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ULTRASOUND LASER-INDUCED BREAKDOWN SPECTROSCOPY FOR OPERATIONAL ANALYSIS OF CHEMICAL ELEMENTS IN MARINE AREAS

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The article presents a brief summary of the studies that led to the creation of a combined ultrasonic and optical spectroscopic analysis of liquid media. The purpose of this work was to determine the potential impact of additional acoustic radiation on increasing the intensity of the lines of elements in the problems of laser induced breakdown spectroscopy of liquid. Experiments on the study of laser breakdown (formation of low-temperature plasma) in a liquid in the field of high-power ultrasound are described, as a result of which experimental data on optical emission were obtained under various modes of breakdown in water: surface, in the water column and mixed. The effect of a significant difference in the thresholds of laser liquid rupture in the presence of ultrasound for sea and fresh water was revealed. It was found that the intensity of the lines of a single ionized calcium doublet (Ca II, 393.4 and 396.8 nm) in the low-temperature plasma of the formed cavity depends on the phase of the acoustic field (stretching and compression phases). Significant variations in the intensities of the spectral lines of the atomic potassium doublet at wavelengths of 766.4 and 769.8 nm depending on the ultrasound frequencies were also obtained. Experimentally, it was found that with varying delay and exposure, a different contribution of ultrasound to the dynamics of the intensity of the spectral lines of oxygen and potassium is recorded. The results obtained made it possible to formulate the basic principles of creating a method of combined ultrasound laser -induced breakdown spectroscopy and create a compact complex that has been tested in marine expeditions: flight No. 81 of the NIS "Professor Gagarinsky" in the Sea of Japan in August 2022 and flight No. 52 of the NIS "Academician Boris Petrov" in the Atlantic Ocean and in the plume of the Amazon River in October - December 2022

Keywords: Laser-induced breakdown spectroscopy, ultrasound, optical breakdown, sea water, carbon

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