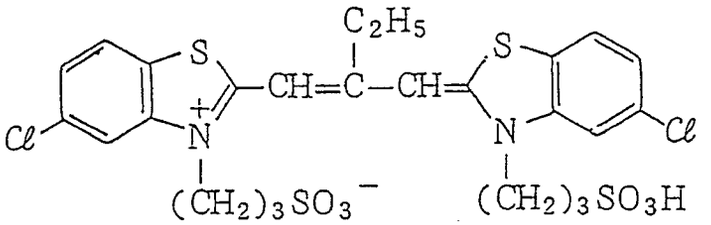
Tenth Layer (High Sensitivity Blue-Sensitive Layer)	
Silver iodobromide EM7 (silver iodide: 2.5 mol%, mean grain size: 1.2 μm, twin) spectrally sensitized with blue-sensitizing dyes (ExS-5 and ExS-6)	0.25
Gelatin	1.00
Yellow coupler (ExY-1)	0.40
Stain inhibitor (Cpd-11)	0.002
Antifading agent (Cpd-6)	0.10
Dispersion medium (Cpd-5) for coupler	0.15
Solvent (Solv-2) for coupler	0.10

Eleventh Layer (Ultraviolet Light Absorbing Layer)	
Gelatin	1.50
Ultraviolet light absorber (Cpd-1, Cpd-3 and Cpd-13)	1.00
Color mixing inhibitor (Cpd-6 and Cpd-14)	0.06
Dispersion medium (Cpd-5)	0.15
Solvent (Solv-1 and Solv-2) for ultraviolet light absorber	0.15
Irradiation preventing dye (Cpd-15 and Cpd-16)	0.02
Irradiation preventing dye (Cpd-17 and Cpd-18)	0.02

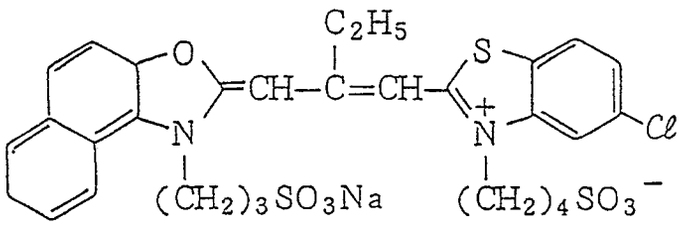
Twelfth Layer (Protective Layer)	
Fine grains of silver chlorobromide (silver chloride: 97 mol%, mean grain size: 0.2 μm)	0.07
Modified poval	0.02
Gelatin	1.50
Gelatin hardener (H-1)	0.17

Further, to each layer were added alkanol XC (Du Pont de Nemours Co.) and sodium alkylbenzenesulfonate as emulsifying dispersion aids, and a succinic ester and Magefac F-120 (Dainippon Ink & Chemical Inc.) as coating aids. Cpd-19, Cpd-20 and Cpd-21 were used as stabilizers in the silver halide-containing layers and the colloidal silver-containing layers. The compounds used in Example are shown below:

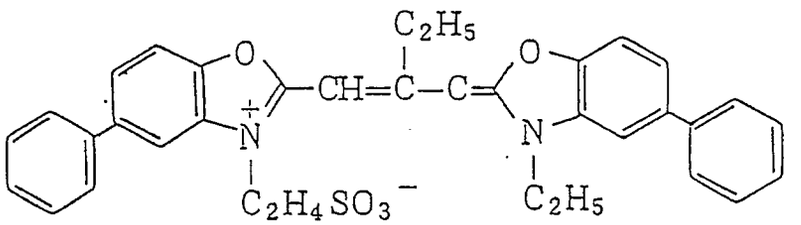
ExS-2



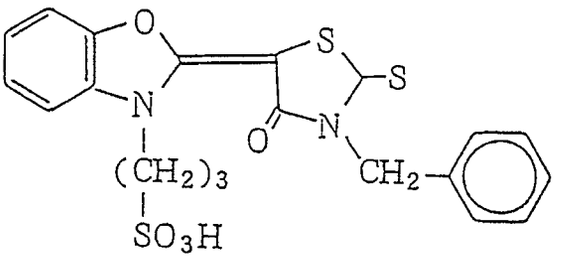
ExS-3



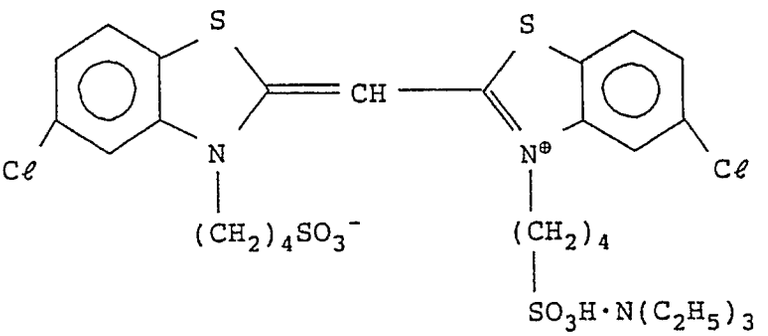
ExS-4



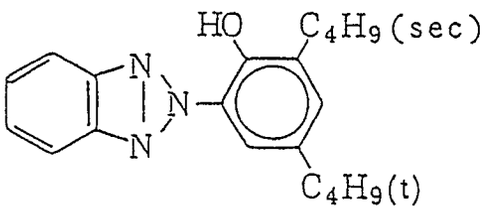
ExS-5



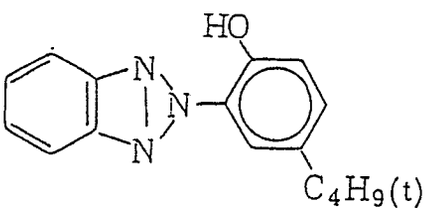
ExS-6



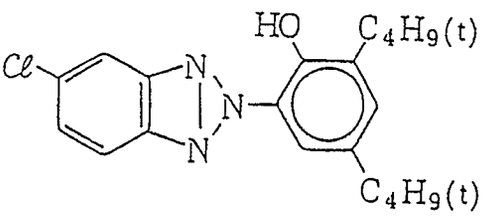
Cpd-1



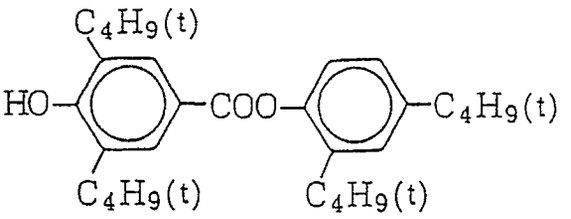
Cpd-2



Cpd-3



Cpd-4



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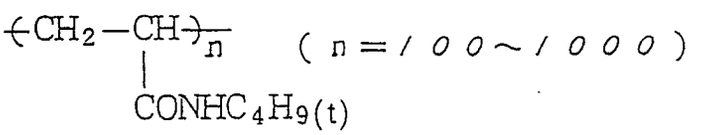
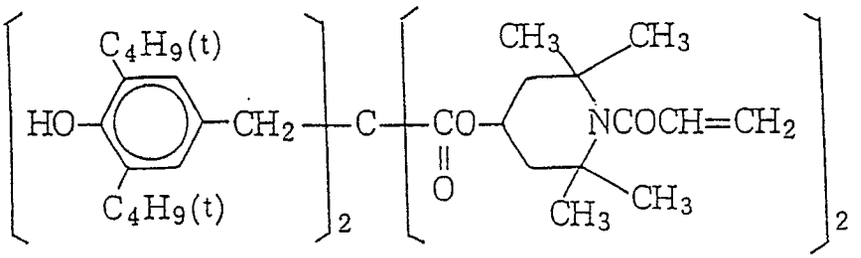
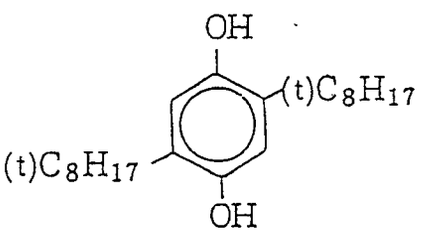


Cpd-6

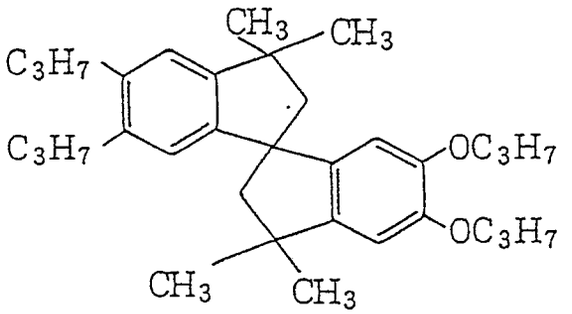


Cpd-7

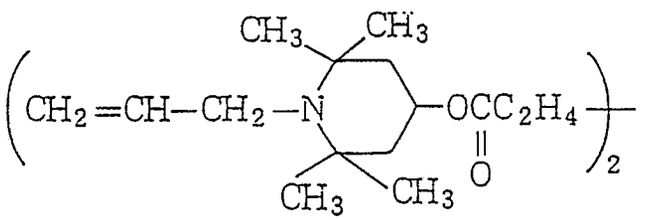


Cpd-8 Polyethylacrylate

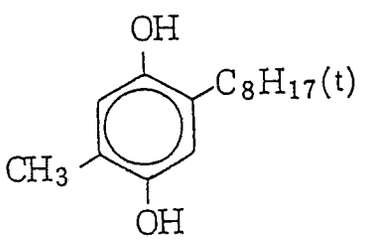
Cpd-9



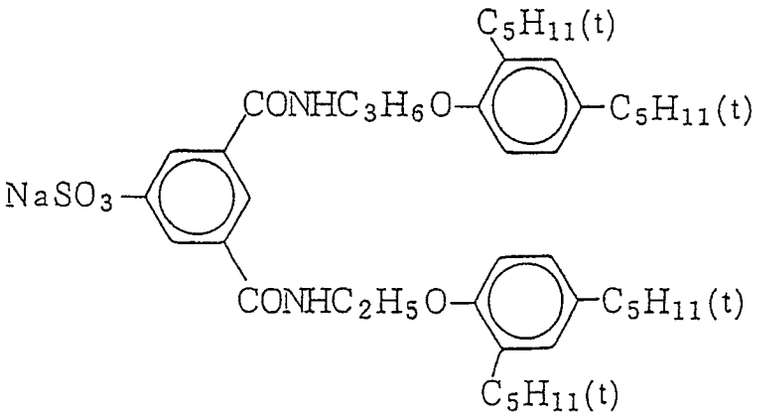
Cpd-10



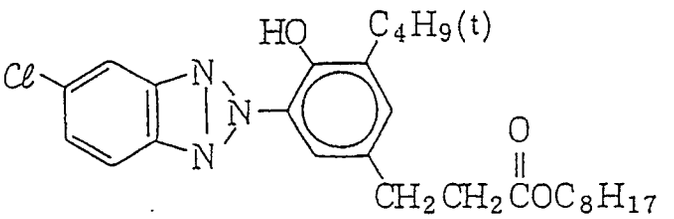
Cpd-11



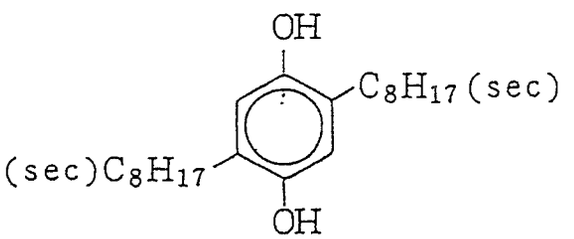
Cpd-12



Cpd-13



Cpd-14



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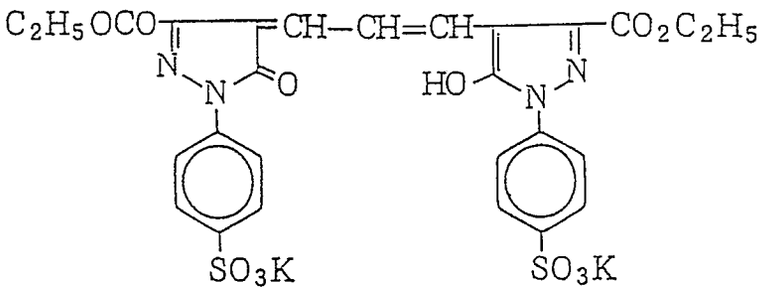
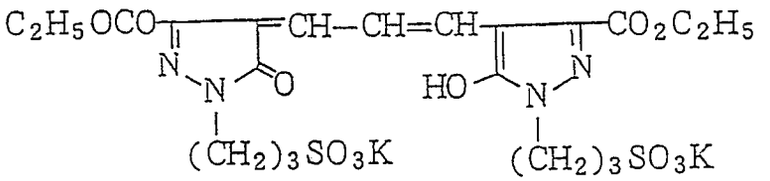
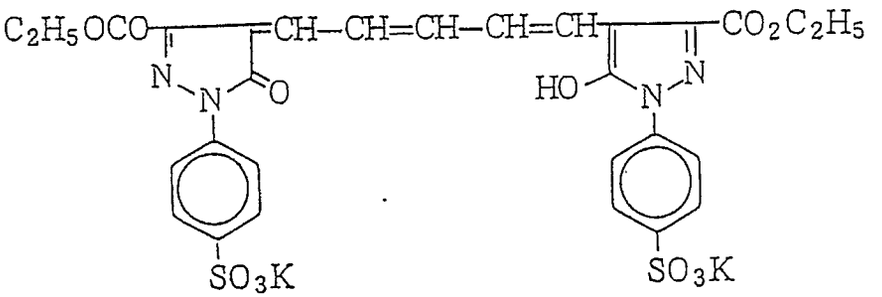


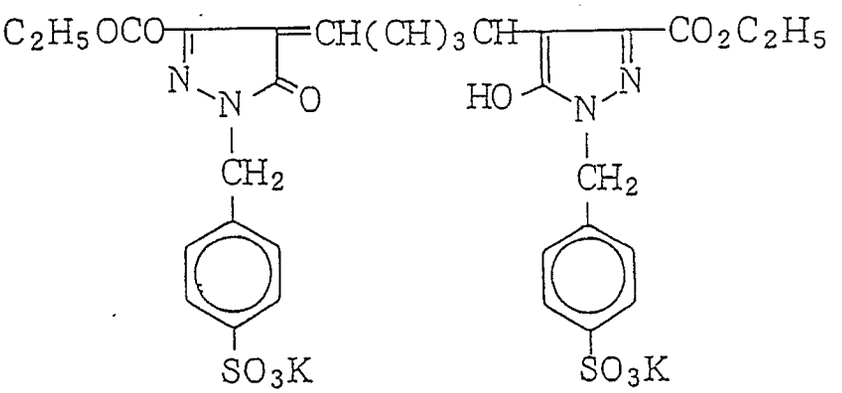
Cpd-16



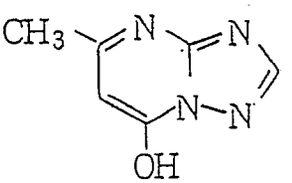
Cpd-17



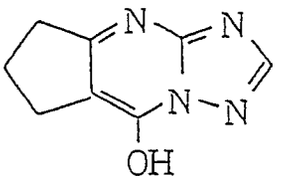
Cpd-18



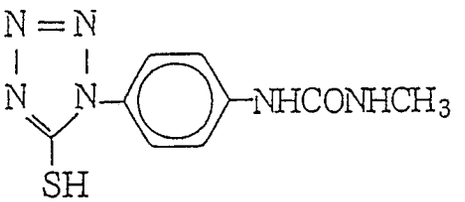
Cpd-19



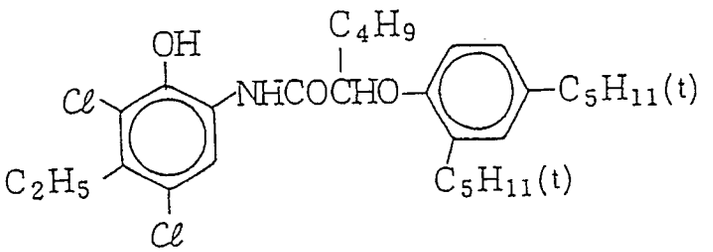
Cpd-20



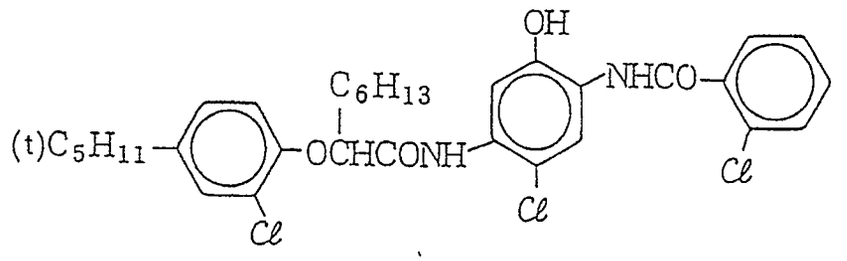
Cpd-21



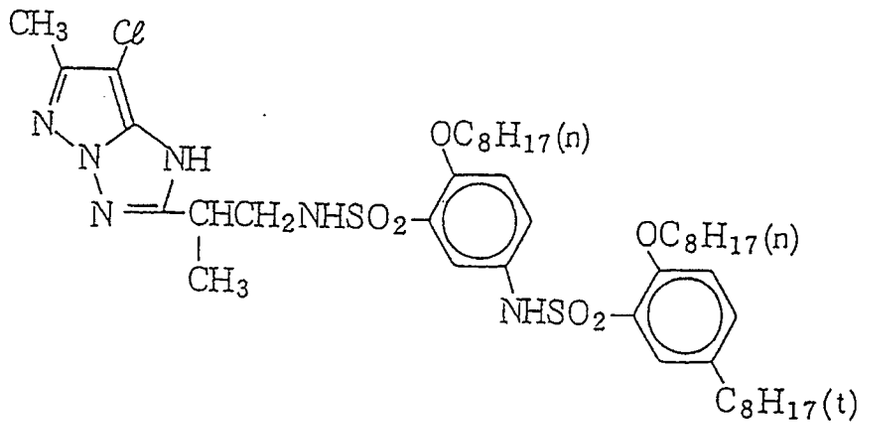
ExC-1



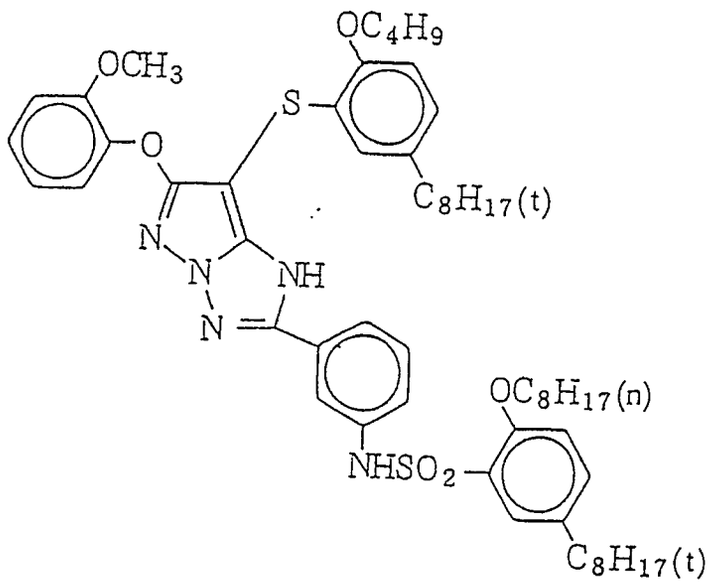
ExC-2



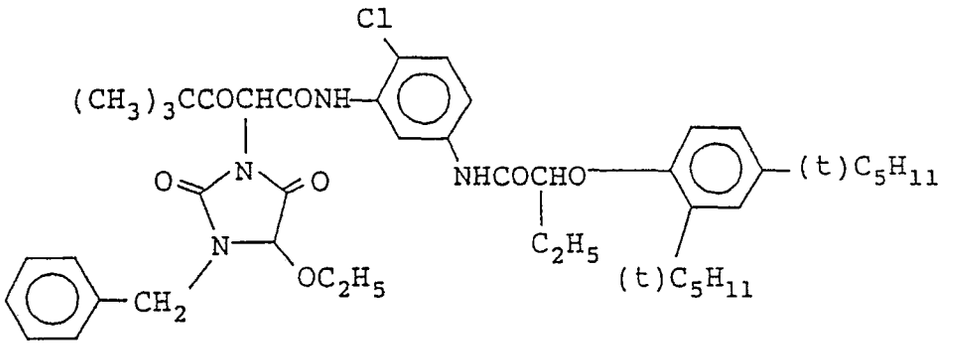
ExM-1



ExM-2



ExY-1



Solv-1 Di(2-ethylhexyl) phthalate

Solv-2 Trinonyl phosphate

Solv-3 Di(3-methylhexyl) phthalate

Solv-4 Tricresyl phosphate

Solv-5 Dibutyl phthalate

Solv-6 Trioctyl phosphate

H-1 1,2-Bis(vinylsulfonylacetamido)ethane

Samples 102 to 106 were prepared by replacing Emulsion A contained in the sixth layer of Sample 101 by Emulsions B to F, respectively. Further, Sample 107 was prepared by replacing yellow colloidal silver contained in the fifth layer of Sample 104 by black colloidal silver. These features are summarized in Table 2.

TABLE 2

Sample No.	Emulsion of Sixth Layer			Colloidal Silver of Fifth Layer
	Emulsion	Mean Sphere-Corresponding Grain Size (μm)	Form	
101 (Comparison)	A	0.35	Cubic	Yellow colloidal silver
102 (Comparison)	B	0.27	Cubic	Yellow colloidal silver
103 (Comparison)	C	0.35	Tabular aspect ratio: 5	Yellow colloidal silver
104 (Invention)	D	0.28	Tabular aspect ratio: 5	Yellow colloidal silver
105 (Invention)	E	0.21	Tabular aspect ratio: 5	Yellow colloidal silver
106 (Invention)	F	0.21	Tabular aspect ratio: 8	Yellow colloidal silver
107 (Invention)	D	0.28	Tabular aspect ratio: 5	Black colloidal silver

Two film pieces were prepared from each of these Samples 101 to 107. One was exposed through an optical wedge using a white light source and the other was exposed through an optical wedge using a green

light source. These exposed Samples were processed by the following processing procedure (I):

(Processing Procedure (I))		
First development (black-and-white development)	38° C	75 seconds
Washing	38° C	90 secons
Reversal exposure	100 lux or more	1 second or more
Color development	38° C	135 seconds
Washing	38° C	45 seconds
Bleach-fixing	38° C	120 seconds
Washing	38° C	135 seconds

(Composition of Processing Solutions)

First Development Solution	
Pentasodium nitrilo-N,N,N-trimethylenephosphonate	0.6 g
Pentasodium diethylenetriaminepentaacetate	4.0 g
Potassium sulfite	30.0 g
Potassium thiocyanate	1.2 g
Potassium carbonate	35.0 g
Potassium hydroquinonemonosulfonate	25.0 g
Diethylene glycol	15.0 ml
1-Phenyl-4-hydroxymethyl-4-methyl-3-pyrazolidone	2.0 g
Potassium bromide	0.5 g
Potassium iodide	5.0 mg
Water to make	1 ℓ (pH: 9.70)

Color Developing Solution	
Benzyl alcohol	15.0 ml
Diethylene glycol	12.0 ml
3,6-Dithia-1,8-octanediol	0.2 g
Pentasodium nitrilo-N,N,N-trimethylenephosphonate	0.5 g
Pentasodium diethylenetriaminepentaacetate	2.0 g
Sodium sulfite	2.0 g
Potassium carbonate	25.0 g
Hydroxylamine sulfate	3.0 g
N-Ethyl-N-(β-methanesulfonamidoethyl)-3-methyl-4-aminoaniline sulfate	5.0 g
Potassium bromide	0.5 g
Potassium iodide	1.0 mg
Water to make	1 ℓ (pH: 10.40)

Bleach-Fixing Solution	
2-Mercapto-1,3,4-triazole	1.0 g
Disodium ethylenediaminetetraacetate dihydrate	5.0 g
Ethylenediaminetetraacetic acid Fe(III) ammonium monohydrate	80.0 g
Sodium sulfite	15.0 g
Sodium thiosulfate (700 g/ℓ)	160.0 ml
Glacial acetic acid	5.0 ml
Water to make	1 ℓ (pH: 6.50)

After processing, sensitometry was conducted for magenta image formed on the above-described Samples. For each Sample, the sensitivity ratio of the magenta image of the test piece exposed to green light to the magenta image of the test piece exposed to white light was determined. The results are shown in Table 3.

Then, Samples 101 to 107 were exposed in the same manner as described above, and processed by the following processing procedure (II).

(Processing Procedure (II))

The same as with processing procedure (I) except the time of the first development (black-and-white development) was 55 seconds.

The results are also shown in Table 3.

TABLE 3

Sample No.	Processing Procedure		Sensitivity Ratio of Magenta Image Exposed to Green Light to That Exposed to White Light (at a density of 0.6)
	Processing	Time of Black-and-White Development (sec)	
101 (Comparison)	I	75	1.37
102 (Comparison)	I	75	1.66
103 (Comparison)	I	75	1.42
104 (Invention)	I	75	1.79
105 (Invention)	I	75	1.90
106 (Invention)	I	75	2.01
107 (Invention)	I	75	1.71
101 (Comparison)	II	55	1.10
102 (Comparison)	II	55	1.35
103 (Comparison)	II	55	1.16
104 (Invention)	II	55	1.51
105 (Invention)	II	55	1.65
106 (Invention)	II	55	1.77
107 (Invention)	II	55	1.42

As the sensitivity ratio of monochromatic exposure to white light exposure is higher, the multilayer effect becomes larger, resulting in a color reversal photographic light-sensitive material showing color reproducibility of high chroma.

As apparent from Table 3, when the form of the emulsion grains contained in the sixth layer is tabular, the multilayer effect is preferably enhanced. The smaller the mean sphere-corresponding grain size is and

the higher the aspect ratio is, the higher effect is obtained.

When the layer adjacent to the emulsion layer contains yellow colloidal silver, the multilayer effect is more enhanced compared with the case that the layer does not contain yellow colloidal silver.

Further, the shorter the time of the black-and-white development is, the less the multilayer effect becomes. However, the effect of the present invention is remarkable when the time of the black-and-white development is short.

According to the present invention, even in the processing in which the time of the first development is short, the color reversal photographic materials which give the sufficient multilayer effect are obtained.

While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

Claims

1. A process for developing a silver halide color reversal photographic material comprising a support having provided thereon at least one red-sensitive silver halide emulsion layer, green-sensitive silver halide emulsion layer and blue-sensitive silver halide emulsion layer, wherein at least one silver halide emulsion layer contains tabular silver halide grains having an aspect ratio of at least 5 occupying at least 50% of all silver halide grains existing in the same layer as a projected area, and having a mean sphere-corresponding grain size of 0.30 μm or less, which comprises developing said color reversal photographic material with a black-and-white developing solution for 100 seconds or less.

2. A process as claimed in claim 1, in which the time of black-and-white development is 60 seconds or less.

3. A process as claimed in claim 1, in which the aspect ratio of the tabular silver halide grains is at least 8.

4. A process as claimed in claim 1, in which the black-and-white developing solution contains a rhodanide.

5. A process as claimed in claim 1, in which the mean sphere-corresponding grain size of said tabular silver halide grain is 0.25 μm or less.

6. A process as claimed in claim 1, in which said tabular silver halide grain is a silver iodobromide having a silver iodide content of 0.01 to 30 mol%.

7. A process as claimed in claim 1, in which the silver halide color reversal photographic material contains a silver having a yellow colloidal silver.

8. A process as claimed in claim 7, in which said tabular silver halide grain is contained in an adjacent layer to the layer having a yellow colloidal silver.

9. A process claimed in claim 1, in which said tabular silver halide grain is contained in the most low-sensitive emulsion layer when each of said emulsion layers consists of a plurality of layers having a similar spectral sensitivity.