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Diverse Sensitivity to Ultraviolet Radiation of DNA and RNA Viruses

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Abstract : The bactericidal effect of UV radiation is known for long time and widely used for inactivation of pathogens but for viruses it is not so uniform. Due to a wide variety of viruses their sensitivity to UV radiation is quite different and not quite predictable. The goal of the study was to determine the inactivation kinetics of UV radiation (254 nm) of the viruses of social importance (HIV), as well as test-viruses (poliovirus, adenovirus) used for the evaluation of the viral inactivation efficacy of germicides. Methods: DNA viruses- adenovirus, type 5; Herpes simplex virus (HSV), type 1, and RNA viruses–human immunodeficiency virus (HIV), type 1 and poliovirus, type 1 (Sabin strain) were obtained from State collection of viruses (The D.I. Ivanovsky Institute of Virology). The source of UV radiation was a 15-watt low-pressure mercury vapor lamp (over 60% 254nm). The samples of 5cm2 were placed direct under the UV lamp flow (h-0.3m). Log reduction value was used as a marker for the rate of virus inactivation. Results: The data obtained indicate that poliovirus (one of the viruses most resistant to chemical germicides) and HSV are rather sensitive to UV radiation (D90 =250-311 J/m2). Adenovirus is much more resistant to UV radiation (750 J/m2). The kinetics of adenovirus inactivation : 0 min- 5.0 lg TCID50, 10 min - 5,0, 15 min -4,0, 30 min – 3.5, 60 min – 1,0, 75 min -0,5 lg TCID50, 90 min –virus not detectable. HIV is most resistant to UV radiation among the studied viruses. It takes more than 4 hrs to inactivate the virus on the surface. D90 = 2000 J/m2 Conclusion: The results of the study show that there is no direct dependence between sensitivity to UV light and the size of the virion or presence\absence of the envelope of the virus. Poliovirus and adenovirus are small viruses (20-30nm poliovirus and 70-90nm adenovirus) and both are non-enveloped viruses but adenovirus 3-fold more resistant to UV radiation than poliovirus. It can be expected that viruses with more complicate structure, like Herpes virus (200nm) or HIV (80-100 nm), would be more sensitive to UV light. However, the very high resistance of HIV to UV radiation needs further investigation. The diverse resistance of the different viruses to UV radiation should be taken into the account when UV light is used to inactivate infectious viruses in hospitals and other public environments.

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