STERILIZATION OF BACTERIA USING PLASMA NEEDLE

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In this abstract we discuss application of a plasma needle to induce necrosis on two breeds of bacteria Staphylococcus aureus (ATCC 25923) and Escherichia coli (ATCC 25922). Plasma generated by the needle has been studied and characterized by means of mass spectrometry and derivative probes in our previous work [1, 2]. Treated samples were prepared as planktonic samples - liquid samples with inoculated bacteria, with varying concentrations of bacterial colony-forming units per ml (CFU/ml) placed in microtiter plate with 96 wells. Each well contained 0.18 ml of suspension. We have treated all the samples for three different times, three different powers and two different flows of helium which served as a buffer gas. After the treatment and the 12-hour incubation bacteria colonies were counted. We have shown that He flow rate and heating do not affect the sterilization. Results of sterilization of Staphylococcus aureus are very good showing the decrease of about 5 orders of magnitude for the highest power used. At very low powers there is no effect, but at higher powers the effect increases dramatically with the treatment time. Similar but somewhat less impressive results were found for Escherichia coli (ATCC 25922). This reduction in efficiency may be expected for gram-negative bacteria. For very high initial densities in both cases effect of plasma was not observed requiring higher powers, or perhaps more optimal choices of flow and proximity. Our results indicate a possibility that plasma needle could be applied in treatments of light bacterial infections, such as in vivo sterilization of skin and periodontal pockets in addition to dental cavities [3].

1. N. Puač. “Development, diagnostic and applications of radio-frequency plasma reactor”, Journal of Physics: Conference Series 133, 2008, pp. 012007.
2. Malović et.al. PSST submitted.
3. E. Stoffels, A. J. Flikweert, W. W. Stoffels, and G. M. W. Kroesen, ”Plasma needle: A nondestructive atmospheric plasma source for fine surface treatment of (bio)materials” Plasma Sources Sci. Technol. 11 no. 4, 2002, pp. 383–388.

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