BACTERICIDAL ACTIVITY ASSESSMENT OF ULTRAVIOLET RADIATION

Tsukanova O.O., Geyderikh O.G.
The National University of Pharmacy, Kharkiv, Ukraine
a.kovaleva@mail.ru

Ultraviolet radiation of bactericidal spectrum is widely used for treatment of air and premises in each health care setting in order to ensure epidemiological regime, prevent infection of the staff and visitors. Ultraviolet radiation with wavelength 205 to 315 nm has bactericidal effect, which results in destructive-modifying photochemical damage of DNA synthesis causing microbial cell death in the first or subsequent generations. Waves ranging 254 to 257 nm have the maximal bactericidal effect.

Bactericidal properties of UV-rays depend on biochemical peculiarities of microflora (species and even stain of the microorganism, thickness of microbial cell membrane and etc.), environmental characteristics (pH, transparency and etc.), characteristics of the UV radiation source (wavelength, intensity, and etc.), exposure time and other factors. UV-flow density reduces depending on distance in quadratic progression and decreases by 10 times when the distance from the source increases from 2 cm to 50 cm, and is insignificantly small at 3 m distance.

Aim of the study is to identify experimentally the effective exposure time for bacteria elimination.

Museum cultures E. coli, S. aureus, P. aerugenusa, C. albicans and B. subtilis were inoculated on Petri dishes (solid nutrient medium) and were left in UV-light on the bank at 250 cm from the source of light for 30 and 60 minutes. Negative control and experimental cultures were incubated during 24 and 48 hours in temperature-regulated chamber.

Obtained results have shown that after 30 min. of UVR exposure bactericidal action on the studied microorganisms was not observed, in control and studied inoculates the uniform lawn-like growth was observed. After 60 min. exposure we obtained S. aureus growth of 12 colony forming units (CFU), E. coli - 107 CFU, C. albicans 113 CFU, P. aerugenusa and B. subtilis more than 10^3 CFU.

High efficiency of UVR in disinfection of the surfaces has been proved, yet there is no robust scientific methodology for air-flows disinfection using UVR. When using UV-radiation the limiting factor is the maximum permissible dose for people, but not the dose needed to kill microorganisms in the air of premises. In laboratory experiments UVR reaches high rates of microorganisms' mortality while creating ideal conditions. In real application efficiency of the equipment is much lower and depends on many factors. Even prolonged for 60 minutes exposure to UV-radiation does not kill blue purulent infection and spore-forming microorganisms. Duration of exposure must be at least 60 minutes, as sublethal doses of UV-rays have mutagenic action on bacteria and viruses. Each organism has biochemical mechanisms that can completely or partially restore the damaged original structure of the DNA molecule. Due to mutagenesis the survived bacteria can form new colonies with a lower susceptibility to radiation.