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Note

The separation of optical brighteners by liquid–solid chromatography*

DIANA KIRKPATRICK

Consumer Product Safety Commission, Bureau of Biomedical Science, Division of Physical Science, Washington, D.C. 20207 (U.S.A.)

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Various optical brighteners are commonly used in detergent and laundry product formulations[1,2] to create an impression of superior brightness in fabrics after laundering. The operating principle in effect here is that such a substance will absorb light in the ultraviolet region and emit light in the visible (blue) region of the spectrum. Thus, the laundered fabric appears to be whiter than a similar non-treated fabric.

In the course of a study of optical brighteners in our laboratory it was decided to attempt an adaptation of a thin-layer chromatographic separation procedure[3] to high-performance liquid–solid chromatography in the hope of achieving a more rapid separation of the compounds.

EXPERIMENTAL

Reagents

Benzene, methanol and 1,4-dioxane were purchased from Burdick and Jackson Lab. (Muskegon, Mich., U.S.A.) and were distilled-in-glass reagent grade. Ammonium hydroxide was purchased from Allied Chemicals (ACS reagent, Code 1293). The optical brightener samples were obtained from Ciba-Geigy (Greensboro, N.C., U.S.A.) and Verona (Union, N.J., U.S.A.).

Chromatography

Separations were achieved using a MicroPak® Si-5 silica gel column (5-μm particles, no activation/deactivation), 25 cm × 2.2 mm I.D., manufactured by Varian (Palo Alto, Calif., U.S.A.). Chromatograms were obtained on a Chromatronix Model 3520 liquid chromatograph using a Chromatronix Model 770 variable wavelength detector set at 350 nm. The separations were run at a flow-rate of 0.4 ml/min a pressure of 2500 p.s.i., $A = 0.4$, and a full scale deflection of 50 mV.

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Solvent system

The composition of the mobile phase used was: benzene–*p*-dioxane–methanol–ammonium hydroxide (16:25:4:4). Approximately 1 mg of each optical brightener sample was dissolved in 50 ml of the mobile phase, and 10-μl samples were injected onto the column.

RESULTS AND DISCUSSION

Table I summarizes the formulae and the retention times for the seven optical brighteners studied, which are all bis(triazinyl) derivatives of 4,4′-diamino-stilbene-2,2′-disulfonic acid. The order of elution is the same as that observed for the thin-layer chromatographic technique[1]. Fig. 1 shows the chromatogram with the optical brighteners identified by peak.

TABLE I
FORMULAE AND RETENTION TIMES FOR THE OPTICAL BRIGHTENERS STUDIED

No.	*Optical brightener*	*Retention time (min)*	*Capacity factor*
I	Naphthotriazolyl stilbene sulfonate	3.1	0.72
II	Bis(anilino-morpholino-triazinylamino) stilbene disulfonate	7.2	3.00
III	Bis(phenyl-triazolyl) stilbene disulfonate	10.4	4.78
IV	Bis(anilino-hydroxyethylmethylamino-triazinylamino) stilbene disulfonate	13.6	5.50
V	Bis(anilino-methylamino-triazinylamino) stilbene disulfonate	11.7	6.56
VI	Bis(anilino-dihydroxyethylamino-triazinylamino) stilbene disulfonate	26.9	13.94
VII	Bis(styrylsulfonate) biphenyl	37.7	19.94

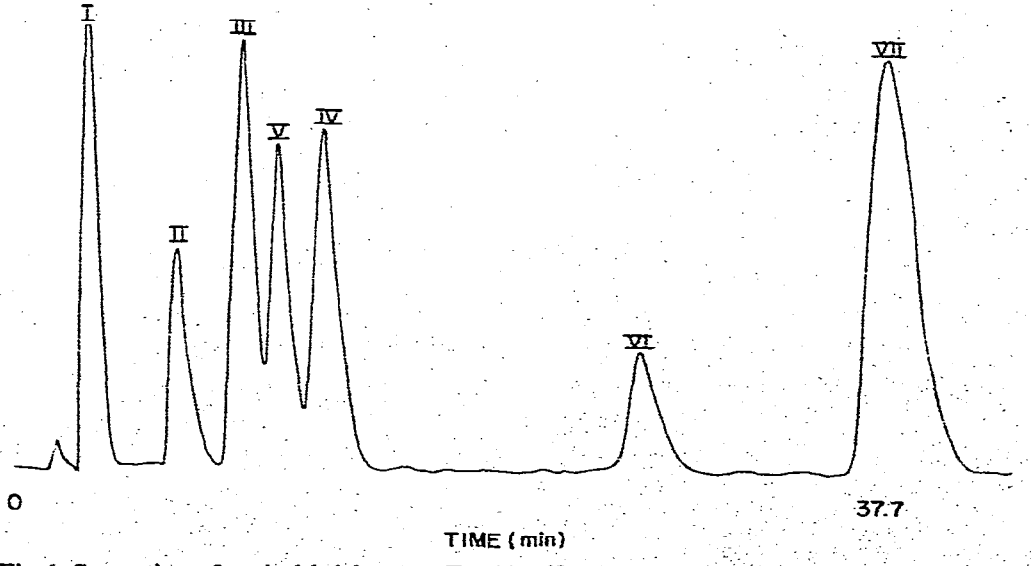

Fig. 1. Separation of optical brighteners. For identification of peaks see Table I.

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