24G01

Basic study of remote microplasma treatment for plasma medicine
プラズマ医療に向けたリモートマイクロプラズマ処理の基礎検討

Kazuo Shimizu, Shigeki Tatematsu, Hodaka Fukunaga, Marius Blajan
清水一男, 立松成基, 福永穂高, マリウスブラジャン

Innovation and Joint Research Center, Shizuoka University, Hamamatsu, 432-8561, Japan
静岡大学イノベーション共同研究センター 〒432-8561 浜松市中区城北3-5-1

Atmospheric microplasma has been intensively studied for various application fields, since this technology has features shown here: (1) Generated around only 1 kV under atmospheric pressure, (2) Discharge gap of only 10 to 100 μm, (3) Dielectric barrier discharge [1]. Low discharge voltage atmospheric plasma process gives us various applications such as indoor air control including sterilization, odor removal, surface treatment, and would be suitable for medical application ("Plasma medicine").

In this article, the basic study for medical application will be presented. One bio/medical application of microplasma is "sterilization". The sterilization process was carried out with active species generated between the electrodes [2].

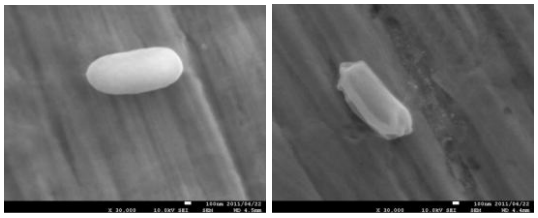

Fig. 1 Image of *Alicyclobacillus* before(left) and after the microplasma treatment (right)
(Photo taken by SEM, x 30,000).

The active species were observed by emission spectrometry. The spectra showed the existence of active species, and the microplasma had typical characteristics of nonthermal plasma.

Sterilization of *E. coli* was confirmed after microplasma treatment with Ar gas. The bacteria shape was changed after the microplasma process (Fig. 1). Surface treatment with long life active species for glass, polymer and other materials could be also possible [3].

One idea may arise; if we were trying to sterilize the bacteria on the surface or if these materials were human or animal skin (Fig. 2). Yes, that would be an application of "Plasma medicine".

How would it work for human beings or animals? Let us try to find out what is the "Key player" for this process.

It should be noted that the plasma process must be the safe, when the target is the creature, especially for human being. Surface potential after microplasma exposure will be also presented to confirm the safety of this process.

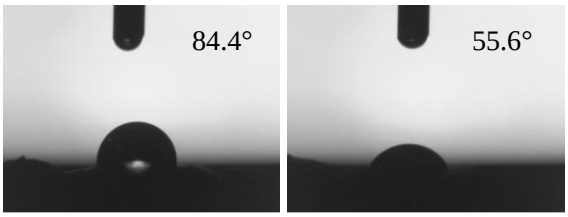

Fig. 2 Contact angle of water droplet on the human skin before(left)and after the microplasma treatment(right)

References

[1] K. Shimizu, et al., "Emission Spectroscopy of Pulsed Power Microplasma for Atmospheric Pollution Control", IEEE Trans. on IAS, Vol. 46, No. 3, pp.1125-1131, 2010.

[2] K. Shimizu, et al., "Study of Sterilization and Disinfection in Room Air by Using Atmospheric Microplasma", Pharmaceutica Analytica Acta, Special issue title: PK/PD: Antifungal and Antibacterial, No. 2, Vol. 11, 2011(in press).

[3] K. Shimizu, et al., "Surface Treatment of Polymer Film by Atmospheric Pulsed Microplasma : Study on Gas Humidity Effect for Improving the Hydrophilic Property", Jpn. J. Appl. Phys. Vol. 50, No. 8, 2011.