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RADIATION SOURCE WITH INCREASED VIRUCIDAL EFFICIENCY BASED ON A MIXTURE OF HELIUM WITH IODINE VAPOR*

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Currently there are various sources of spontaneous emission in the UV and VUV spectral regions, which are widely used in science and technology. One of the most important applications in the context of the covid-19 pandemic is UV-inactivation of pathogens, including coronavirus [1]. The most efficient sources in this spectral region are excilamps - gas-discharge sources of spontaneous radiation in the UV and VUV regions of the spectrum, based on the nonequilibrium radiation of exciplex and excimer molecules [2]. From the point of view of coronavirus inactivation, the most promising are KrCl- and KrBr-excilamps (peak wavelengths of the main radiation bands are 222 nm and 206 nm, respectively), whose radiation is both effective for coronavirus inactivation and minimally dangerous for human skin and eyes [3]. At the same time, these excilamps have additional bands in the range of 225–300 nm, the radiation of which damages DNA molecules with high efficiency [4]. Therefore, the search for other efficient sources of radiation in the region of 200–225 nm is very important. At the same time, an additional important condition is the absence of intense lines or bands in the emission spectrum of the radiation source in the spectral region of 230–350 nm in order to exclude damage to DNA molecules during irradiation of human skin or eyes.

One of the options for creating a radiation source in this region of the spectrum, effective in terms of inactivation of the SARS-CoV-2 coronovirus, is a gas discharge lamp emitting at the iodine atom line with a wavelength of 206.16 nm. The advantage of this lamp compared to the KrCl-excilamp is that the absorption coefficient of DNA and protein molecules that make up bacteria and viruses at a wavelength of 206.16 nm is more than 2 times higher than the absorption coefficient at a wavelength of 222 nm. This provides a greater bactericidal/virucidal efficiency of the iodine lamp radiation, including during the inactivation of the coronovirus [4].

The aim of this work is to study the amplitude-time, energy, and spectral characteristics of an iodine vapor lamp, based on iodine vapor excited by a low-pressure capacitive discharge, which is promising from the point of view of developing a radiation source with increased virucidal efficiency for UV-disinfection of a human environment contaminated by pathogenic microorganisms, including the SARS-CoV-2 coronavirus. When performing the work, a comparison was made of the radiative characteristics of iodine vapors and their mixtures with inert gases. The light source under study based on iodine vapor can compensate for the lack of spontaneous emission sources in the spectral range of 200-220 nm.

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