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HARDENING PHOTOGRAPHIC MATERIALS

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7 Claims. (Cl. 95—88)

For hardening the gelatin of photographic plates, films and papers, it is customary to employ a chromium salt such as potassium chromium sulphate, known as potassium chromium alum, together with sulphuric acid or acetic acid, and in some cases the sulphuric or acetic acid is used with an aluminum salt such as potassium aluminum sulphate or alum, and these hardening solutions are used either as separate baths solely for the purpose of hardening, or are incorporated in the fixing bath of sodium thiosulphate or other silver halide solvent where the photographic material to be hardened contains silver halide. In these hardening compositions, the acids are strong acids, and their function is on the one hand to assist in producing the hardening effect, and on the other hand where hardening follows development, as a neutralizer to neutralize what alkali is carried over from the developer. Hardening solutions of this kind, particularly those containing potassium chromium sulphate, have the very serious disadvantage that deterioration begins immediately after the solution is prepared and proceeds with increasing loss of hardening effect. In this deterioration there is formed also an insoluble precipitate which not only reduces the hardening effect but occasions a hard scum or deposit on the photographic material and on the walls of the vessel, particularly when the hardener is incorporated in or is used in conjunction with sodium thiosulphate fixing solutions. In accordance with the present invention, it now becomes possible to avoid the disadvantages noted, and new hardening solutions may be provided which operate especially desirably.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

I have found that hardening solutions prepared according to my invention maintain their hardening effect over extended periods, and tendency to over-hardening is absent, and the hardening solutions of my invention may be used separately or may be incorporated in a silver halide solvent such as sodium thiosulphate, and when such sodium thiosulphate is present the advantages of the invention are notably apparent. My hardening composition involves gluconic acid, by which term I include glucono-delta-lactone and glucono-gamma-lactone, it being commonly understood that the two latter compounds when dissolved in water hydrolyze to form gluconic acid. The normal gluconic acid may be used, or generally I prefer to employ the lactone form because of its solid state instead of liquid and its general availability and convenience. Of the two lactones I prefer the delta lactone because of its relative cheapness. The gluconic acid or glucono-lactone may be employed in concentrations of different amounts depending upon the particular conditions to be met and the results sought, and in general it may be such as to yield 0.5 to 15 per cent of gluconic acid in the solution; and therewith I employ a hardening salt, such as ordinary alum or chrome alum i. e. potassium aluminum sulphate or potassium chromium sulphate, and generally I prefer the chromium salt, as the effect is more permanent.

As an example of a bath for hardening only, the following may be noted:

Water	cc	1000
Glucono-delta-lactone	grams	5
Potassium aluminum sulphate	do	20

As another example of this kind of hardening bath:

Water	cc	1000
Glucono-delta-lactone	grams	5
Potassium chromium sulphate	do	20

As an example of a combined hardening and fixing bath, the following may be noted:

Water	cc	600
Glucono-delta-lactone	grams	50
Potassium aluminum sulphate	do	20
Sodium thiosulphate	do	400
Sodium sulphite	do	20
Ammonium chloride	do	50

As another example:

Water	cc	600
Glucono-delta-lactone	grams	50
Potassium chromium sulphate	do	20
Sodium thiosulphate	do	400
Sodium sulphite	do	20
Ammonium chloride	do	50

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a process of the character described, subjecting a photographic gelatin layer carrying a silver image to the action of a solution of gluconic acid containing 0.5 to 15 per cent of gluconic acid and a chromium salt and a fixing agent.

2. In a process of the character described, subjecting a photographic gelatin layer carrying a silver image to the action of a solution of gluconic acid containing 0.5 to 15 per cent of gluconic acid and a chromium salt.

3. In a process of the character described, subjecting a photographic gelatin layer carrying a silver image to the action of a solution of gluconic acid containing 0.5 to 15 per cent of gluconic acid and an alum.

4. A treating composition for photographic gelatin layers carrying a silver image containing a substance selected from the group consisting of gluconic acid and glucono-lactone in such concentration as to yield 0.5 to 15 per cent of gluconic acid in solution and therewith a hardening agent selected from the group consisting of an aluminum salt and a chromium salt having hardening action.

5. A treating composition for photographic gelatin layers carrying a silver image containing a substance selected from the group consisting of gluconic acid and glucono-lactone in such concentration as to yield 0.5 to 15 per cent of gluconic acid in solution and therewith a fixing agent and a hardening agent selected from the group consisting of an aluminum salt and a chromium salt having hardening action.

6. A treating composition for photographic gelatin layers carrying a silver image containing a substance selected from the group consisting of gluconic acid and glucono-lactone in such concentration as to yield 0.5 to 15 per cent of gluconic acid in solution and therewith a fixing agent and a chromium salt having hardening action.

7. A treating bath for photographic gelatin layers carrying a silver image containing 0.5 to 15 per cent of gluconic acid in solution and a hardening agent selected from the group consisting of an aluminum salt and a chromium salt having hardening action.

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