LUMINESCENCE OF DYE AFTER EXPOSURE TO ELECTRON BEAM RADIATION*

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Wastewater containing emissions from textile production poses an environmental hazard due to the refractory carcinogenic nature of dyes. Crystal violet (CV) is a typical triphenylmethane dye, is toxic to living organisms and is a mutagenic and mitotic poison. We know that the CV molecule is of interest for scientific research in the field of nonlinear properties, its interaction with ferroelectric crystals leads to outstanding optical properties and is of great interest because of its potential use in displays and electro-optical devices. The chemical coagulation process can intelligently remove dyes from wastewater, but it will generate a large amount of secondary waste. Activated carbon processes can remove dyes in aqueous solution efficiently but activated carbon and post-treatment of spent carbon are costly. There are a few research works devoted to the study of wastewater treatment from dyes using photolytic oxidation (TiO_2/UV, ZnO/UV, H_2O_2/UV, Fe^{2+}/H_2O_2/UV). UV radiation can destroy organic pollutants, including crystal violet, through direct and indirect photolysis. An analysis of the rate constant of CV had been reduced in water under the action of KrCl and XeBr excilamp radiation shows that under the action of XeBr radiation, the efficiency of CV degradation without additives in water is low and amounts to only 2%. The addition of hydrogen peroxide (1:1) reduces the concentration of CV in solutions, the conversion is already 93% under the action of KrCl [1]. The HPLC data of the irradiated solutions for 60 min showed that, in addition to the CV residue, the solution also contains its phototransformation products. The report presents the results of measuring the luminescence of the ambient air and aqueous solutions of CV when they are irradiated with a high-current pulsed electron beam with an average energy of Ee=170 keV and a duration of 2 ns, formed by the RADAN-303 accelerator [2]. The CV concentration in water was 0.05 mM (Fig. 1). Experimental studies were carried out in air at room temperature. The time-integrated emission spectrum in the range 200÷850 nm was recorded by two multichannel photodetectors with sensitivity ranges 200÷400 and 400÷850 nm. The absorption spectra of the CV after exposure to an electron beam were recorded on a two-beam Shimadzu UV-1700 spectrophotometer in the region of 200÷800 nm. It is shown that under such an impact, the dissolved CF is transformed, which is accompanied by a weakening of the air spectral lines during CV degradation with an increase in the number of irradiation pulses. The report discusses the mechanism and efficiency of CV transformations in water under the action of an electron beam.

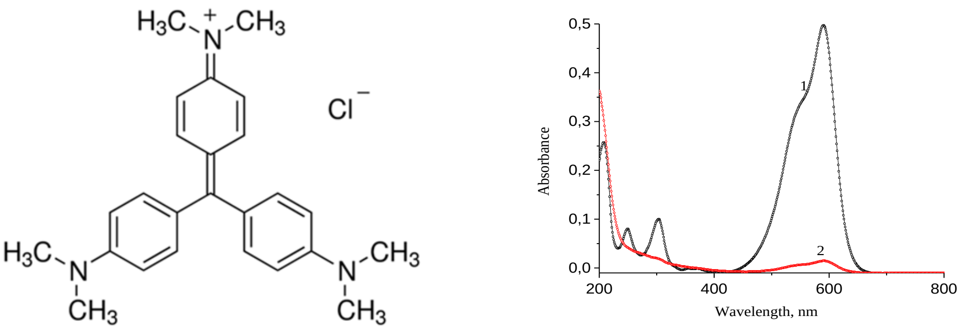

Fig.1. The structure of crystalline violet and the absorption spectrum of CV in water: before (1) and after exposure to an electron beam of 1600 pulses (2).

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