SPECTROPHOTOMETRIC ANALYSIS OF THE PREPARATION PSOBERAN

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UDC 547.918:615.215

The preparation Psoberan [1] is obtained from the leaves of Ficus carica L., which grows in Central Asia. Psoberan possesses a pronounced photosensitizing action and consists of a mixture of two furocoumarins – bergapten and psoralen.

Chromatophotocolorimetric and chromatospectrophotometric methods for analyzing these furocoumarins in plant raw material [2] and also a spectrophotometric method for the simultaneous determination of the amounts of psoralen and bergapten without their preliminary chromatography in the preparation Furalen [3] are known in the literature.

The basis of the proposed method, like that of the existing method [3], is the measurement of the optical density (D) of a solution of the mixture of psoralen and bergapten at three wavelengths (λ): 246, 268, and 298 nm. At 246 and 268 nm there is the greatest difference in the intensities of absorption of the components of the mixture, and at 298 nm the specific absorption coefficients of psoralen and bergapten are equal, which enables their total absorption to be determined relative to a standard sample of one of the components of the preparation.

In contrast to the well-known spectrophotometric method, in the proposed modification to determine the amounts of the components of the mixture instead of the absolute values of the absorption, the ratio (A) of the absorption at 246 nm to the absorption at 268 nm ($A = D_{246}/D_{268}$) is taken and a calibration curve of the absorption ratio A (axis of ordinates) as a function of the percentage of psoralen and bergapten (axis of abscissas) is plotted. This approach to the analysis of the mixture enables the influence of impurities to be excluded, and the value A is frequently used in pharmacopeal analysis as a criterion of authenticity [4].

The calibration curve for the quantitative determination of the amounts (%) of psoralen and bergapten is shown in Fig. 1. The results of analyses for psoralen and bergapten in 11 samples of synthetic mixtures have shown that the relative error of the determination for the sum of the substances does not exceed +2.68%, that for psoralen +4.68%, and that for bergapten −4.80%. The method described above was used to analyze four batches of the preparation Psobaren (Table 1).

The results of the spectrophotometric simultaneous determination of psoralen and bergapten in Psobaren are comparable within the limits of error of the measurements with the results obtained in the separate analysis of the furocoumarins by the chromatospectrophotometric method [2].

EXPERIMENTAL

The work was performed on a SF-4 spectrophotometer. Chromatographically homogeneous samples of psoralen (mp 164°C) and the bergapten (mp 181°C) were used as standard substances. The solvent was spectrally pure ethanol. A 2- to 3-mg sample of the material (accurately weighed) was dissolved in ethanol with heating (at 70-80°C) for 10 min in a 50-ml measuring flask, and the volume was made up to the mark with the same ethanol. Of this solution, 1 ml was transferred to a flask, 9 ml of ethanol was added, and the optical density of the resulting solution was measured at wavelengths of 246, 268, and 298 nm in a cell with a layer thickness of 1 cm. The optical density of a solution of a standard sample of psoralen or bergapten

Order of the Red Banner of Labor Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR. Translated from Khimiya Prirodnykh Soedinenii, No. 2, pp. 155-156, March-April, 1974. Original article submitted December 29, 1972.

TABLE 1. Amounts of Psoralen and Bergapten in the Preparation Psobaren, %

Batch number of the preparation	Found, % ± ε*			Method of Usmanov et al. [2]	
	sum	psoralen	bergapten	sum	psoralen
I	97,80±0,98	72,10±0,33	25070	97,60	72,10
II	98,10±1,03	74,80±0,46	23,30	97,20	75,60
III	99,85±0,61	73,69±0,19	26,16	99,45	73,30
IV	97,48±0,53	70,28±0,72	27,20	98,00	74,00

*The mean values of four determinations; ε – relative accuracy at a confidence level of 95% [5].

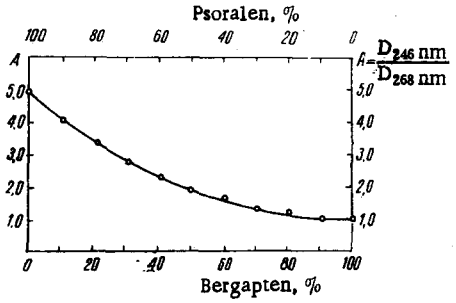

Fig. 1

was measured in parallel at λ =298 nm, and the total amount (x, %) of furocoumarins in the absolutely dry material was calculated from the formula

$$x = \frac{D \cdot C_0 \cdot 100}{D_0 \cdot a},$$

where D and D_0 have optical densities of the test solution (preparation) and of a solution of the standard sample at λ =298 nm; C_0 is the weight of the sample of standard substance, g; and a is the weight of the sample of preparation, g.

Then, for the same solution, the value of A was calculated and the percentages of psoralen and bergapten were determined from the calibration curve. The time for performing an analysis is 1 h.

CONCLUSIONS

A modification of the spectrophotometric method for the simultaneous determination of psoralen and bergapten in mixtures of them has been proposed.

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