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ANTIHALATION BACKING FOR PHOTOGRAPHIC FILMS

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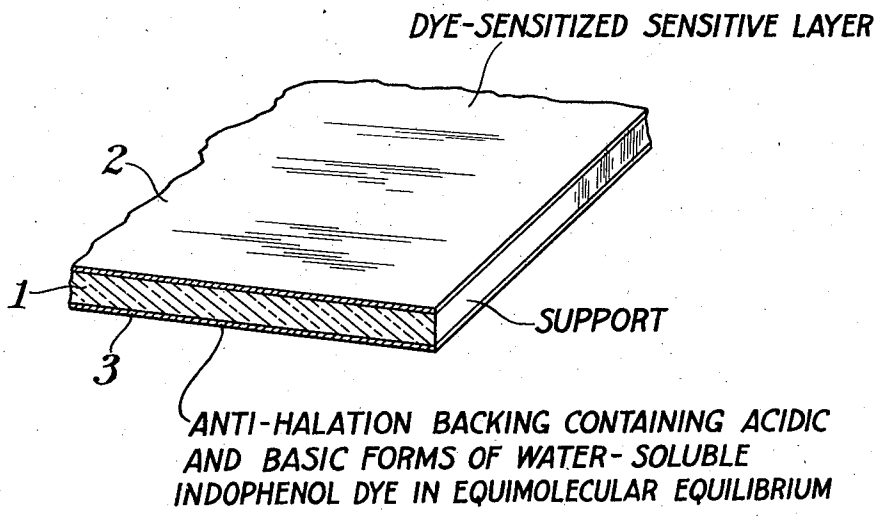

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ANTIHALATION BACKING FOR PHOTOGRAPHIC FILMS

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3 Claims. (Cl. 95—9)

This invention relates to photographic films, and more particularly to anti-halation backings for photographic films.

It is known to coat the rear face of photographic film with a layer containing a dye, in order to prevent halation caused by the reflection of light from the back of the film. With photographic film whose emulsion layer is sensitized to certain colors of light, it is especially desirable that light of the color or colors to which the emulsion is sensitized should be prevented from reflecting back from the rear surface of the film.

I have discovered that the class of dyes known as the water-soluble indophenol dyes are especially suitable for use in anti-halation backings on films whose emulsion layer has been sensitized by the incorporation of sensitizing dyes. Such films include, for instance, orthochromatic films, which are sensitized to yellow-green light, and panchromatic films, which are sensitized to both yellow-green and red.

The water-soluble indophenol dyes are known to exist in two modifications absorbing light strongly in different portions of the spectrum. The ratio of the two forms present in any given solution is determined by the hydrogen ion concentration. At a certain hydrogen ion concentration, which is specific for each dye, equimolecular concentrations of the two forms are present in equilibrium, and consequently, the absorption bands of both forms are present. A solution of this composition absorbs light over a considerably greater region of the spectrum than solutions containing almost entirely the one form or the other of the dye.

I have found that if a water-soluble indophenol dye is incorporated into a gelatin solution containing such proportions of acidic and basic constituents that, when the solution has been dried, the two forms of the dye will be present in approximately equimolecular equilibrium, the gelatin solution containing the dye may be advantageously used for forming an anti-halation backing on either orthochromatic or panchromatic film. In general, the concentration of dye used will be considerably higher than in solutions where it is used as an indicator of acid-base titrations, and the color of the layer will be correspondingly less sensitive to minute traces of acid or base which may be introduced from the atmosphere or the film support during the storage of the film. It should be kept in mind that there is usually a change in the equilibrium between the two forms of the dye upon drying down the backing. Thus, the dye which has the correct color at the pH of the backing solution may not have the correct color when the backing has dried.

In the attached drawing, 1 designates a support, such as cellulosic film or glass, 2 designates a dye-sensitized sensitive layer, such as an orthochromatic or panchromatic emulsion, and 3 designates an anti-halation or selectively light-absorbing layer containing the acidic and basic forms of a water-soluble indophenol dye in approximately equimolecular equilibrium.

The water-soluble indophenol dyes are red or pink in acid solution, and blue or greenish blue in alkaline solution. At equimolecular equilibrium the mixture is purplish or gray. The red form absorbs green light, and the blue form absorbs red light.

The indophenol dyes, when used in the concentrations necessary for anti-halation purposes, are readily decolorized by ordinary photographic developer solutions containing sodium sulfite. This is, of course, a necessary feature in a dye used for an anti-halation backing. An example of such a developer solution is the following:

Elon	8.0	grams
Sodium sulfite (desiccated)	400.0	do.
Hydroquinone	20.0	do.
Borax	8.0	do.
Water to make	4.0	liters

Presumably the sodium salt of the leuco-base of the dye is formed.

Although I may use the water-soluble indophenol dyes in equimolecular equilibrium, and although, in equilibrium, they absorb over a broad region of the spectrum, I have found that in this equilibrium they tend to have a lower total visual absorption than either of the two forms when present substantially alone. Also, at equimolecular equilibrium some of the dyes have a tendency to form microscopic crystals in the dried backing. While this does not prohibit their use in anti-halation backings, it is, of course, preferable that crystals should not be present in the backing.

I have found that water-soluble indophenol dyes which have their equimolecular equilibria at sufficiently high pH's show a strong red color in the dried backing, and do not tend to crystallize. These dyes are useful as anti-halation dyes for orthochromatic film, which is sensitized in the yellow-green region.

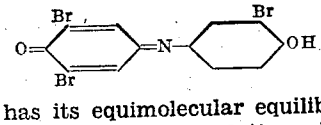
I have further found that water-soluble indo-

phenol dyes which have their equimolecular equilibria at sufficiently low pH's exist predominantly in the blue alkaline form in the backing, have a greater optical absorption in the backing than do equimolecular mixtures of the two forms, and, in fact, show sufficient absorption over the required ranges of the spectrum to be of value in anti-halation coatings for panchromatic film.

Although it is possible to adjust the composition of the backing solution so that any desired water-soluble indophenol dye may be used, practical considerations make it more advantageous to select dyes which exist in the desired form in the dried backing made from a solution of a predetermined composition. A plain solution of gelatin in water may be used as the backing solution, or sufficient chrome alum may be added so that the gelatin hardens upon setting and drying, and does not melt or become sticky under the conditions to which it is subjected. The pH of the solution is preferably adjusted to a value of about 5.5 to prevent premature setting of the gelatin, which would occur in a more alkaline solution.

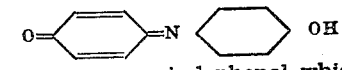
In my U. S. Patent No. 1,921,545 I have described and claimed the use of non-diffusing or water-insoluble indophenol dyes in screening layers which may be placed either upon the back of the film support or upon the surface of the emulsion layer. The water-soluble indophenol dyes are not particularly suitable for layers which are to be coated upon the emulsion layer, because of their diffusing character. However, they are entirely suitable for anti-halation backings or other screening layers coated on the back of the film support, because under proper storage conditions the anti-halation layer does not come in contact with the emulsion layer while either is in a moist condition. The use of the water-soluble indophenol dyes has great advantages over the use of the insoluble indophenol dyes in layers where non-diffusibility of the dye is not essential, because of the vastly greater ease with which the soluble indophenol dyes are incorporated. The insoluble indophenol dyes must be formed in the gelatin solution, as by mixing two separately prepared gelatin solutions, or by drawing air through a gelatin solution for several hours. In any event, the resulting gelatin-dye emulsion must be cooled, shredded, washed and remelted, in order to free it from the soluble impurities formed or introduced. When the water-soluble indophenol dyes are used, all that is necessary is to add the required amount of the dye or of its sodium salt, to a warm gelatin solution, with stirring. The solution is then ready to coat immediately. No cooling, shredding, washing or remelting is necessary. It will be obvious that an enormous saving in cost is thus effected.

As an example of a water-soluble indopenol dye whose two forms are in equimolecular equilibrium at a pH of approximately 5.5, I may mention 2:6-dibromobenzenoneindo-2'-bromophenol, which has the structural formula

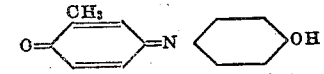


This dye has its equimolecular equilibrium at a pH of 6.3, but in a backing solution whose pH is 5.5, it gives a purplish mixture with broad absorption bands.

Examples of soluble indophenol dyes which give red backings which are useful on orthochromatic film are benzenoneindophenol, which has the structural formula

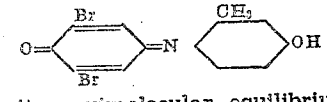


and 2-methylbenzenoneindophenol, which has the structural formula



Backing solutions of pH 5.5 containing these dyes dry to give films that absorb principally between 460 mμ and 560 mμ. The dyes have their equimolecular equilibria at pH's of 8.1 and 8.4, respectively.

An example of a soluble idophenol dye which gives a blue backing which is useful on panchromatic film is 2:6 - dibromobenzenoneindo - 3'-methyl phenol, which has the structural formula



and has its equimolecular equilibrium at 5.4. Spectrophotometric examination of the dried backing containing this dye shows that it has its absorption maximum in the red at about 630 mμ and its minimum in the blue at about 450 mμ, but that its absorption band is sufficiently broad, and its absorption at the minimum sufficiently great, to make the dye very useful as an anti-halation dye for panchromatic films.

Other soluble indophenol dyes, such, for instance, as 2:6:2':6' - tetrabromoindophenol and 2:6 - dichloroindonaphthol - 3' - sulfonic acid, are likewise useful in anti-halation backings.

As examples of the way in which my invention may be carried out, I may prepare backing solutions as follows.

Example I.—Solution for a red backing, especially suitable for orthochromatic film:

	Parts
Sodium salt of benzenoneindophenol	1
Gelatin	30
Water	1000

Example II.—Solution for a blue backing, especially suitable for panchromatic film:

	Parts
Sodium salt of 2:6-dibromobenzenoneindo-3'-methyl phenol	1
Gelatin	30
Water	1000

While above and in certain of the appended claims I have spoken of photographic film, it will be understood that my invention is equally applicable to the preparation of anti-halation backings or other screening layers on the back of photographic plates.

What I claim as my invention, and desire to be secured by Letters Patent of the United States is:

1. A sensitive photographic element comprising a support, a dye-sensitized sensitive layer, and a selectively light-absorbing layer comprising, as its essential light-absorbing component, a water-soluble indophenol dye, the sensitive layer and the selectively light-absorbing layer being on opposite sides of the support, and the acidic and basic forms of the indophenol dye being present in approximately equimolecular equilibrium.

2. A sensitive photographic element comprising a support, a dye-sensitized sensitive layer, and a selectively light-absorbing layer comprising, as its essential light-absorbing component, a water-soluble indophenol dye which is easily bleached

by a photographic developing solution containing sodium sulfite, the sensitive layer and the selectively light-absorbing layer being on opposite sides of the support, and the acidic and basic forms of the indophenol dye being present in approximately equimolecular equilibrium.

3. A dye-sensitized, sensitive photographic element having, on the opposite side of the support from the sensitive layer, an anti-halation backing layer comprising, as its essential light-absorbing component, a water-soluble indophenol dye, the acidic and basic forms of the indophenol dye being present in approximately equimolecular equilibrium.

MERRILL W. SEYMOUR.