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Inactivation kinetics of DNA and RNA viruses by ozone-air mixture in a flow mixer

Introduction & Aim: Virucidal activity of ozone is well known, when dissolved in water it kills viruses very fast. The virucidal capacity of ozone in ozone-air mixture is less known. The goal of the study was to investigate the virucidal potentials of the ozone-air mixture and kinetics of virus inactivation.

Materials & Methods: Ozone (O_3) was generated from oxygen with ozonizer (1.0-75.0 mg\l). The ozone concentration was determined by the spectrophotometric methods. Virus contaminated samples were placed into the flowing reactor. Viruses: Poliovirus type-1, vaccine strain (Sabin) and adenovirus type-5 were obtained from the State virus collection. Titrations of viruses were carried out in appropriate cell cultures. CxT value (mg\lxmin) was calculated.

Results: Metallic, polycarbonic and fiber Kevlar samples were contaminated with virus, dried and treated with ozone-air mixture in the flowing reactor. Kinetics of poliovirus inactivation in 15 min at 5.0 mg\l - 2.0 lg TCID50 inhibition, in 15 min at 10 mg\l - 2.5 lg TCID50, 4.0 lg TCID50 inactivation of poliovirus was achieved after 75 min at ozone concentration 20.0 mg\l (99.99%). (CxT=75, 150 and 1500 mg\lxmin on all three types of surfaces). It was found that the inactivation of poliovirus was more effective when the virus contaminated samples were wet (in 15 min at 20mg\l inhibition of virus in dry samples was 2.0 TCID50, in wet samples - 4.0 TCID50). Adenovirus was less resistant to ozone treatment than poliovirus: 4.0 lg TCID50 inhibition was observed after 30 min of the treatment with ozone at 20mg\l (CxT mg\lxmin=300 for adenovirus as for poliovirus it was 1500).

Conclusion: It was found that ozone-air mixture inactivates viruses at rather high concentrations (compared to the reported effect of ozone dissolved in water). Despite of that there is a difference in the resistance to ozone action between viruses– poliovirus is more resistant than adenovirus, ozone-air mixture can be used for disinfection of large rooms. The maintaining of the virus contaminated surfaces in wet condition allows decreasing the ozone load for virus inactivation.

Biography

N Nosik has graduated from Moscow Medical University in 1956 and became Physician. In 1959, he has completed his Post-doctorate at the D.I. Ivanovsky Institute of Virology, Russian Academy of Medical Sciences and received PhD degree in Virology in 1988. Since 1959, he has been working at the D.I. Ivanovsky Institute of Virology Russian Academy of Medical Sciences as the Head of the Laboratory. From 1968 to 1973, he has worked for the WHO and as an WHO Expert in Virology in SEARO, India on national and international projects on virology and epidemiology. He was a Visiting Scientist at the National Institute of Oncology in Fort Detrick, Maryland, USA in 1975. In 1976 and 1978, he was involved in the study on interferons (ISERM program) in Paris, France as Visiting Scientist. His main scientific interests have been connected with interferons, immunomodulators and antiviral preparations, antiviral immunity, cytokines, etc. Presently his research focuses on the prevention of viral diseases (inactivation of pathogenic viruses with chemical and physical means (UV, ozone) as well as studies on antivirals (natural and synthetic origin; betulin derivatives, fullerene derivatives and others).

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