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NOTE

SPECTRAL SENSITIZATION OF BENZOXAZOLO CARBOCYANINE DYE IN PHOTOGRAPHIC EMULSION

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Abstract – The green-sensitive silver halide emulsion layer has been studied UV-Vis absorption band of 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl)benzoxazolo carbocyanine triethyl ammonium salt in methanol solution and 10% methanol containing 10^{-2} *M* KCl, the products were observed at 502nm and 540nm(J-band), respectively. The maximum spectral sensitivity of sensntizing silver halide emulsion showed at 546nm. In conclusion, benzoxazolo carbocyanine dye can be used as a green-sensitizing dye for the photographic emulsion.

INTRODUCTION

In 1873, Vogel observed that certain dry plates showed unusual sensitivity in the green region of spectrum. He found that this was due to the presence of the yellow dye Coralline which had been added to the emulsion to anti-halation.[1,2] Spectral sensitization occurs by transfer of an electron from an excited dye molecule to the conduction band of the silver halide. This electron can take part in latent image formation or be lost by recombination or other processes, like an electron liberated by absorption of a photon by the silver halide.[3]

Sensitizing dyes are adsorbed at the surface of the silver halide particles.[4] 9-Methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl)benzoxazolo carbocyanine triethyl ammonium salt was synthesized in this laboratory.[5-8]

UV-Vis absorption spectra were recorded using a Shimadzu UV 256 spectrophotometer. 9-Methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl) benzoxazolo carbocyanine triethyl ammonium salt in methanol solution and 10% methanol containing 10^{-2} *M* KCl were examined,[9,10] and then wedge spectrogram was measured to test the performance of the dye as a green sensitizer in photographic emulsion. The photographic emulsion for color paper was prepared by double-jet method.

The tabular grain emulsion was precipitated using the double-jet method with automated control of pAg, coagulated, and washed.

Then it was redispersed, chemically sensitized with sodium thiosulfate, spectrally sensitized with 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl)benzoxazolo carbocyanine triethyl ammonium salt, coated on the paper base, dried, exposed, and developed in developer.

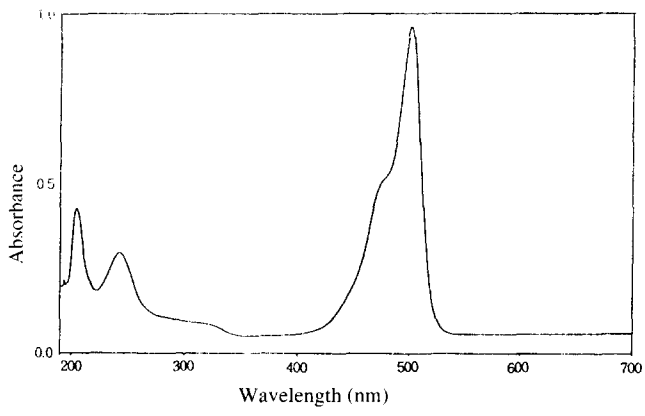

Figure 1. UV-Vis spectrum of 9-methyl-5,5'-diphenyl-3,3'-bis-(3-sulfopropyl)benzoxazolo carbocyanine triethyl ammonium salt in methanol.

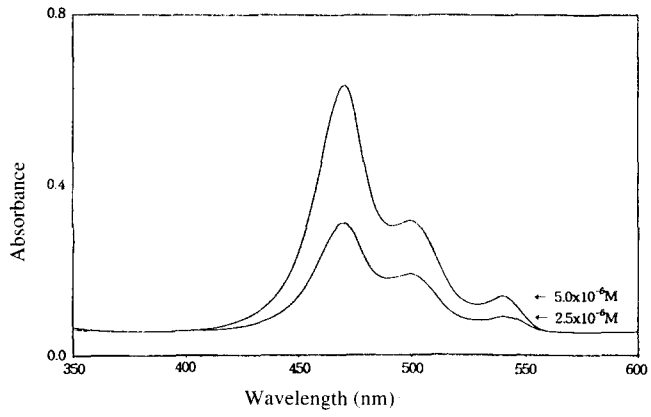

Figure 2. UV-Vis spectrum of 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfo-propyl)benzoxazolo carbocyanine triethyl ammonium salt solutions of 2.5×10^{-6} *M* and 5×10^{-6} *M* concentrations in 10% aqueous methanol containing 10^{-2} *M* KCl.

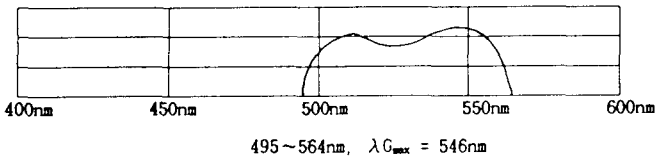

Figure 3. Wedge spectrogram of the color paper added to dye (1 mL, 0.1%) per 0.03 mol of silver.

The spectral sensitizer used in the green-sensitive silver halide emulsion layer may preferably be in an amount of 0.1% methanol solution per 0.03 mol of silver.

In the next place, the results and discussion of spectral sensitizing dye for photographic emulsion are as follows.

Absorption spectrum of 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl) benzoxazolo carbocyanine triethyl ammonium salt in methanol solution was determined (dye concentration about 5×10^{-5} mol/L). In the Fig.1, absorption maximum of the dye was observed near 502 nm.[6]

Fig. 2 represents the absorption spectra of dye in 10% aqueous methanol solution containing 10^{-2} *M* potassium chloride and it shows absorption band at 540 nm.

The light-sensitive material has a blue-sensitive layer, green-sensitive layer and a red-sensitive layer. The blue-sensitive layer has the maximum spectral sensitivity at a wavelength within the range of 415 nm to 470 nm. The green-sensitive layer has the maximum spectral sensitivity at a wavelength within the range of 530 nm to 560 nm. The red-sensitive layer has the maximum spectral sensitivity at a wavelength within the range of 595 nm to 700 nm. In this paper, it was mentioned only about the green-sensitive layer.

Fig. 3 represents the spectral sensitivity at the wavelength range from 495 nm to 564 nm, and maximum spectral sensitivity was observed at 546 nm.[11]

As compared with the maximum absorption peak of the monomer in methanol solution, the maximum spectral sensitivity of 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl)benzoxazolo carbocyanine triethyl ammonium salt has red shift of 44 nm.

Maximum absorption of the dye in electrolyte solution has red shift 38 nm more than that of the monomer in methanol solution.

The amount of residual color in the coated layer also depends upon the dye structure; the dye has no residual color after development and fixation. It was concluded that 9-methyl-5,5'-diphenyl-3,3'-bis(3-sulfopropyl) benzoxazolo carbocyanine triethyl ammonium salt can be used as a green-sensitizing dye for the spectral sensitization of photographic emulsion.

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