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PHOTOGRAPHIC SILVER HALIDE MATERIAL CONTAINING LACTOSE

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8 Claims. (Cl. 96—94)

This invention relates to a novel and particularly advantageous photosensitive photographic silver halide material having improved properties.

It is desirable for many reasons to attain the blackening of photosensitive photographic silver halide preparations, essential to image formation, with the smallest possible application of silver halide. Films with slight application of silver and gelatin have, in addition to the considerable economic advantage, also the great merit that they can be processed and dried in a very short time, which is of utmost significance in view of the steady increase in automatic processing.

In this connection, it is known in the art that the covering power of gelatin-containing photographic emulsions can be increased by replacing a portion of the gelatin with macromolecular compounds, for example, N-vinyl lactame polymers, dextrin, dextran or the like. These substances also have the effect that for the same quantity of applied silver halide the developed image is given a substantial increment in maximum density and in contrast.

But substances used in the prior art for increasing covering power have serious drawbacks. Since the prior art concerned itself with macromolecular substances, which must be added to the gelatin in comparatively large amounts, there is an unfavorable and uncontrollable effect on the viscosity of the emulsions. Moreover, these substances frequently display low compatibility with the photosensitive emulsion, so that they can be used only in combination with special stabilizers.

Now it has been found that the covering power of photosensitive photographic silver halide preparations can be increased by adding lactose to the photosensitive layer and/or to the auxiliary layers, e.g., sublayers, filter layers and anti-abrasion layers, with no occurrence of the drawbacks mentioned above. Addition of lactose then not only enhances covering power, but also substantially diminishes fogging. These results are wholly unexpected and were in no way predictable. As is known in the art, lactose is not even a macromolecular compound, but has a comparatively low molecular weight and is also characterized by substantial solubility in water. Hence, from this it would be expected that the lactose would be leached out of the film layers during processing so that its effect would be lost. Surprisingly, however, this does not occur; instead, the effect of lactose in giving greater covering power is fully retained even in the final processed film. Thus, the present invention offers the possibility of employing a low-molecular substance for the specified purpose, with the advantage that it does not affect the viscosity of the emulsion.

Again, it is known to those skilled in the art that addition of reducing agents to photosensitive emulsions increase their fogging tendency. Yet with the addition of lactose, even though it also has reducing properties, there is against all expectation a notable decrease in fogging. Hence, it is possible by means of the present invention to make photosensitive photographic silver halide preparations having enhanced covering power and increased contrast and being at the same time stabilized against fogging.

Preparation of the emulsions according to this invention may be carried out by the usual methods. Preferably the lactose is added to the emulsion in amounts of 5–55 g. per liter, the addition being advantageously effected either before finishing the emulsion or immediately before coating the film. Addition may, however, be effected at any other time as may be desired during the emulsification process.

Along the same line, it is especially advantageous to add the lactose to the photosensitive layer and/or to the auxiliary layers in amounts of 5–55 g. to 20–100 g. of silver bromide.

The gelatino-silver halide emulsions of the invention contain at least 20% by weight of lactose based on silver halide. On a dry basis, the lactose-containing gelatino-silver halide emulsions contain 35% to 70% silver halide, 20% to 60% gelatin, and 5% to 40% lactose, all by weight.

The process is applicable to all silver halide: gelatin emulsions but is particularly effective in coarse-grained high-sensitivity emulsions.

The lactose can be added to gelatin silver chloride, silver bromide, silver iodobromide, silver chlorobromide and other simple and mixed silver halide emulsions. The final emulsions, moreover, can contain any of the well-known optical sensitizing dyes as well as non-optical sensitizers such as sulphur sensitizers, e.g., allyl isothiocyanate, allyl diethyl thiourea, phenyl isothiocyanate and sodium thiosulfate; the polyoxyalkylene ethers disclosed in Blake et al., U.S. Patent 2,400,532 and the polyglycols disclosed in Blake et al., U.S. Patent 2,423,549. Other non-optical sensitizers such as amines as taught by Staud et al., U.S. Patent 1,925,508 and metal salts as taught by Baldsiefen, U.S. Patent 2,540,085 and Baldsiefen et al., U.S. Patent 2,540,086 may also be used. Antifoggants, e.g., benzotriazole and triazaindenes can be used as well as the usual hardeners, i.e., chrome alum, formaldehyde, etc.

The modified lactose-containing gelatino-silver halide emulsions may be coated on any suitable support such as paper or films composed of cellulosic esters, e.g., cellulose triacetate, cellulose acetate/butyrate; superpolymers, e.g., polyvinyl chloride co vinyl acetate, polyvinyl acetals, e.g., formal and acetal; polystyrene, polyamides, e.g., polyhexamethylene adipamide, and polyesters, e.g., polyethylene terephthalate, polyethylene terephthalate/isophthalate and those polyesters obtainable by condensing terephthalic acid or dimethyl terephthalate with propylene glycol, diethylene glycol, tetramethylene glycol or cyclohexane-1,4-dimethanol (hexahydro-p-xylene alcohol). The vinylidene chloride copolymer-coated oriented polyester films of Alles et al., U.S. Patent 2,627,088 and Alles, U.S. Patent 2,779,684 are especially suitable.

Commercially available lactose may be used in emulsions according to this invention. Because of its low price, it has substantial commercial superiority over the dextrans.

Example

A high-sensitivity gelatin:silver iodobromide emulsion, containing 7.5% gelatin and 8.25% silver halide,[1] is treated with the needed emulsion additives or adjuvants, after the finishing process, and is divided into 2 parts (A) and (B).

Lactose, 40 g. per kg. of emulsion ready for coating, is added to emulsion B while no lactose is added to emulsion A.

The emulsions are cast on a film base, yielding films A and B.

[1] Consisting of approx. 98% silver bromide and approx. 2% silver iodide.

A wedge pattern was copied on each of these films.

They were developed in a developer having the composition:

	Grams
Phenidone	0.3
Hydroquinone	15
Sodium sulfite	60
Sodium carbonate	50
Potassium bromide	3

in 1 liter of water.

Development: 3 minutes at 20° C.; fixing: about 5 minutes.

After washing and drying the film strips, measurements were made of maximum density at like application of silver, and of fogging:

	Maximum density	Fogging
Film A	2.7	.07
Film B	3.5	.01

An important advantage of the invention is that it provides a simple and economical way of providing photographic gelatin-silver halide emulsions of increased covering power.

Still other advantages will be apparent from the above description to those skilled in the art.

I claim:

1. A photographic gelatin-silver halide emulsion containing at least 20%, by weight, of lactose, by weight of silver halide.

2. A photographic gelatin-silver halide emulsion layer containing on a dry basis 35% to 70% silver halide, 20% to 60% gelatin and 5% to 40% lactose, all by weight.

3. A photographic element comprising a gelatino-silver halide emulsion layer having in intimate association therewith 5 to 22 grams of lactose per 20 to 100 grams of silver halide.

4. An element according to claim 3 wherein the lactose is in the emulsion layer.

5. An element according to claim 3 wherein the silver halide is silver iodobromide.

6. A photographic element comprising a gelatino-silver halide emulsion layer having in intimate association therewith on a dry basis 35% to 70% silver halide, 20% to 60% gelatin, and 5% to 40% lactose, by weight.

7. An element according to claim 6 wherein the lactose is in the emulsion layer.

8. An element according to claim 6 wherein the silver halide is silver iodobromide.

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