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PHOTOGRAPHIC SOLUTION

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This invention relates to combined developers and fixers for developing and fixing photographic emulsions; and more particularly to composite solutions containing both the developing and the fixing agents which are quite stable and may be used over relatively long periods of time, e. g., as much as a year or more, and which retain, until the active ingredients are practically exhausted, the property of satisfactorily fixing and developing films and the like by immersion in a single bath.

In United States Patent 2,138,486, granted November 29, 1938, to Ernst Fournes and myself, there are described improvements in composite fixing and developing solutions. The solutions of that patent are relatively stable, and may be used over a relatively long period of time with reasonably good results. The solutions of that patent contain an organic developing agent, a fixing agent, a caustic alkali and a reducing carbohydrate, the invention consisting in the use, along with the caustic alkali, of the reducing carbohydrate which renders the solutions stable. It has been known for a long time that composite developing and fixing solutions can be produced by using a developing agent and a fixing agent in a single solution along with caustic alkali or the like; but such solutions are not stable, and at the most may be effectively used for one or two days after preparation.

The solutions of said Patent 2,138,486, while satisfactory for many purposes, have, in use, certain disadvantages. The properties of the solutions tend to change with use, so that a solution which is freshly prepared gives somewhat different results, i. e., a different degree of development, than a solution which has been used over a period of time and in which some of the active ingredients have been consumed. Also, in some cases, the solutions of said patent tend to produce developed pictures having a relatively coarse grain, such that they cannot be greatly enlarged, and lack the resolution and fine detail which is highly desirable.

In accordance with the present invention, composite developing and fixing solutions are prepared which are quite stable, i. e., may be used over a period of a month or two or even more without substantial deterioration, which give substantially the same degree of development after considerable use as when freshly prepared, i. e., do not change the degree of development after partial, and even after very substantial, exhaustion of the active ingredients, and which do not cause the coarse grain which may be produced when the solutions of said Patent 2,138,486 are used.

The composite solutions of the invention contain an organic developing agent, such as Metol, hydroquinone, paraphenylenediamine, chlorhydroquinone, mixtures thereof or other organic developing agents, a fixing agent, such as hypo (sodium thiosulfate), one or more alkaline salts, such as sodium carbonate, trisodium phosphate, borax, or other alkaline salts, and a reducing carbohydrate, such as a reducing sugar, e. g., dextrose, fructose, lactose, maltose, or a sugar alcohol, such as mannite, or their anhydrides, etc., together with other conventional ingredients such as sodium sulfite and methyl alcohol when necessary or desirable.

Such solutions, when used for fixing and developing, accomplish both the developing and fixing in a single operation. They eliminate entirely the need for care with respect to the time of treatment, as it is simply necessary to immerse the film or the like in the solution for a sufficient period of time to permit the development and fixing to take place. It is not necessary to remove the film or the like promptly after developing and fixing, because over-development does not take place. The developed pictures have a finer grain, and there is little tendency for the pictures to develop a coarse grain, as sometimes occurs with the caustic alkali compositions of Patent 2,138,486. The solutions are relatively stable, and need not be used promptly after preparation, that is, they may be used over, or kept for, a period of months, or a year or even a longer period, after preparation, without such oxidation because of exposure to air as renders them unfit for use.

The solutions give an almost uniform degree of development during their entire life. If, as initially produced, the solutions develop to a proper degree, they will develop to almost the same degree even when the active ingredients are almost exhausted, and if they develop to the proper degree when made, they will not under-develop or over-develop when they have been used to a considerable extent.

The invention will be further illustrated by the following examples, but it is not limited thereto.

Example I.—A combined developing and fixing solution is prepared from the following:

Chlorhydroquinone 8.5 g
Sodium sulfite (anhydrous) 32.0 g
Lactose 3.4 g
Hypo (sodium thiosulfate) 60.0 g
Sodium carbonate (monohydrate) 100.0 g
Methyl alcohol 5.0 cc
Water to 1000 cc.

This solution is prepared following the usual practice for mixing developers. Warm water (125° F.) is used, the sodium sulfite and lactose are dissolved in it, the chlorhydroquinone is then fully dissolved, the methyl alcohol is added, the hypo and sodium carbonate are added last and the water made up to 1000 cc.

Example II.—A solution is prepared from the following:
Metol 4.0 g
Hydroquinone 6.0 g
Fructose 3.0 g
Lactose 2.5 g
Sodium sulfite (anhydrous) 50.0 g
Sodium carbonate (monohydrate) 100 g
Hypo (sodium thiosulfate) 66.0 g
Water to 1000 cc.

The solution is prepared as in Example I, except that the Metol is dissolved before the sodium sulfite.

Tests have shown that this product retains its property of developing and fixing, and of giving a uniform degree of developing both when fresh and after considerable use, for periods of at least a year.

Example III.—A developing and fixing solution is prepared from the following:
Paraphenylenediamine hydrochloride 12.0 g
Metol 4.0 g
Glycine 4.0 g
Sodium sulfite (anhydrous) 60.0 g
Mannite 4.0 g
Lactose 6.0 g
Hypo 60.0 g
Sodium carbonate (monohydrate) 100.0 g
Water to 1000 cc.

This solution gives excellent results for fine-grain development.

Example IV.—A fixing and developing solution is prepared as follows:
Dextrose 4.0 g
Metol 3.0 g
Hydroquinone 10.0 g
Lactose 5.0 g
Sodium sulfite (anhydrous) 60.0 g
Borax 10.0 g
Boric acid 5.0 g
Sodium thiosulfate 50.0 g
Sodium carbonate (monohydrate) 80.0 g
Methyl alcohol 30.0 cc
Water to 1000 cc.

The formulae given in the examples may, of course, be considerably modified. For example, instead of using sodium carbonate, other alkaline salts, such as trisodium or disodium phosphate may be used. Buffering agents, such as boric acid, may be added to reduce the alkalinity of the salts somewhat. Similarly, other reducing carbohydrates than the reducing sugars of the examples may be used.

While the solutions are advantageously prepared as described in Example I, they may be prepared in the form of concentrated solutions, pastes or powders, to be diluted or dissolved when used; and it is to be understood that such concentrated solutions, pastes or powders are included in the invention.

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