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Development Analysis Methods of Pesticides Acetomipride Isolated from a Biological Object by Uv-Spectrophotometry

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Abstract: There have been developed analysis methods of pesticides acetomipride, extracted from biological objects, by the methods of UF-spectrophotometry. It was found that the solution of pesticides in concentrations of 10-90 mcg / ml obeys the law of Bugera-Lamberta-Bera. In the conditions of this analysis is shown that it is possible to analyze acetomiprid, selected from the composition of the biological object. The average relative strength of the method for acetomipride was 3.33%.

Keywords: neonicotinoid, acetomiprid, isolation of biological objects, UV spectrophotometry.

Introduction

Acetomiprid is a highly effective insecticide belonging to the neonicotinoid group, which is used to protect plants from various diseases and to control pests [1]. To study the accumulation of this pesticide in human internal organs and tissues, the characteristics of its distribution, the prevention of adverse effects, the development of methods for determining its residual content in the diagnosis of acute and chronic poisoning.

According to the literature, the method of UV spectrophotometry is widely used in the identification and quantification of acetomiprid in various environmental objects. This method is one of the modern instrumental methods due to the low cost of the instrument used in it, ease of measurement and accurate results [2]. However, data on the use of the method in the analysis of acetomiprid isolated from a biological object were not found in the studied literature.

Taking into account the analysis of toxic substances isolated from biological objects by UV spectrophotometry in the practice of forensic examination, the development of a method of analysis of these pesticides has great practical importance.

Materials and methods

The analysis method was carried out on a spectrophotometer "SHIMADZU UV-1800"of UV spectrophotometry. The optical density of the substance was measured at a wavelength of 200 to 400 nm. In order to determine the wavelength of the detector, the optical density of a 0.05% solution of 95% ethyl alcohol in a standard sample of acetomiprid was determined in a quartz

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cuvette with a layer thickness of 10 mm. 95% ethyl alcohol was used as the reference solution. It was found that a solution of acetomiprid in 95% ethyl alcohol had a high light absorption index at 246 wavelengths. The UV spectrum of acetomiprid obtained during the study is shown in Figure 1.

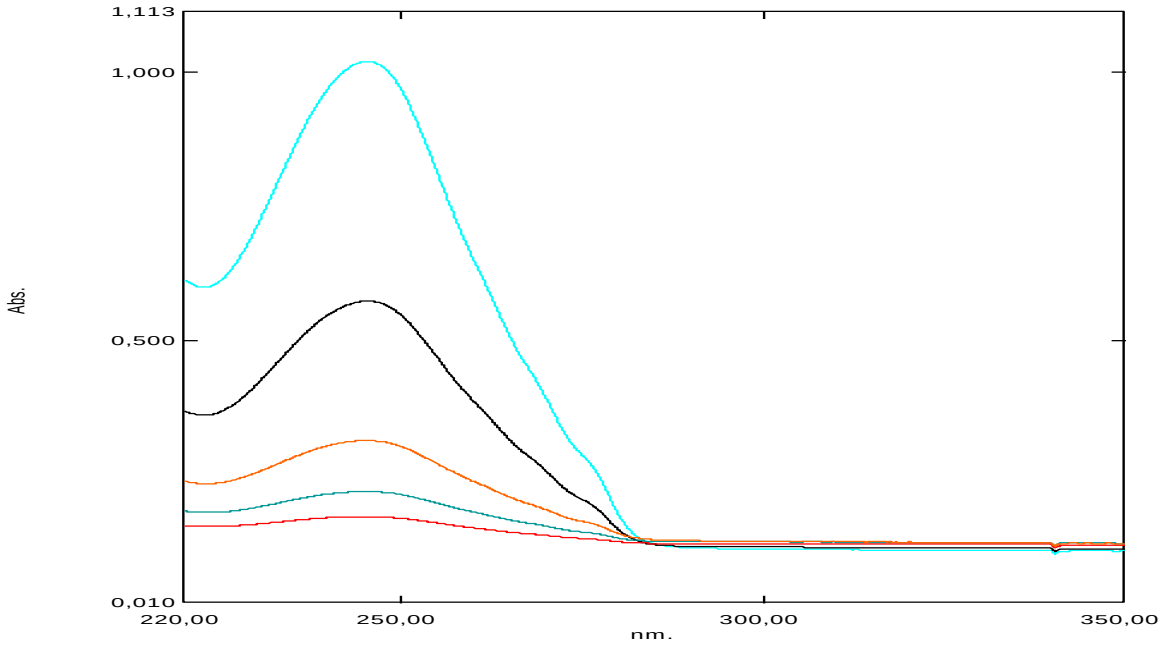

Figure 1. UV absorption spectrum of acetomiprid pesticide in the UV field

Based on the spectrum obtained, subsequent analyzes determined the detection wavelength to be 246 nm. A calibration diagram was developed for the quantitative analysis of acetomiprid by UV spectrophotometry. To do this, 0.1 g (a.t.) of acetomiprid standard sample powder was weighed on an analytical balance and placed in a 100 ml volumetric flask. From this solution, working standard solutions in the amount of 10-90 μg / ml were prepared by the dilution method. The optical density of the prepared solution was measured in the area of maximum absorption of the substance and a calibration diagram was drawn using the results obtained. The diagram is shown in Figure 2.

Based on the diagram shown in the figure, it was determined that a solution of the pesticide at a concentration of 10-90 μg / ml obeys the Buger-Lambert-Behr law. Based on the data obtained in the experiments, the specific and molar light absorption values of acetomiprid were calculated. The results of the analysis are presented in Table 1.

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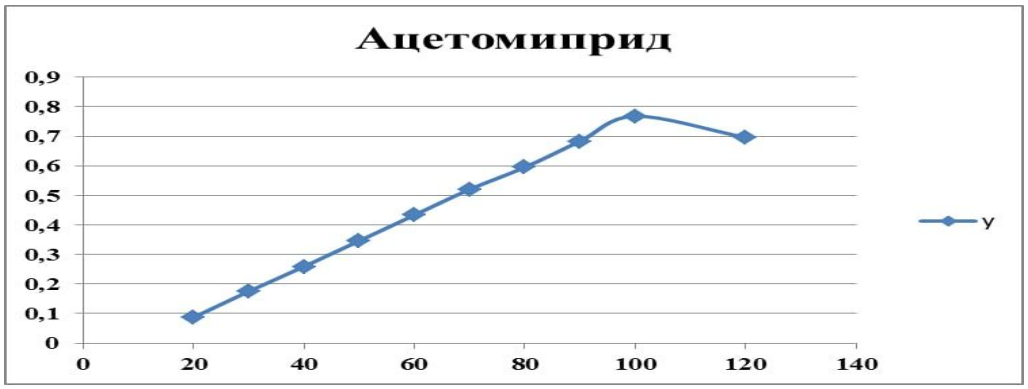

Figure 2. Concentration dependence diagram of the optical density of acetomiprid

There can be seen from the picture above, the working solution of acetomiprid at a concentration of 10-90 μg / ml is directly proportional to its optical density. At higher concentrations, it is disproportionate, which means that this condition must be taken into account when analyzing acetomiprid by UV spectrophotometry.

Table 1

Results of determination of specific and molar light absorption of acetomiprid

№	Quantity of substance obtained for the experiment, μg / ml	Optical density, D	Specific light absorption indicator, E (1%) ¦1cm	Molar absorption index Ɛ
1	10	0,087	87,0	1937,49
2	20	0,175	87.5	1948,62
3	30	0,259	86,3	1921,9
4	40	0,346	86,5	1926,3
5	50	0,433	86,6	1928,5
6	60	0,520	86,6	1928,5
7	70	0,595	85,0	1892,9
8	80	0,683	85,3	1899,6
9	90	0,768	85,3	1899,6
10	100	0,850	85,0	1892,9
			$E^{1\%}_{1см}$-86,11	$Ɛ_{avg}$1917,63

According to the table, the specific and molar luminosity of a solution of a standard sample of acetipiprid in ethyl alcohol averaged 86.11 and 1917.63, respectively. It was recommended that these values be used to determine the amount of pesticide released from the biological object and

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liquids.

Determination of the content of acetomiprid in the test objects was carried out on the basis of the following formula.

$$X = \frac{D * V_2 * 100}{E_{1см}^{1\%} * a * V_1 * 100}$$

In this case, X - the amount of acetomiprid in the test object, μg;

D - the optical density of the solution;

$E_{1см}^{1\%}$ - the specific light absorption index of acetomiprid;

V_1- volume of test solution, ml;

V_2- solution obtained for dilution, ml;

a - initial sample of acetomiprid powder (a.t.).

In order to study the accuracy and repeatability of the developed method of analysis, solutions of precise concentration were prepared from standard samples of the substance and analyzed using them. For this, 5 samples were prepared using a measuring pipette from a working standard solution of 50 μg / ml of acetomiprid, and then the optical density of the solutions was determined on a spectrophotometer at a wavelength of 246 nm [3]. The calculation of the amount of test substances was performed using a pre-constructed calibration diagram. Metrological processing of the obtained results was carried out according to the edition of DF XI [4]. The experimental results are presented in Table 2.

Table 2

The study results of the accuracy of the developed analysis method

Added quantity of acetomiprid, mkg	Determined		Metrological analysis of results
	мкг	%	
50	49,5	99,3	$\overline{X}$ =99,98 T(95%-4)=2,78
50	50,8	101,6	S^2=0,8920 S=0,94445Sx=0,4223
50	49,7	99,4	$\Delta\overline{X}$ =1,1742ΔX=2,6255
50	50,0	100,0	Ɛ =2,6261 $\overline{\varepsilon}$ =1,1744 %
50	49,8	99,6	

According to the given data in Table 2, it can be seen that the average relative error of the UF-spectrophotometry analysis method of acetomiprid was 1.174%. This indicates that the developed method is sufficiently accurate.

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In order to test the analytical methods developed in the next stage of the experiments in terms of chemical-toxicological examination, a pesticide was isolated from a biological object obtained from the internal organs of the animal. For this purpose, a model was prepared using Mospilan, which contains 20% acetomiprid in a biological object (liver). In a clean 200 ml clean dry flask, take a piece of 25 g of biological object (black beef liver) and grind it well. 0.5 ml of Mospilan working solution containing 100 mcg / ml of acetomiprid was added. The pH of the mixture was adjusted to 9-10 with 10% sodium hydroxide solution and 75.0 ml of acetone solution of organic solvent in a ratio of 1: 3. The mixture was then shaken at room temperature for 2 h. In the process of separation of acetomiprid pesticide from biological objects, it is possible that natural so-extractive substances will pass through them. This interferes with the qualitative and quantitative analysis of acetomiprid. With this in mind, the acetone layer was separated and the mixture was centrifuged for 10 min at a speed of 3000 rpm to remove impurities [4]. The resulting 10 ml of centrifuge was transferred to a porcelain dish using a filter paper containing 5 g of anhydrous sodium sulfate and polished at room temperature. The dry residue was dissolved in 10 ml of 95% alcohol and filtered using a paper filter moistened with alcohol. The optical density of the test substance at a wavelength of 200-400 nm was determined using a spectrophotometer by taking 5 ml of the filtrate. 95% alcohol was used as the reference solution. The results of the analysis obtained are presented in Figure 3 and Table 3.

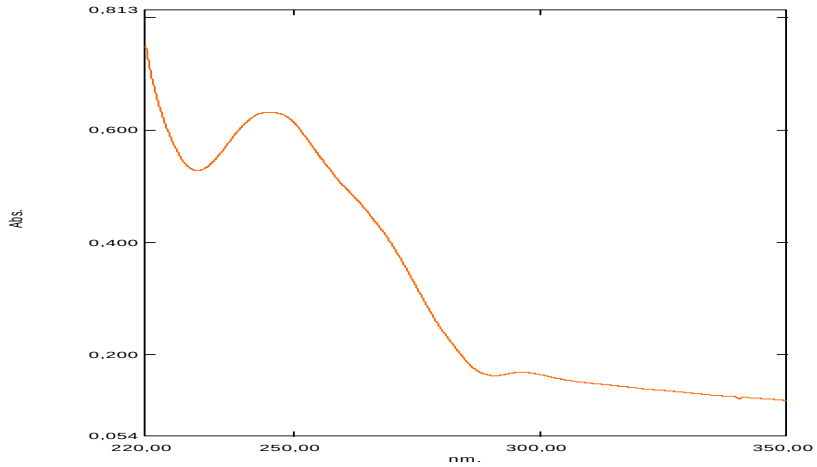

Figure 3. Light absorption spectrum of acetomiprid isolated from a biological object

According to the given data in Table 3under the conditions of this analysis, acetomiprid isolated from the biological object can be analyzed by the developed UV-spectrophotometry method. In the figure, it can be identified by the presence of a UV spectrum specific to acetomiprid and a maximum light absorption area at 246 nm.

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Table 3

Determination results of the amount of acetomiprid isolated from the biological object (object amount - 25 g)

№	Added quantity of acetomiprid, mkg	Detyerminedquantiryimidocloprid		The results of metrological processing of the obtained results
		мкг	%	
1	50	31,22	62,44	$\overline{X}$ =63,97T(95%, 4)-2,78 S^2=2,9458S_x=0,7675 S=1,7163 ΔX=4,7714 $\Delta\overline{X}$ =2,1338 Ɛ=7,4582% $\overline{\varepsilon}$ =3,335%
2	50	32,15	64,30	
3	50	33,26	66,52	
4	50	32,15	64,30	
5	50	31,16	62,32	

According to the data in Table 3, it is clear that the amount of acetomiprid isolated from the composition of the biological object can be determined by the developed analysis method. An average of 64% of acetomiprid can be isolated from a sample prepared from a biological object using the method used. The mean relative error of the method used was 3.33% for acetomiprid. This value meets the requirements for this type of analysis and can be applied in practice.

Conclusions

1. A method of analysis of acetomiprid isolated from a biological object by UV-spectrophotometry was developed. The spectral characteristics of acetomiprid were studied, and it was once again found that solutions prepared in 95% ethyl alcohol had a high light absorption index at a wavelength of 246 nm. The sensitivity of the method was 10 μg / ml.

2. It was found that a solution of the pesticide at a concentration of 10-90 μg / ml obeys the Buger-Lambert-Behr law. The molar and specific light absorption rates of acetomiprid were shown to be 86.11 and 1917.63, respectively.

3. To determine the suitability of the developed method of analysis, acetomiprid was isolated from the composition of the model biological object and the amount was determined using the developed method. In this case, acetomiprid was isolated in the amount of 63.97% and the average relative error of the method was found to be 3.33%. The developed method meets the requirements for this type of analysis methods and has been shown to be applicable in practice.

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