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A Study of Hydrogen Bond Activity of Oil Formers

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Abstract

The hydrogen bond activity of oil formers used in photographic system was studied, and HBA was defined as a new parameter to express hydrogen bond activity of solvents. It was found that the parameter could be applied to both hydrogen bond donating and accepting solvents. The parameter is useful in studying effects of hydrogen bond activity of oil formers on photographic performance.

Introduction

The hydrogen bond activity of components in oil droplet containing couplers and oil formers is one of the important factors that effect on photographic performance. While a variety of hydrogen bond parameters such as h_D[1]), pK_{HB}[2]), AN[3]), νa[4]) and νd[4]) were reported, these parameters are used to either hydrogen bond donating or accepting solvents. And common parameters applied to both hydrogen bond donating and accepting solvents have not been reported. A new parameter to express hydrogen bond activity of oil formers which could be applied to both hydrogen bond donating and accepting solvents was studied.

Results and Discussion

2,6-dichloroindophenol showed a large solvatochromic shift in the absorption maximum (λmax), and using the shift, HBA was defined as equation 1.

$$HBA = -(1/\lambda maxSolvent - 1/\lambda maxToluene) \times 10^3 \qquad (1)$$

Figure 1 shows a good correlation between HBA and the known parameters. It can be concluded that HBA is the parameter to express both hydrogen bond donating and accepting activity.

The λmax of 2,6-dichloroindophenol in oil former was measured and HBA was calculated. Table 1 shows typical oil formers measured in this study and HBA of the oil formers.

The HBA was expected to be useful in studying effects of hydrogen bond activity of oil formers on several photographic performance. A relationship between HBA and light stability of a specific magenta dye was investigated. Figure 2 shows that HBA closely related to light stability of the magenta dye and that oil formers with weak hydrogen bond activity enhanced the light stability of the magenta dye in both of hydrogen bond donating and accepting solvents.

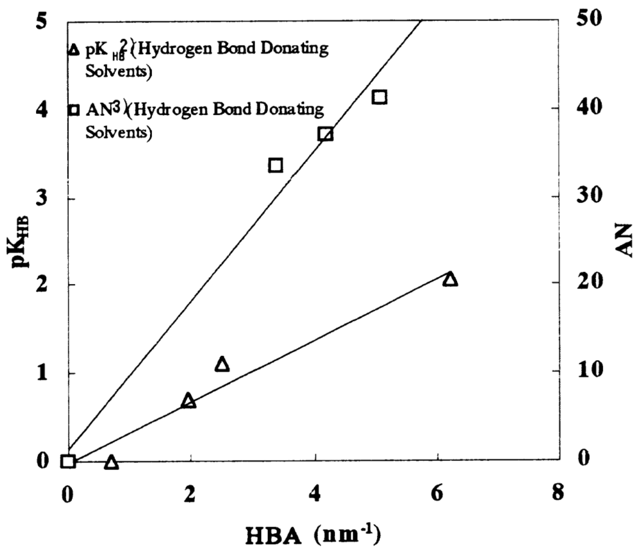

Figure 1: Relationship between HBA and Known Parameters;

Table 1: Hydrogen Bond Activity of Oil Formers

Compounds	HBA (nm⁻¹)	Hydrogen Bond Activity
Glycerol allyl ether derivative A	2.60	weaker
Sorbitan derivative A	2.62	↑
Sorbitan derivative B	2.69	
Dioctylphthalate	2.75	
Tricresylphosphate	2.82	
Glycerol allyl ether derivative B	2.84	↓
Octadecanol	3.03	stronger

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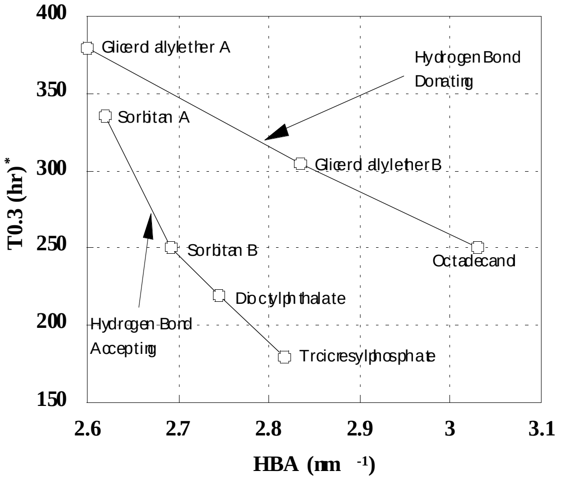

*Figure 2: Effect of Hydrogen Bond Activity of Oil Formers on Light Stability of Magenta Dye; *Time for 30% density loss; Light source : Xenon lamp (70klx)*

Conclusion

It could be concluded that hydrogen bond activity was expressed by a new parameter HBA and the parameter was applied to both hydrogen bond donating and accepting solvents. The parameter seems to be useful in studying effects of hydrogen bond activity of oil formers on photographic performance such as light stability.

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