SPECTROPHOTOMETRIC DETERMINATION OF FUROCOUMARINS IN THE PREPARATION "FURALEN"

B. A. Krivut, A. A. Kir'yanov, and M. E. Perel'son

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Furalen is a preparation with a photosensitizing action consisting of combined psoralen and bergapten coumarins. Spectrophotometric and colorimetric methods of determining these furocoumarins in plant raw material have been proposed previously [1, 2].

We here describe a spectrophotometric method of determining psoralen and bergapten in the preparation without preliminary chromatographic separation of the combined furocoumarins.

The method is based on the measurement of the optical density of a solution of a mixture of psoralen and bergapten at two wavelengths (246 and 268 nm). The optical density of the solution at 297.5 nm, where the specific absorption coefficients of psoralen and bergapten are equal, is measured simultaneously, which enables the total content of furocoumarins to be determined (for the UV spectra of psoralen and bergapten, see Fig. 1). The amount of psoralen is calculated from its known optical densities at 246 and 268 nm and the amount of bergapten by the difference. This method of analysis gives a somewhat greater accuracy than the method described previously.

Table 1 gives the values of the specific absorption coefficients of the pure compounds at the appropriate wavelength.

To check the accuracy of this method, simultaneous determination of psoralen and bergapten in synthetic mixtures was performed. The error in the determination of each component did not exceed ± 5%, and of the total content did not exceed ± 1.5%.

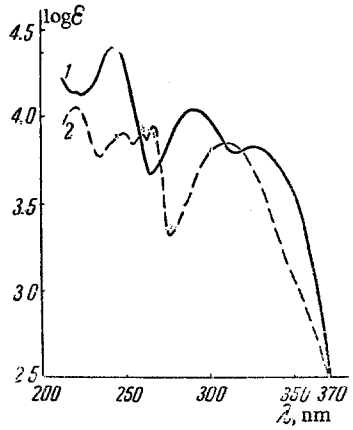

Fig. 1. UV spectra of psorelen (1) and bergapten (2) in 96% ethanol.

Three samples of furalen were analyzed by this method (Table 2). We see from Table 2 that the amount of combined furocoumarins found is always somewhat less than the amount of furalen taken, which is due to the presence of impurities not absorbing at 297.5 nm (probably solvent of crystallization.

EXPERIMENTAL

About 2 mg of furalen (accurately weighed) was dissolved in ethanol in a 50-ml measuring flask (solution A), and 1 ml of solution A was transferred with a pipette to a flask and diluted with 5 ml of ethanol (solution B). The optical densities of solution B at wavelengths of 246, 268, and 297.5 nm were determined on an SF-4A instrument in a layer 1 cm thick. The combined percentage of psoralen and bergapten was calculated from the following equation:

$$X\,\% = \frac{1000 \cdot V \cdot n \cdot D^{297,5}}{\left(D^{1\%}_{1\,cm}\right) \cdot P}, \qquad (1)$$

where X% is the percentage content of psoralen and bergapten, together, in the sample; V is the volume of solution A (in the method

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TABLE 1

Compound	Wavelength, nm		
	246	268	297,5
Psoralen	1197±6,33	219±1,33	512±1,58
Bergapten	754±3,69	838±4,22	512±2,13

TABLE 2

Sample No.	Amt. of furalen taken, mg	Found, %		
		total, mg	psoralen	bergapten
1	2,438	1,931	79,69	20,31
2	2,916	2,826	84,01	15,99
3	1,170	1,159	82,6.	17,39

used, V = 50 ml), ml; n is the dilution factor (in the method used, n = 6); $D^{297.5}$ is the optical density of the solution at 297.5 nm; $D_{1\text{ cm}}^{1\%}$ is the specific absorption coefficient of psoralen and bergapten at 297.5 nm, namely 512.5 (see Table 1); and P is the weight of furalen taken, mg.

The percentage of psoralen was determined from the following equation:

$$X\% = \frac{\left[D^{246}\cdot\left(D_{1\,см}^{1\%}\right)_б^{268} - D^{268}\cdot\left(D_{1\,см}^{1\%}\right)_б^{246}\right]\cdot 1000\cdot n\cdot V}{\left(D_{1\,см}^{1\%}\right)_б^{268}\cdot\left(D_{1\,см}^{1\%}\right)_п^{246} - \left(D_{1\,см}^{1\%}\right)_б^{246}\cdot\left(D_{1\,см}^{1\%}\right)_п^{268}}\cdot P; \quad (2)$$

where D^{246} and D^{268} are the optical densities of solution B at 246 and 268 nm; and $\left(D_{1\,см}^{1\%}\right)_п^{246}$ and $\left(D_{1\,см}^{1\%}\right)_б^{246}$ are the specific absorption coefficients of psoralen and bergapten at 246 nm (the symbols for the specific absorption coefficient at 268 nm being analogous).

After the substitution of the numerical values, Eq. (2) assumes the following form:

$$X\% = \frac{[D^{246}\cdot 838 - D^{268}\cdot 754]\cdot n\cdot V}{847{,}96\cdot P}.$$

The bergapten content was determined by the difference.

CONCLUSIONS

A spectrophotometric method for the simultaneous determination of psoralen and bergapten in the preparation "furalen" has been developed.

LITERATURE CITED

1. B. Z. Usmanov and N. K. Abubakirov, KhPS [Chemistry of Natural Compounds], 295 (1967).
2. B. Z. Usmanov, A. U. Kasymov, and N. K. Abubakirov, KhPS [Chemistry of Natural Compounds], 473 (1969).
3. M. E. Perel'son and G. K. Nikonov, Med. prom. SSSR, No. 3, 42 (1965).