LASER SPECTROSCOPY IN THE INVESTIGATIONS ON SPECTRAL-LUMINESCENT PROPERTIES OF VIPER METABOLITES

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Spectral-luminescent characteristics of viper venom metabolites isolated from the intoxicated animals were studied exciting them by LGI-21 type of impulse nitrogen laser (337,1 nm. 10 ns).

PL spectrum of viper venom metabolites is occupied the region of wavelength 485-520 nm. Half width of PL spectrum of venom metabolites covers the region of 0,63-0,88 eV.

It is impossible to found out the high-active toxic substances and also venom toxins and products of their biotransformation in extremely small doses without using of high sensitive analytic methods [1] .

There are many chemical compounds having proper luminescence in the tissues of animal and human organisms and by contrast biomoleculas promoting putting out of luminescence occur [2].

Cell luminescence responses on slightest disturbances of their functional state [3]. Using of luminescent analysis to study of luminescence of venom and its metabolites as wen in the experiment with the purpose of disease diagnostics is great interesting.

Metabolites of venom were divided by the gel-chromatography method in the column with Sephadex G-75 with 0.04 M phosphate sodium buffer and ion exchange chromatography in the column within servacel DEAE-52 by stepped elimination with 0.03 M sodium chloride solution.

Photoluminescence spectra of venom, proteins and metabolites were studied in the setting assembled on the bases of spectrophotometer SDL-1 of the firm "LOMO" (Leningrad) with automatic record. The memory oscillography of two-ray, universal C-1-74 to registrate of temporary dependence of registration of physical processes proceeding within 10^{-7}-10^{-5}s was used.

Photoluminescence spectra of 19 metabolites of were venom studied exciting them by LGJ-21 type of nitrogen Laser (337.1 nm, 10 ns) PL spectrum covers the region of wavelength 360 ÷ 630 nm.

The change of PL intensity and displacement of maxim depending on concentrations of metabolites and their structure respectively was observed. Maxim of PL metabolites appear at 485, 495, 510 and 520 nm (figure 1,2).

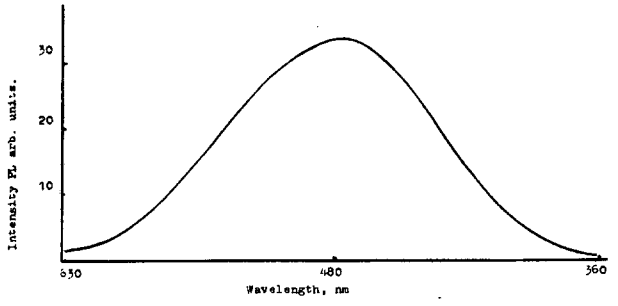

Fig.1. Photoluminescent spectrum of metabolite of λ_{max}=480 nm.

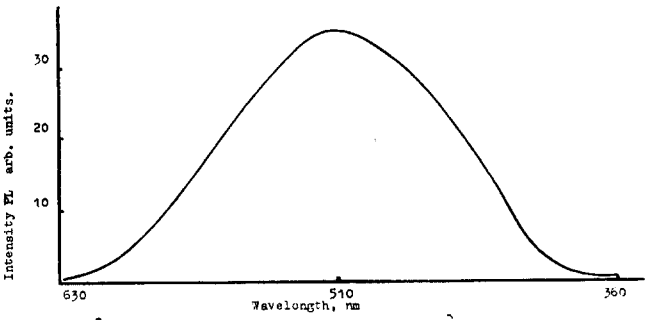

Fig.2. Photoluminescent spectrum of metabolite of λ_{max}=510 nm.

Investigation on spectral – luminescence characteristics of metabolites of venom isolated from organs and tissues of experimental animals intoxicated by venom influencing by impulse nitrogen laser showed, that positions of maxima in the luminescence spectra of venom, proteins and metabolites are not differed and occupied the region of wavelength 480÷520 nm, their luminescence intensity is lower than in whole venom.

Spectral luminescent characteristics of venom metabolites isolated from organs and tissues of the experimental wice are presented in table 1.

Table 1.

Spectral luminescent characteristics of metabolites of venom extracted from organs and tissues of intoxicated mice.

M. thous. Dalton	Half-width of PL Spectrum, EV	λ_{max}
153	0.75	510
150	0.68	495
146	0.74	495
142	0.71	500
139	0.67	480
136	0.78	480
132	0.66	490
113	0.68	510
102	0.77	485
92	0.81	495
89	0.85	485
80	0.88	485
69	0.63	510
63	0.72	510
43	0.71	495
35	0.77	510
29	0.75	500
11	0.74	520
2.5	0.83	520

As it is shown on the figures the luminescence spectrum of products of zootoxin biotransformation has similar form and clear maximum of photoluminescence.

Kinetics of luminescence of venom metabolites was studied.

Typical Sor all studied compositions temporal dependence of maxima of PL intensity was presented in figure 3,4.

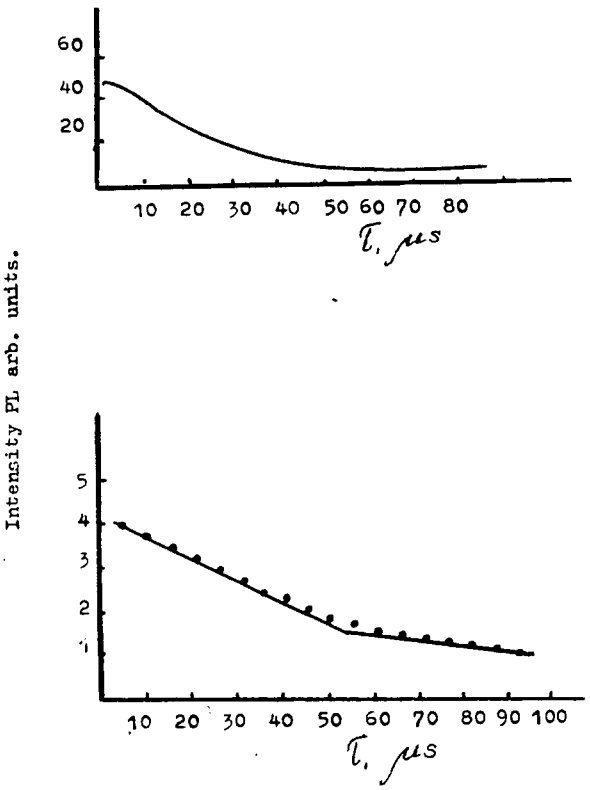

Fig.3. Temporal dependence of PL spectrum of metabolite on vipera venom for maximum λ =520 nm at 300 °K.

Intensity of photoluminescence in the wide interval of wavelengths after stopping of exiting is decreased in due course according to exponential law:

$$I = I_o \exp\left(-\frac{t}{\tau_D}\right) ,$$

where I – intensity at the time, I_o - intensity at t=0, τ_D - constant time characterizing the life time of excited state of luminescent center.

According to formula lgI decreases linearly when t increases. Depending on amount of luminescent centers there are regulated several linear sections are differed which is striking illustration of presence of these centers in the patterns of venom or metabolites. It was obtained from ones data that $\tau_D = (2-3)\cdot 10^{-5}$ c (tabl 2).

Table 2 shows the temporal dependence of maximum of luminescence on viper venom metabolites.

Laser spectroscopy method of venom extracted from organisms of animals intoxicated by viper venom, much more raises significance of studying of tissues luminescence and broadens application of luminescent analysis.

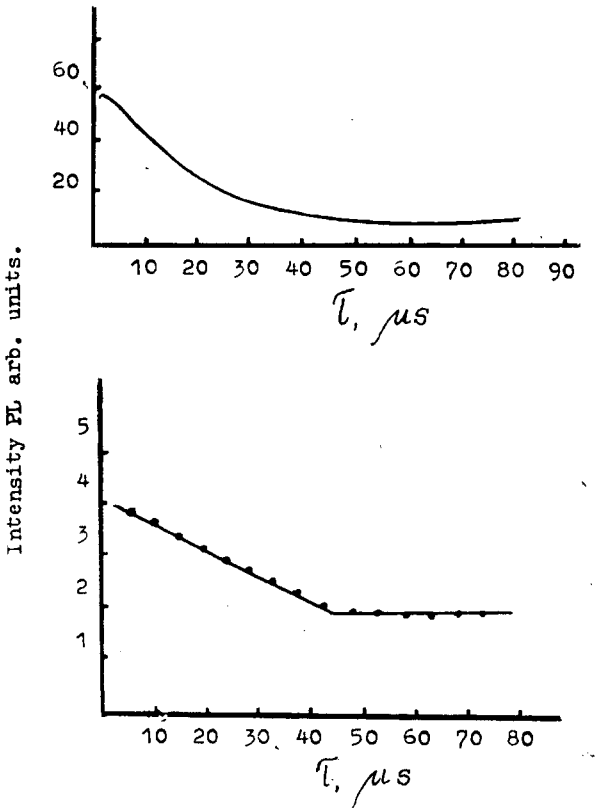

Fig.4. Temporal dependence of PL spectrum of metabolite on vipera venom for maximum λ =510 nm at 300 °K.

Table 2.

Temporal dependence of luminescence on viper venom metabolites

Intensity, I in orbitrary units			Time t in sec		
M. m., kD			M. m., kD		
2.5	153	89	2.5	153	89
108	52	50	5	5	5
92	42	34	10	10	10
74	32	26	15	15	15
60	26	21	20	20	20
44	20	15	25	25	25
32	16	12	30	30	30
24	13	9	35	35	35
18	11	8	40	40	40
16	9	7	45	45	45
13	8	6	50	50	50
10	7	5	55	55	55
9	7	4	60	60	60
8	6	4	65	65	65
7	7	3	70	70	70
7	8	3	75	75	75
7	8	2.5	80	80	80
7	8	2.5	85	85	85
	9			90	

[1] *H. Setlow, E. Pollard.* Molecular biophysics, M. Mir, 1964, p.488.

[2] *R.M.Hochstrasser, C.K.Johnson.* Electr.Ont.,1985, v.21, p. 100.

[3] *A.B. Priezjov, V.V. Tygin, A. Shubogkin.* Laser diagnostics in biology and medicine, Nauka, 1989, p.240.

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LAZER SPEKTROSKOPİYASI VASİTƏSİLƏ GÜRZƏ ZƏHƏRİNİN METABOLİZM MƏHSULLARININ SPEKTRAL-LÜMİNESSENT XÜSUSİYYƏTLƏRİNİN TƏDQİQİ

Zaqafqaziya gürzəsi zəhəri ilə zəhərləndirilmiş heyvanların orqanizmindən çıxarılmış ilan metabolitlərinin spektral-lüminessent xüsusiyyətləri LQİ-21 tipli (dalğa uzunluğu 337.1 nm, impulsun davam etmə müddəti 10ns) impuls azot lazeri vasitəsilə həyəcanlandırılmış və öyrənilmişdir.

İlan zəhəri metabolitlərinin FL spektrləri 360÷630 nm intervalı əhatə edir, işıqlanma maksimumu 485÷520 nm dalğa uzunluğuna uyğun gəlir. Zəhərin metabolitlərinin FL spektrinin yarım eni 0.63÷0.88 eV.

Ш.А. Топчиева

ЛАЗЕРНАЯ СПЕКТРОСКОПИЯ В ИССЛЕДОВАНИИ СПЕКТРАЛЬНО-ЛЮМИНЕСЦЕНТНЫХ СВОЙСТВ ПРОДУКТОВ МЕТАБОЛИЗМА ЯДА ГЮРЗЫ

Изучены спектрально-люминесцентные характеристики метаболитов яда закавказской гюрзы, выделенных из организма интоксицированных животных, при возбуждении их импульсным азотным лазером типа ЛГИ-21 (длина волны 337.1 нм, длительность импульса 10 нс).

Спектры ФЛ метаболитов змеиного яда охватывают область 360÷630 нм с характерным максимумом в пределах 485÷520 нм. Полуширина ФЛ спектра ФЛ метаболитов яда находится в пределах 0.63÷0.88 эВ.

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