

Plasma-Microbubble Generator for Water Purification

Hiroyuki Yoshiki¹, Kouki Okuda¹, Kazushige Sato¹

¹ Tsuruoka National College of Technology, Tsuruoka, 997-8511, Japan

E-mail: yoshiki@tsuruoka-nct.ac.jp

Water purification technology by the plasma-microbubble (P-MB) generator has been developed. Atmospheric-pressure μ plasma (AP μ P) was generated by a pulsed corona discharge using a metal pipe electrode of 0.70 mm in diameter [1] with a peak-to-peak voltage of 6-7 kV and a pulse repetition frequency of 950 Hz. Radicals such as O*, OH, N* and O₃ generated by the air μ plasma were enclosed with microbubbles and these microbubbles were instantly ejected into a water. The most significant character of a microbubble less than 50 μ m in diameter is the decrease in size and subsequent collapse under the water in contrast with an ordinary bubble of several mm in diameter, because of long stagnation and excellent gas dissolution due to Henry's law [2]. Therefore, the gas-liquid interface of the microbubbles is expected to act as the chemical reaction field. Figure 1 shows a compact P-MB generator developed in this study. The generator was made of an acrylic cylindrical pipe (15 mm in diameter and 10 cm in length). AP μ P was stably generated in the plasma chamber, in which a water did not flow backward from the liquid chamber. The photographs of Indigo Carmine solution (32 L with a concentration of 20 mg/L) treated by the air P-MBs are shown in Fig. 2. Decolorization was attained after the P-MB treatment of 34 h. On the other hand, no change was observed in the microbubble-treated dye solution with no plasma. To clarify what's happened in the treated water, the air P-MB treatment on deionized pure water was conducted and pH and UV absorbance were examined. The pH abruptly decreased to be 4-5 with increasing treatment time and UV absorption spectrum showed a strong peak at a wavelength around 210 nm which seems to originate from the H₂O₂ or NO₂⁻ [3]. From these results, it was confirmed that H₂O₂ and OH radical produced in the water-microbubble interface as well as O₃ contributed to decolorize the dye solution.

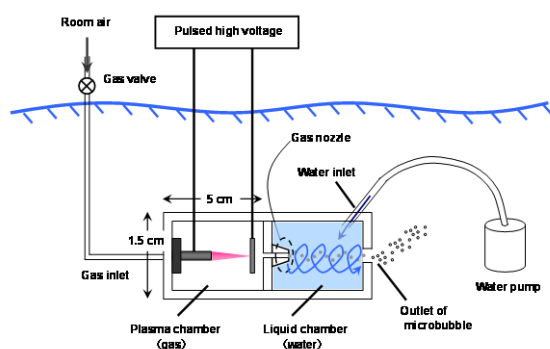


Figure 1 Experimental setup of P-MS.



Figure 2 Indigo Carmine solution after the P-MB treatment.

The P-MBs were also applied to sterilization of *E.coli* in an environmental foul water.

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