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REDUCING AERIAL OXIDATION OF PHOTOGRAPHIC DEVELOPERS

Ralph M. Evans and Wesley T. Hanson, Jr., Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

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4 Claims. (Cl. 95—88)

This invention relates to photographic developers and particularly to a method and agents for reducing aerial oxidation of photographic developers.

In some photographic developing machines, the developer solutions are agitated by air. This aeration sometimes oxidizes more of the developing agent than the actual development process itself and thus causes additional expense due to exhaustion of the developer, as well as some difficulty in controlling the developing action of the solution. Soluble sulfites, such as sodium sulfite, are customarily added to developing solutions with the purpose of preserving the developer and preventing aerial oxidation, but the use of sulfite is objectionable in many developers, particularly color-forming developers, in which aromatic amino developing agents are used.

It is, therefore, an object of the present invention to provide a novel means for preventing aerial oxidation of photographic developers, especially color-forming developers. A further object is to provide a means for reducing the amount of sulfite used in color-forming photographic developers.

These objects are accomplished by the addition of small amounts of hydroquinones to developing solutions containing aromatic amino developing agents, or in general the addition of reducing agents having a higher solution reduction potential than the developer in question but which are not strongly adsorbed to the grains in the emulsion and, therefore, take only a very small part in the actual development process.

Reducing agents which may be used for this purpose include hydroquinone, hydroquinone monosulfonate, toluhydroquinone or similar dihydroxy compounds. When these compounds are added to an amino developer solution, the oxidation due to air agitation will affect the hydroquinone or other reducing agent to a much greater extent than the amino developer due to the higher solution reduction potential of the hydroquinone or other dihydroxy compound. However, since the amino developer is much more strongly adsorbed to the silver halide grains than the hydroxy compound, the amino compound will be more active in the development process and its oxidized form will still be available for forming a dye image with any coupler that is present.

Our invention, therefore, resides in the use of any reducing agent whose electrochemical solution reduction potential is higher than that of the developing agent but whose photographic reduction potential is less than that of the developing agent to decrease aerial oxidation of the developer without greatly affecting the photographic activity of the solution. We particularly propose to use these reducing agents with developing solutions in which the developer contains one or more substituted or unsubstituted amino groups and where the developer is to be used under conditions such that it is readily attacked and oxidized by air.

The following examples illustrate developing solutions containing reducing agents of the type mentioned.

Example 1

Diethyl-p-phenylenediamine	grams	2
Sodium sulfite	do	5
Sodium carbonate	do	20
Potassium bromide	do	5
α-Naphthol	do	1
Sodium hydroxide	do	1.5
Hydroquinone	do	0.3
Water to	cc	1000

Example 2

Diethyl-p-phenylenediamine	grams	2
Sodium sulfite	do	5
Sodium carbonate	do	20
Potassium bromide	do	5
2,3,4-trichloro-naphthol	do	1
Sodium hydroxide	do	1.5
Hydroquinone monosulfonate	do	1.0
Water to	cc	1000

Example 3

Dimethyl-p-phenylenediamine	grams	3
Sodium sulfite	do	5
Sodium carbonate	do	20
Potassium bromide	do	5
4-chloro-o-phenyl phenol	do	1
Sodium hydroxide	do	1.5
Toluhydroquinone	do	0.2
Water to	cc	1000

Example 4

Diethyl-p-phenylenediamine	grams	2
Sodium sulfite	do	40
Sodium carbonate	do	20
Potassium bromide	do	5
α-Naphthol	do	1.5
Sodium hydroxide	do	1.5
Hydroquinone monosulfonate	do	1.0
Water to	cc	1000

The dihydroxy reducing agents used in the developer may be added in varying amounts with

color forming developers containing from 1 to 5 grams of developing agent per liter of developing solution. The amount of added dihydroxy compound may vary from about 0.1 gram to 1.0 gram per liter.

In many cases the dihydroxy reducing agents, besides preventing aerial oxidation of the developer, have an additional beneficial effect in retarding the formation of a general dye stain thereby improving the character of the dye image formed with color developers. These compounds may also modify the effective depth distribution of the dye images and so insure a more desirable dye distribution throughout the emulsion.

It is to be understood that the examples and modifications contained herein are illustrative only and that our invention is to be taken as limited only by the scope of the appended claims.

We claim:

1. A color-forming photographic developer in which the color developing agent is not subject to aerial oxidation, comprising a primary aromatic amino coupling developing agent, a coupler and a hydroquinone.

2. A color-forming photographic developer in which the color developing agent is not subject to aerial oxidation, comprising a paraphenylenediamine developing agent, a coupler and a hydroquinone.

3. A color-forming photographic developer in which the color developing agent is not subject to aerial oxidation, comprising a paraphenylenediamine developing agent, a coupler and hydroquinone.

4. A color-forming photographic developer in which the color developing agent is not subject to aerial oxidation, comprising a paraphenylenediamine developing agent, a coupler and hydroquinone monosulfonate.

RALPH M. EVANS.
WESLEY T. HANSON, JR.