EFRE 2020 | 7th International Congress on ENERGY FLUXES AND RADIATION EFFECTS
ONLINE
September 14 - 26, 2020 | Tomsk, Russia
IEEE NPSS NUCLEAR & PLASMA SCIENCES SOCIETY
RFBR RUSSIAN FOUNDATION FOR BASIC RESEARCH

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LUMINESENCE ANALYSIS OF PHOTODEGRADATION OF CRYSTAL VIOLET EXPOSED TO PULSED POWER BEAMS

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Tomsk– 2020

Crystal Violet

Crystal Violet (CV) is a fundamental cytochemical dye.

A structural feature is the presence of three nitrogen compounds, which leads to various photophysical and photochemical processes occurring under conditions of excitation by an electromagnetic field.

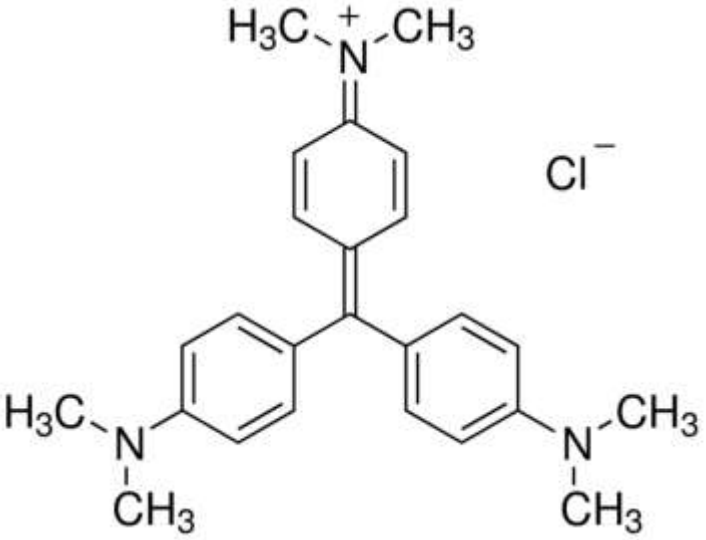


Fig. 1. The structural formula of Crystal Violet

Application fields

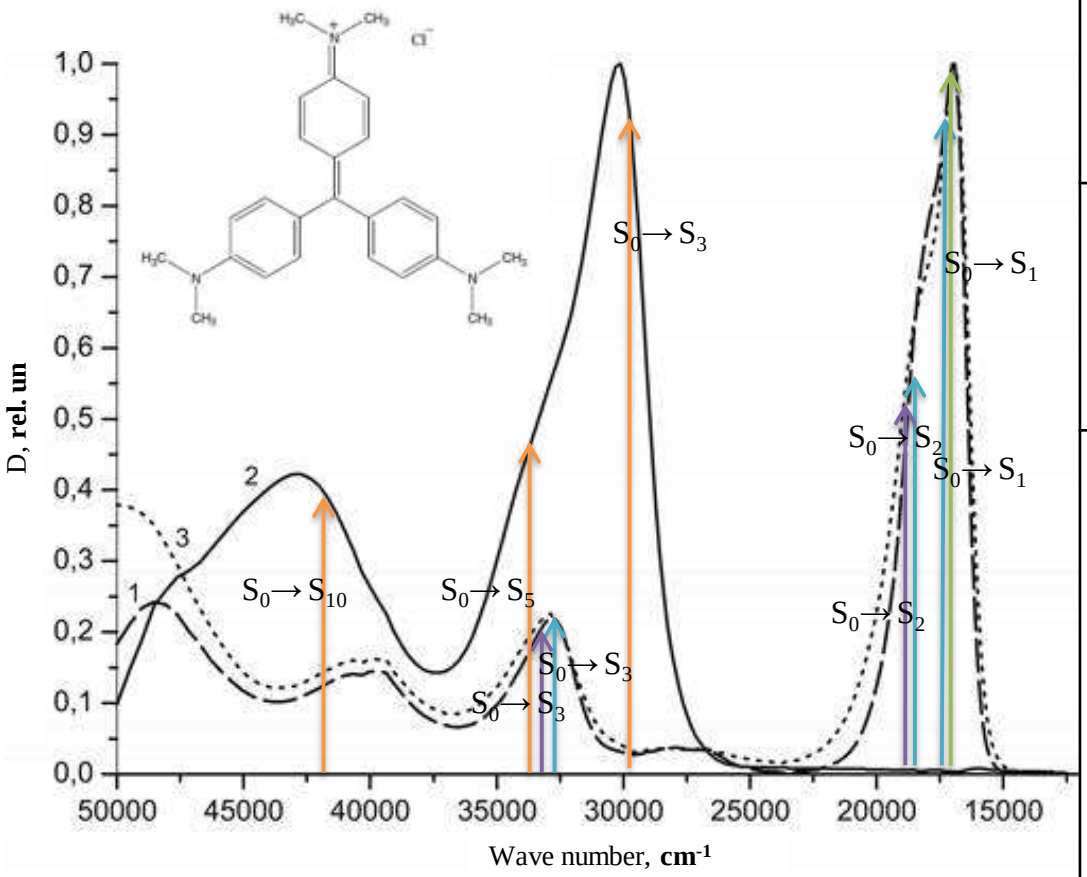
- quantum generators;
- computer devices as information carriers;
- photodynamic therapy of various diseases as photosensitizers;
- devices for converting solar energy.

*Matveev V.I. // JETP. 2003.V. 124. No. 5 (11). S. 1023.
*Yang, Y.; Jung, D. W.; Bai, D. G.; Yoo, G. S.; Choi, J. K. (2001), 855–859.
*Klingenberg, Marcel; Becker, Jürgen; Eberth, Sonja; Kube, Dieter; Wilting, Jörg (2014-04-06). 833–841.

The aim

is to study the spectral and luminescent properties of photoactivated Cristal Violet when exposed to pulsed power beams in solutions

Absorption Spectra of CV

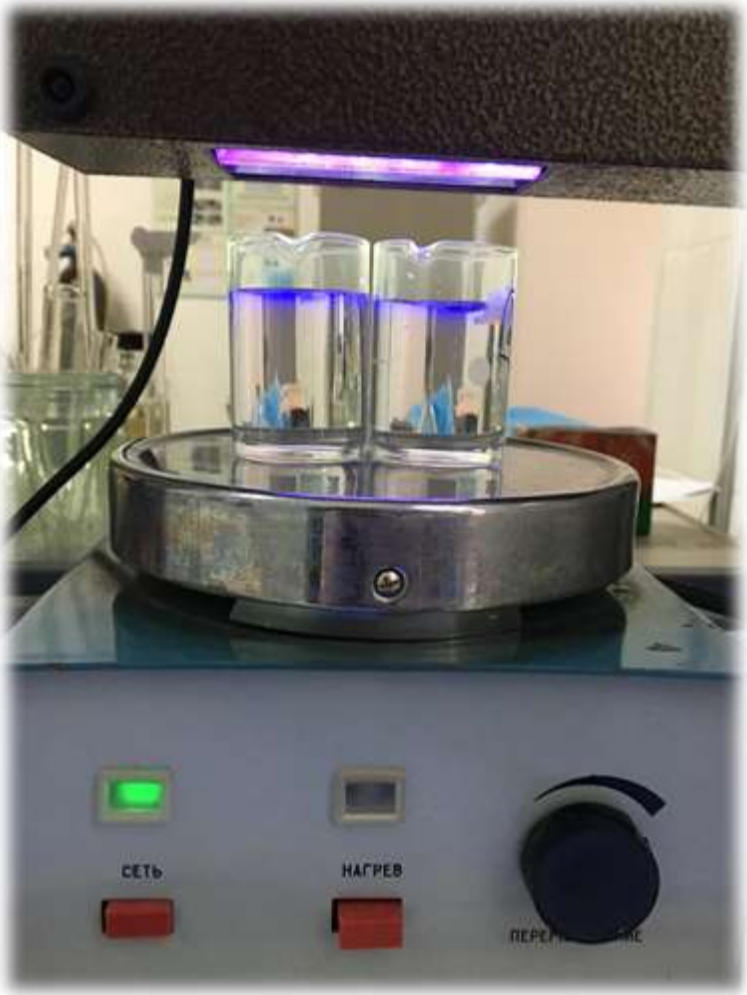


Absorption spectra of CV in ethanol (1), in hexane (2), in water (3) at a concentration C=10^{-5}

		AM1	Experiment
		λ, nm	
CV in ethanol	$S_0 \rightarrow S_1$	463	590
	$S_0 \rightarrow S_2$	442	554
	$S_0 \rightarrow S_3$	339	304
CV in hexane	$S_0 \rightarrow S_1$	463	-
	$S_0 \rightarrow S_2$	442	-
	$S_0 \rightarrow S_3$	339	340
	$S_0 \rightarrow S_5$	305	304
	$S_0 \rightarrow S_{10}$	280	240
CV in wather	$S_0 \rightarrow S_1$	463	590
	$S_0 \rightarrow S_2$	442	540
	$S_0 \rightarrow S_3$	339	304

Stationary Photoreactor

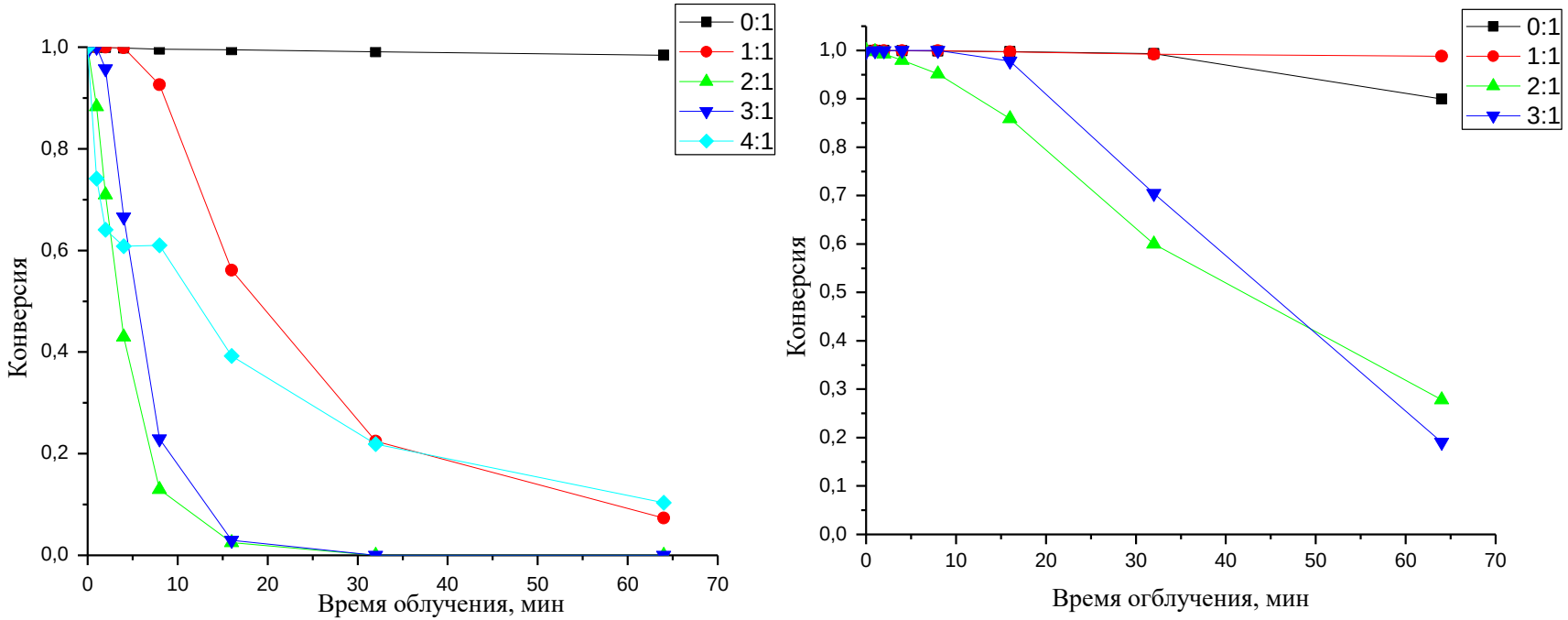
A KrCl (222 nm) and a XeBr (283 nm) exilamps.
Time of exposure – 0, 1, 2, 4, 8, 16, 32, 64 min.
Ratio H_2O_2:CV – 0:1, 1:1, 2:1, 3:1, 4:1.
Distance from research solution to the lamp 4 cm.
(diametr D_{sol} = 4 cm)



Excilamps made at the Institute of High Current Electronics*

*Lomaev M.V., Skakun V.S., Sosnin E.A., Tarasenko V.F., Schitz D.V., Erofeev M.V. Advances in Physical Sciences, 2003
*Sosnin E.A., Erofeev M.V., Tarasenko V.F., Schitz D.V. Instruments and experimental technique, 2002.

Conversion of CV in aqueous solution



The dependence of the CV conversion in aqueous solution on the irradiation time a - KrCl and b - XeBr excilamps in the presence of H_2O_2 at a ratio H_2O_2: BPA – 0:1, 1:1, 2:1, 3:1, 4:1.

Results

- UV radiation can destroy organic contaminants, including Crystal Violet, through direct and indirect photolysis.

- An analysis of the rate constant of the CV decrease in water under the action of KrCl and XeBr radiation to excilamps indicates that under the influence of excilamp radiation the efficiency of CV degradation without additives in water is only 2%.

- The addition of hydrogen peroxide (1:1) reduces CV in solutions and the conversion is 93%.

- The HPLC data of the irradiated solutions for 60 min showed that in addition to CV, the products of its phototransformation are also contained in the solution.

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Thank you for attention!

This work was supported in part by the Ministry of Education and Science of the Russian Federation within the framework of State Assignment.