S5-1.11

Microbiological Decontamination of Air and Surfaces due to Nanosecond Discharges

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Presented observational data indicate that a significant number of infections with the *SARS-CoV-2* coronavirus occur by air without direct contact with the source, in addition, in a tangibly long time interval. It is noticed that atmospheric precipitations help to cleanse the air from pollution and at the same time from viruses, reducing non-contact infections. These facts additionally actualize the problem of optimal microbiological decontamination of air and surfaces. In order to optimize microbiological sterilization, a thermodynamic approach is applied. It is shown that irreversible chemical oxidation reactions are the shortest way to achieve sterility, they being capable of providing one hundred percent reliability of decontamination. It is established that oxygen is optimal as an oxidant, including ecologically, because it and all of its reactive forms harmoniously fit into natural exchange cycles. The optimal way to obtain reactive oxygen species for disinfection is the use of low-temperature ("cold") plasma, which provides energy-efficient generation of oxidative reactive forms - atomic oxygen (O), ozone (O_3), hydroxyl radical ($\cdot OH$), hydrogen peroxide (H_2O_2) , superoxide (O_2^-), singlet oxygen $O_2(a^1\Delta_g)$. Due to the short lifetime for most of the above forms outside the plasma applicator, remoted from the plasma generator objects should be sterilized with ozone (O_3), the minimum lifetime of which is quite long (several minutes). It is substantiated that microwave method of generating oxygen plasma is optimal for energy efficient ozone production. A modular principle of generation is proposed for varying the productivity of ozone generating units over a wide range. The module is developed on the basis of an adapted serial microwave oven, in which a non-self-sustaining microwave discharge is maintained due to ionizations produced by radionuclides-emitters.