Sterilizing Air Plasma and Aesthetic Microwave Plasma Devices at Atmospheric Pressure

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Low temperature plasma has strong possibilities of application, for instance, sterilization, tooth whitening, skin treatment and others [1, 2]. Thanks for synergetic characteristic of plasma elements like electron, radical, UV light and electric fields, the plasma can do better work compared with conventional sterilization methods [3]. But plasma sterilization methods also have disadvantages. Hydrogen peroxide plasma has long process time and a bulk vacuum system, and atmospheric air plasma can cause damage on sterilization objects by high concentration of ozone. In this study, atmospheric air plasma sterilization with low concentration of ozone has been proposed. Portable plasma source driven by low frequency (~10 kHz) generates atmospheric air plasma inside a chamber. An ozone filter, that strongly grabs ozone molecules, is placed at the front of the plasma source to prevent sample damages by high ozone concentration. To enhance the sterilization efficacy and reduce the ozone production amount, low concentration of hydrogen peroxide is sprayed into the chamber before and during the sterilization process. Its sterilization performance has been verified with biological indicator disk placed at the center of the chamber. Compared with the low frequency atmospheric air plasma that has a good sterilizing ability, microwave (~GHz) plasma has a strong potential to be applied in biomedical applications such as skin treatment and dental applications because it generate lots of reactive species, and can be driven by a low voltage and consequently provides a great safety [4]. Although a lot scholarly progress has been made in the past ten years for this issue, it is still far from the commercialization of a microwave system for biomedical applications due to bulky and expensive equipment. Reducing gas and power consumption is challenging issues of the commercialization of the microwave plasma system. Portable microwave system that has six/twelve plasma jets those can be driven by low microwave power and low Ar gas flow rate has been developed. Plasma generator's structure has been optimized for this requirement.

References

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