

### Interaction of PVC Thermal Stabilizers and UV Absorbers

The principle of the action of UV absorbers is based on intensive spectrum absorption in the range of 290–390 nm. The absorption energy should be scattered without chemical change of absorber into harmless heat energy or long-wave light energy. The UV absorbers should be unreactive, readily miscible with components of stabilized medium, colorless, odorless, nonvolatile, and resistant to extraction.

As best absorbers from the points of view mentioned above, the derivatives of benzotriazole and benzophenone should be mentioned.

Colorless components have been obtained because of the correct recognition of the character of the influence of auxochromic substituents on the initial color of benzotriazole derivatives.<sup>1</sup> The initial properties can be worsening owing to interaction of benzotriazole derivatives with ions of heavy metals, which, as has been pointed out, causes the formation of color complexes.<sup>2</sup> This is important, because in practical conditions the possibility of contact between benzotriazole derivatives with thermal stabilizers often is observed, which chemically are the organic derivatives of heavy metals.

The influence of PVC thermal stabilizers on the color of UV absorbers is the main direction of investigations in this paper. No literature data on that subject appears to exist.

#### EXPERIMENTAL

As material for the investigations, UV absorbers such as 2-(2-hydroxy-5-methylphenyl)benzotriazole (Tinuvin P), 2-(2-hydroxy-3,5-di-*tert*-butylphenyl)-5-chlorobenzotriazole (Tinuvin 327), and UV Absorber Bayer 340 were used, as well as such thermal stabilizers as tin mercaptide (Ergoterm BTGO), organotin (Ergoterm BMB), Ba and Cd carboxylates (Irgastab BC-100), Zn, Ba, and Cd carboxylates (Nuostab V 1277), and Ca, Zn carboxylates (Irgastab ABC-1).

Prepared solutions in dioctyl phtalate (DOP) containing 0.5% by weight of UV absorber and 2% by weight of thermal stabilizer were let to stay for 6 hr and the absorption in the region of 400–600 nm in comparison with clean DOP was measured. The spectrum of stabilizer without UV absorber was compared as well. The results obtained are illustrated in Figures 1–5.

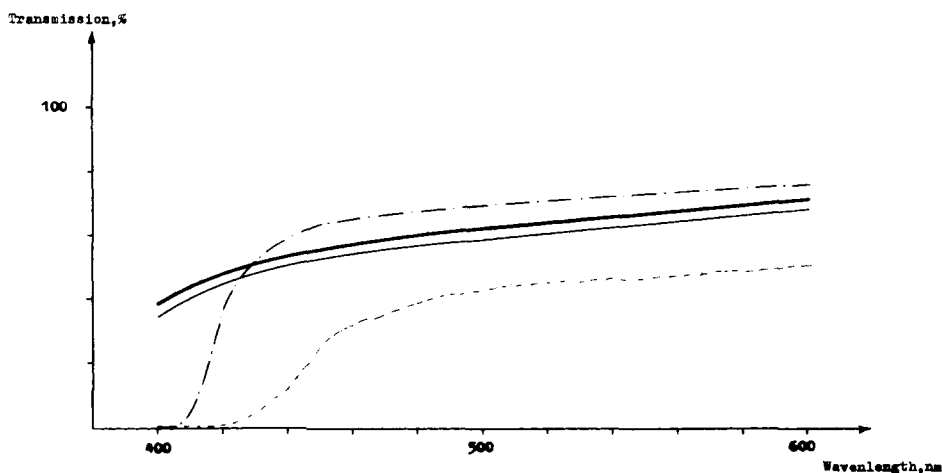


Fig. 1. Transmission spectra of solutions with tin mercaptide stabilizer in the visible region: (-----) Tinuvin P; (- · - ·) Tinuvin 327; (—) UV Absorber Bayer 340; (—) control solution without UV absorber.

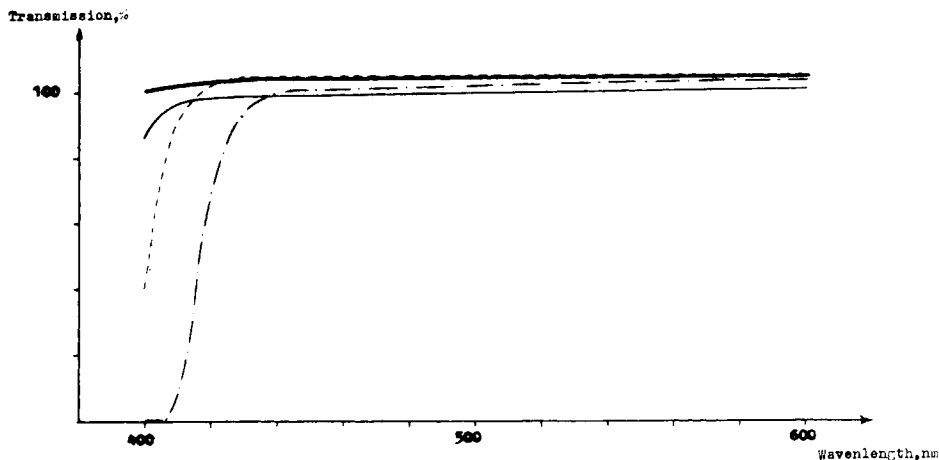


Fig. 2. Transmission spectra of solutions with organotin stabilizer in the visible region: (· · · ·) Tinuvin P; (- · - ·) Tinuvin 327; (—) UV Absorber Bayer 340; (—) control solution without UV absorber.

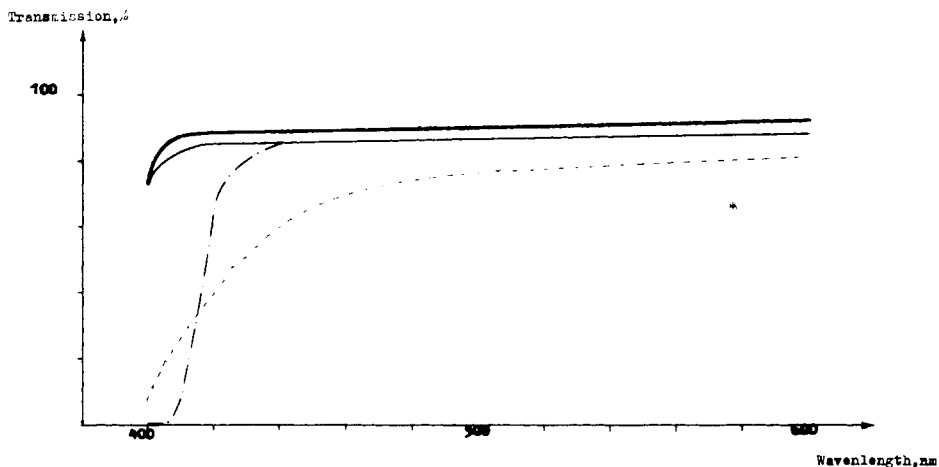


Fig. 3. Transmission spectra of solutions with Ba, Cd carboxylate stabilizer in the visible region: (· · · · ·) Tinuvin P; (- · - ·) Tinuvin 327; (—) UV Absorber Bayer 340; (—) control solution without UV absorber.

## DISCUSSION

The absorption spectra in the visible range pointed out that, regardless of the kind of thermal stabilizer used, the character of absorption by solutions containing UV Absorber Bayer 340 is similar to the character of absorption of thermal stabilizer solution alone in DOP. It can be seen that PVC thermal stabilizer did not cause a change in color of this stabilizer. On the other hand, the absorption spectra of benzotriazole derivatives in solutions containing organic compounds of Ba, Cd, Ca, Zn, and Sn are different. Influence of PVC thermal stabilizer on the color of Tinuvin 327 is smaller than on the color of Tinuvin P.

The color of solutions of benzotriazole derivatives does not change under the influence of stabilizers containing Sn.

Color complexes of Tinuvin P are formed very easily, but stabilizers containing cadmium and zinc, which are situated in higher position in the electromotive series, are more active.

The data mentioned above lead to the conclusion that only stabilizers with Sn should be used

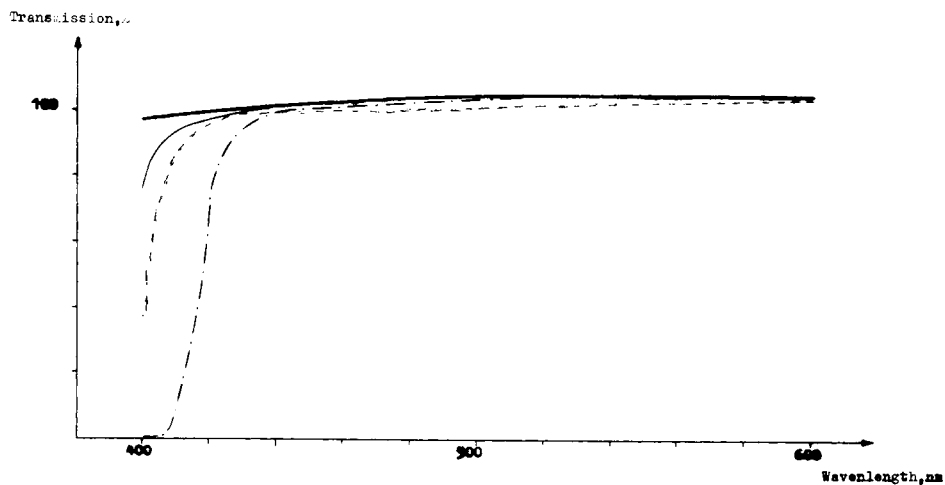


Fig. 4. Transmission spectra of solutions with Zn, Ba, Cd carboxylate stabilizer in the visible region: (· · · · ·) Tinuvin P; (- · - · -) Tinuvin 327; (—) UV Absorber Bayer 340; (—) control solution without UV absorber.

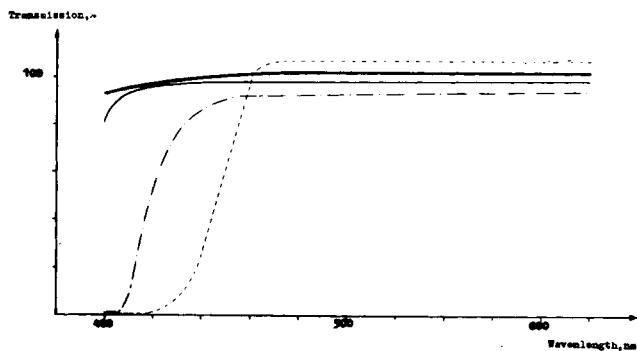


Fig. 5. Transmission spectra of solutions with Ca, Zn carboxylate stabilizer in the visible region: (· · · · ·) Tinuvin P; (- · - · -) uv; (—) UV Absorber Bayer 340; (—) control solution without UV absorber.

together with benzotriazole derivatives if white or colorless products of PVC are required.

The observed changes in the nature of absorption in the visible region did not take place in ultraviolet, where the intensity of the absorption was stable.

#### References

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