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COLOR PHOTOGRAPHY

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This invention relates to color photography and particularly to a method for preventing discoloration of photographic layers containing dye images.

In the coupling process of color photography, the dye images produced by coupling are of the indophenol, indaniline or azomethine type. Dyes produced by developing with aminophenols in the presence of a phenol or naphthol coupler are indophenol dyes and those produced by developing with a p-phenylenediamine type developer in the presence of phenol or naphthol couplers or reactive methylene compounds are indaniline or azomethine dyes, respectively. All of these developing agents are primary aromatic amino developing agents.

One of the difficulties encountered with such processes is the relatively low stability of the dye images to light or conditions of high temperature or humidity. This results in more or less rapid discoloration of the finished pictures under certain conditions of use or storage. This discoloration takes the form of a bleaching or less in the dye present in the layer.

In those processes where couplers are incorporated in the emulsion layers or in plain gelatin layers in the film, another difficulty frequently encountered is the instability to heat or light of the residual unused coupler in the layers. This unused coupler sometimes has a tendency to darken under the influence of heat and light which results in the building up of discolored areas which are evident as stain in the highlights of the finished pictures.

It is, therefore, an object of the present invention to provide a method for preventing discoloration of photographic dye images produced by coupling. A further object is to provide a method for preventing the darkening or discoloration of residual couplers in photographic layers. Other objects will appear from the following description of my invention.

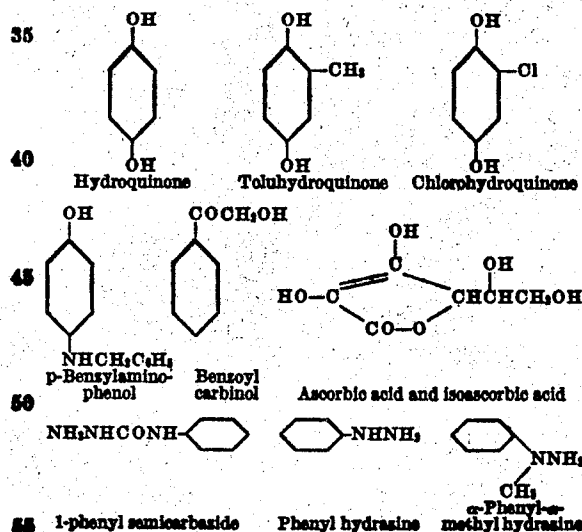
These objects are accomplished by introducing into the layers containing the couplers or dye images, or anti-oxidant or reducing agent as one of the final stages of processing the exposed photographic element.

I have found that both the decolorization of the dye images and the darkening or discoloration of the residual couplers in photographic layers are oxidation processes involving atmospheric oxygen and may be effectively inhibited in many cases by the introduction into layers containing the dyes or couplers, of an anti-oxidant or reducing agent as one of the final stages of processing. My

method is applicable to various types of color development processes such as those described in Mannes, Godowsky and Wilder U. S. Patent 2,252,718, granted August 19, 1941, Mannes and Godowsky U. S. Patent 2,304,940, granted December 15, 1943, Schinzel U. S. Patent 2,306,410, granted December 29, 1942 and Jelley and Vittum U. S. Patent 2,322,027, granted June 15, 1943. These patents disclose color development processes in which the couplers are incorporated in the developing solution, in which case my method is applicable only to decoloration of the final dye image, or in the emulsion layers either as non-diffusing compounds or incorporated in water-immiscible solvent droplets, in which case my method is useful for preventing discoloration of both the residual coupler and the dye image.

In all of these color development processes, it is customary to remove the developed silver and any residual silver halide as a final step in the process by treating the film with a solution of potassium ferricyanide and potassium bromide followed by a hypo bath. Such treatment is described, for example, on page 2, column 2 of the Mannes, Godowsky and Wilder U. S. Patent 2,252,718, referred to above. According to my invention the film is treated after removal of the silver images, with an aqueous or alcoholic aqueous solution of an anti-oxidant to effect an increase in the stability of the dye images or residual couplers or both.

The following compounds have been found suitable for use according to my invention:



Ascorbic acid can be used in any of its isomeric forms, such as d-ascorbic acid and l-ascorbic acid.

The following solutions are suitable for use according to my invention:

Example 1

Hydroquinone	-----grams--	5
Sodium sulfite	-----do-----	0.5
Water to	-----cc-----	1000

Example 2

1-Ascorbic acid	-----grams--	2.5
Water to	-----cc-----	1000

The anti-oxidants suggested above are preferably used in amounts of from 1 gram to 10 grams per liter of solution although more or less than these amounts may be employed.

Some of the anti-oxidants suggested above, such as hydroquinone, have been used for other purposes in treating developed color images, for example, for removing stain. For these purposes the anti-oxidant has been applied before or during development. It is essential for the present purpose that the anti-oxidant is introduced at the end of the process or at least after the application of the oxidizing silver removal bath.

It will be understood that the examples included herein are illustrative only and that my invention is to be taken as limited only by the scope of the appended claims.

I claim:

1. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, together with the residual silver halide, and thereafter treating said layer with a solution of an organic reducing agent containing at least two groups selected from the class consisting of hydroxyl, amino, and substituted amino groups.

2. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, together with the residual

silver halide, and thereafter treating said layer with a solution of an aromatic hydroxy reducing agent containing at least two hydroxyl groups.

3. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, and treating said layer with a solution of a hydroquinone.

4. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, and treating said layer with a solution of hydroquinone.

5. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, and treating said layer with a solution of an aromatic derivative of hydrazine.

6. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, and treating said layer with a solution of phenyl hydrazine.

7. The method of preventing the discoloration of photographic layers containing dye images selected from the class consisting of indophenol, indamine, and azomethine dyes, which comprises forming said dye image in said layer by development of an exposed silver halide with a primary aromatic amino developing agent in the presence of a coupler compound, removing the silver images thus formed, and treating said layer with a solution of 1-phenylsemicarbazide.

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