

[54] ANTISTATIC PHOTOGRAPHIC
COMPOSITIONS

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[58] Field of Search96/87 A, 114.2

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[57] ABSTRACT

Improved photographic compositions are disclosed compris-
ing a support, a photographic silver halide layer and at least
one layer containing a static-inhibiting amount of a compound
which is a salt of glycerophosphoric acid.

9 Claims, No Drawings

ANTISTATIC PHOTOGRAPHIC COMPOSITIONS

This invention relates to antistatic compounds which are useful in photographic compositions. In one aspect, this invention relates to the use of salts of glycerophosphoric acid as antistatic agents.

It is known that certain anionic phosphate compounds having lipophilic and hydrophilic groups display antistatic properties when used in combination with cationic surfactants. It is also known that polyesters of phosphoric acid used in combination with glycerol provide antistatic properties to synthetic materials. These antistatic substances which are commonly used in textile materials as well as photographic compositions frequently cause problems when used in photographic compositions leading to undesirable changes in hardness and sensitometric properties. Many of these antistatic substances modify the silver halide grain properties.

Photographic elements containing the antistatic compounds of out invention provide improved antistatic properties without substantially affecting sensitometric properties, silver halide grain properties or hardness. Moreover, the glycerophosphates of the invention are simple, ionic compounds which are readily available and which can be used alone or in combination with other compounds such as wetting agents, soaps, hygroscopic agents, dispersing agents, etc.

In one embodiment, a photographic composition comprises a support, a photographic silver halide layer and at least one layer comprising a static-inhibiting amount of a compound which is a salt of glycerophosphoric acid and is preferably an ammonium or alkali metal salt of glycerophosphoric acid.

In a preferred embodiment, said photographic composition comprises a support and a photographic silver halide emulsion layer comprising a static-inhibiting amount of sodium glycerophosphate.

In another embodiment, said photographic composition comprises a support, a photographic silver halide layer and a gelatin backing layer comprising sodium glycerophosphate.

In still another embodiment, said photographic composition comprises a support and a photographic silver halide emulsion layer comprising sodium glycerophosphate and monoammonium glycerophosphate.

Suitable antistatic compounds include all those salts of glycerophosphoric acid which impart conductivity to a photographic material and thus substantially dissipate electrical charges before their accumulation leads to local discharges leading to black streaks, lines or irregular fogged patterns in the emulsion layer. Preferred antistatic agents are glycerophosphates of alkali metals used alone or in combination with other glycerophosphates such as monoammonium glycerophosphate. Examples of useful antistatic compounds include glycerophosphates of metal ions such as, for example, potassium glycerophosphate, sodium glycerophosphate, calcium glycerophosphate, lithium glycerophosphate, ammonium glycerophosphate and the like.

The compounds of the invention used in static-inhibiting quantities lower the surface resistivity of the photographic element under various conditions of relative humidity without modifying the silver halide grain properties or without changing physical properties such as hardness of gelatin-containing layers.

The compounds of the invention can be dissolved in water and added to photographic silver halide emulsions or binder vehicles such as, for example, hydrophilic colloids, latex polymers, water-insoluble polymers and the like. Typical preferred binder vehicles include proteins such as gelatin, hydrophilic polymers and dispersed vinyl compounds such as those in the latex form and combinations of the same. Suitable synthetic polymers include those described, for example, in U.S. Pat. No. 3,142,568 of Nottorf, issued July 28, 1964; No. 3,193,386 of White, issued July 6, 1965; No. 3,062,674 of Houck, Smith and Yudelson, issued Nov. 6, 1962; No. 3,220,844 of Houck, Smith and Yudelson, issued Nov. 30, 1965; No. 3,287,289 of Ream and Fowler, issued Nov. 22,

1966; and No. 3,411,911 of Dykstra, issued Nov. 19, 1968; particularly effective are those water-insoluble polymers of alkyl acrylates and methacrylates, acrylic acid, sulfoalkyl acrylates or methacrylates, those which have cross-linking sites which facilitate hardening or curing, and those having recurring sulfobetaine units as described in Canadian Pat. No. 774,054. The compounds of this invention can be incorporated in at least one layer of a photographic element such as, for example, anti-abrasive layers, backing layers, photographic silver halide emulsion layers, combinations of layers, etc., though photographic silver halide emulsion layers are preferred.

Optimum static-inhibiting levels of antistatic compounds are determined experimentally by measuring the electrical surface resistivity of a photographic composition containing a sample compound. In general, increased levels of antistatic compounds produce lower surface resistivities resulting in improved static-inhibiting properties. The glycerophosphates generally provide improved antistatic properties when incorporated in the binder vehicle at a concentration of about 5 grams to about 60 grams per 100 grams of vehicle; preferably they are added at a concentration of 15 grams to about 40 grams per 100 grams of binder vehicle.

This invention is further illustrated by the following examples.

EXAMPLE 1

Sodium glycerophosphate in a backing layer

Sodium glycerophosphate is dissolved in water and the pH is adjusted to that of the final pH of the backing layer without the antistatic compound. The sodium glycerophosphate solution is then added to an 11 percent gelatin solution which is coated on the back of a film support at a rate of coverage of 240 mg./square decimeter.

In Table I below, the level of glycerophosphate addition varies according to the resistivity desired. Results indicate that film surface resistivity measured at 30 percent and 50 percent RH decreases as the level of glycerophosphate addition increases from 1.5 to 4.0 percent by weight of gelatin solution. The addition of another phosphate such as monoammonium phosphate in combination with sodium glycerophosphate further lowers the resistivity of the photographic composition.

No appreciable change is observed in gelatin hardening in tests of samples containing antistatic agents as evaluated by measuring the melting point of gelatin in water on samples which have been stored for 7 days at room temperature.

TABLE I

Sample No.	Grams of addenda in 1 kg. of gelatin solution		Surface resistivity $10^9 \Omega/\text{square}$		Melting point after 7 days of storage, °C.
	Na glycerophosphate	Monoammonium phosphate	30% RH	50% RH	
1.....	(1)	0	1000	57	100
2.....	15	0	110	7	100
3.....	25	0	90	1.4	100
4.....	40	0	3.7	0.021	100
5.....	40	10	1.7	0.0065	100

¹ (0) control.

EXAMPLE 2

Sodium glycerophosphate in a photographic silver halide emulsion layer

Sodium glycerophosphate is added to a silver halide gelatin emulsion at a rate of 80 grams per 2 kilograms of 7 percent gelatin. Emulsion samples are coated on a film support at a rate of 54 mg./square decimeter. Surface resistivities of test coatings are set forth in Table 2 below.

Sensitometric data shows that substantially no change occurs in photographic speed or in minimum density on both fresh and incubated samples. Changes in minimum densities of

incubated samples are further minimized in coatings containing both sodium glycerophosphate and monoammonium phosphate.

4. A photographic element according to claim 1 wherein said silver halide layer is a photographic silver halide emulsion layer comprising sodium glycerophosphate and monoammoni-

TABLE 2

Sample No.:	Grams of addenda in 2 kg. of emulsion		Surface resistivity 10 ⁹ Ω/square		Melting point after 7 days of storage, ° C.	Change in speed	Change in minimum density	
	Na glycero- phosphate	Mono- ammonium phosphate	30% RH	50% RH			Fresh	Incubation
1	(1)	0	2,500	62	100			
2	80	0	800	0.013	100	+0.06	+0.04	+0.54
3	80	40	10	0.0028	99	+0.06	+0.04	+0.02

¹ (U) control.

Similar results are obtained when potassium glycerophosphate, calcium glycerophosphate and lithium glycerophosphate are used as antistatic compounds in the photographic emulsion.

Although the invention has been described in considerable detail with particular reference to certain preferred embodiments thereof, variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. A photographic element comprising a support, a photographic silver halide layer and at least one layer comprising a static-inhibiting amount of a compound which is a salt of glycerophosphoric acid.
2. A photographic element according to claim 1 wherein said silver halide layer is a photographic silver halide emulsion layer comprising a static-inhibiting amount of an alkali metal glycerophosphate.
3. A photographic element according to claim 1 wherein said compound is sodium glycerophosphate incorporated in a gelatin backing layer.

um phosphate.

5. A photographic element according to claim 1 wherein said salt of glycerophosphoric acid is potassium glycerophosphate, sodium glycerophosphate, calcium glycerophosphate acid or lithium glycerophosphate.
6. A photographic element according to claim 1 wherein said salt of glycerophosphoric acid is sodium glycerophosphate.
7. A photographic element according to claim 1 comprising from about 5 grams to about 60 grams of said salt of glycerophosphoric acid per 100 grams of binder vehicle.
8. A photographic element according to claim 1 comprising from about 15 grams to about 40 grams of said salt of glycerophosphoric acid per 100 grams of binder vehicle in said layer.
9. A photographic element according to claim 1 wherein said binder vehicle is gelatin.

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