EuroSciCon

7th International Conference on

Parasitology and Infectious Diseases

March 01-02, 2023
Webinar

Archives of Clinical Microbiology
ISSN: 1989-8436

Pulse sterilization technology in the fight against the pandemic

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The results of experimental studies of the impact of pulsed Ultra-Violet (UV) radiation on pathogens and viruses are presented. It is shown that in traditional sterilization technologies using low-power bactericidal UV emitters, a cumulative mechanism for the destruction of pathogens and viruses is realized. At the same time, the achievement of the required level of bactericidal and viral purity is ensured by the accumulation of a high dose of radiation, which leads to significant costs of electrical energy and requires a lot of time. In addition, as a result of such treatment, the formation of residual bactericidal and/or viral population is inevitable, which can be a source of nosocomial infection.

With powerful pulsed irradiation, a shock mechanism for the destruction of pathogens and viruses is realized. The high efficiency of pulsed action has been shown, which makes it possible to provide the effect of complete 100% sterilization.

An experimental sample of a small-sized pulsed UV sterilizer was developed and created, which was applied for laboratory studies of pulsed exposure effectiveness (Figure 1). Comparative analysis of the characteristics of traditional low-power continuous UV sources and a pulsed sterilizer (Table 1) shows the overwhelming advantage of the latter in terms of processing time required to achieve the required sterilization efficiency.

$J_{bac} = N_1/N_0 \times 100\%$ Where=Concentration of viruses surviving after irradiation, =Initial concentration before the irradiation.

For the first time, the possibility of complete sterilization of the TGV virus, which is the RNA genome of a virus of the coronavirus family, has been experimentally proven (Table 2). Thus, the possibility of practical implementation of the monopulse sterilization technology is shown, the purpose of which is to ensure air hygiene and break the chain of transmission of a viral infection from a sick person to a healthy one. Monopulse sterilization is shown should be on a par with another pandemic control measures. The model of sterilization by continuous radiation is described by a function that asymptotically tends to a certain limit. This model also implies the fundamental impossibility of complete sterilization. It is shown that the shock adiabatic mechanism of pulsed sterilization is described by a model that allows the realization of the effect within a finite time interval, in particularly, within one pulse duration.'

Biography

Volodymyr Chumakov is a Ukrainian researcher in physics and radio engineering, doctor of technical science, professor. He has graduated from Kharkiv National University of Radioelectronics (KhNURE). He is currently working at KhNURE, Ukrainian Naval Academy by of P.S. Nakhimov (Sevastopol), National Science Center "Kharkiv Institute of Physics and Technology". His Topics of researches: pulse processes and systems, in particular, generation of high-power microwave and its application, super-power magnetic fields, electrodynamic launch systems. He is Coauthor of more than 300 publications, 15 patents. His Awards: Ukrainian Honored research and technical worker, badge of honor "For merit" Ukrainian Ministry of defence.

Received: 06-02, 2023 | **Accepted:** 08-02, 2023 | **Published:** 22-04, 2023