

Inactivation of pathogenic bacteria by mid-infrared laser pulses

Svetlana N. Shelygina,¹ Yuri M. Klimachev,¹ Eteri R. Tolordava,^{1,2} Sergey I. Kudryashov,¹ Yulia K. Yushina⁴

¹ Lebedev Physical Institute RAS, Moscow, Russia

³ Gamaleya National Research Center for Epidemiology and Microbiology, Moscow, Russia

³ V.M. Gorbатов Federal Scientific Center for Food Systems, Russian Academy of Sciences, Moscow, Russia

e-mail: shelyginasn@lebedev.ru

This work is continuation of investigation of using of mid-IR femtosecond laser irradiation to inactivation of pathogenic microorganisms. Our previous studies have shown the high efficiency of direct laser inactivation of food pathogenic bacteria in the mid-IR range by femtosecond laser pulses with a wavelength of 3 and 6 μm . In this work pathogenic bacteria, that placed on fluorite substrates as a submonolayer and covered by polyethylene film, were irradiated by mid-IR femtosecond laser irradiation with selective wavelength, corresponds to the high absorption efficiency of the bacterial cell and the minimum absorption of the polyethylene film. These wavelengths correspond to the stretching C-H vibrations (3 μm), or stretching C=O, C-N vibrations (6 μm) of amide groups of bacteria. This experiment simulates mid-IR laser disinfection of food in polyethylene packing.

The research was supported by the Ministry of Science and Higher Education of the Russian Federation (Project No. 075-15-2020-775).