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多孔質セラミックを用いた平行平板電極により生成したバブル放電の液中化学反応における酸素および水蒸気添加の効果

Effects of O_2 and H_2O Vapors Addition on the Solution Chemistry in Bubble Discharges Produced Using a Parallel Plate Electrode with Porous Ceramic

ソニア　ムラディア, 永津　雅章
Sonia Muradia, Masaaki Nagatsu

静岡大学創造科学技術大学院，浜松市中区城北3-5-1
Graduate School of Science and Technology, Shizuoka Univ., 3-5-1, Johoku,Nakaku, Hamamatsu, Japan

The recent challenge in the field of plasma technology for wastewater treatment is to develop a plasma process which is cost-effective and highly efficient for the purpose. We developed a multi-bubbles discharge system for wastewater treatment by using a porous ceramic sheet clutched over a hollow metallic frame. We used this discharge system for the decomposition of Indigo Carmine (IC) dye. For experiment, we used pulsed power source with low voltage = 2.5kV and freq. = 5 kHz. We used 200ml of 10mg/l Indigo carmine solution in pure water and argon as the background gas. We characterized our discharge by the production of H_2O_2 during the discharge with time and its efficiency for decomposition of Indigo Carmine at various treatment times. Our results show the production of H_2O_2 ~ 15mg/l in 120s of discharge inside the solution and the decomposition of IC by the discharge is < 20%. In order to enhance the efficiency of the discharge, we studied the effects of addition of O_2 gas and H_2O vapors to the argon gas respectively. The result shows that there is remarkable increase in the decomposition efficiency on addition of O_2 gas (Fig. 1).

We observed > 98% decomposition on addition of 20% O_2 gas to the argon. The water vapors on the other hand do not show any significant effect on enhancing the efficiency. However, the amount of H_2O_2 gradually decreases with the addition of either O_2 or H_2O vapors (Fig. 2). We also found that on addition of O_2 gas, ozone gas is produced exponentially which could be the reason for its higher efficiency but ozone is not significantly observed in H_2O vapors addition and Ar discharge (Fig. 3).

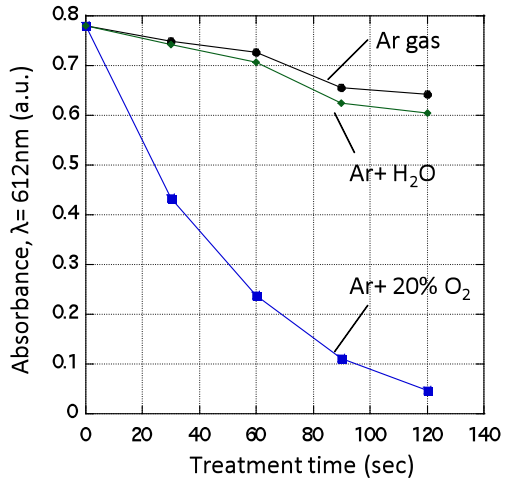

Fig. 1 Decomposition of Indigo Carmine.

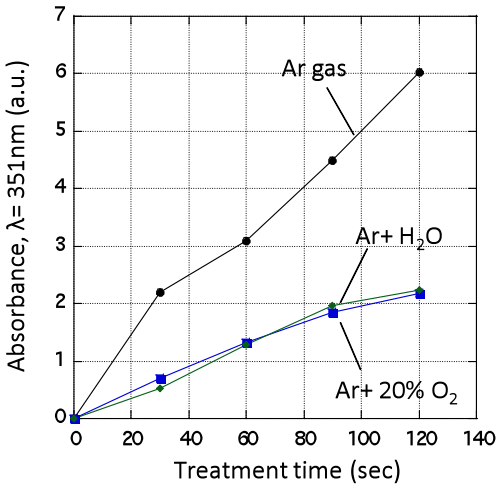

Fig. 2 Absorbance by H_2O_2 generated during discharge.

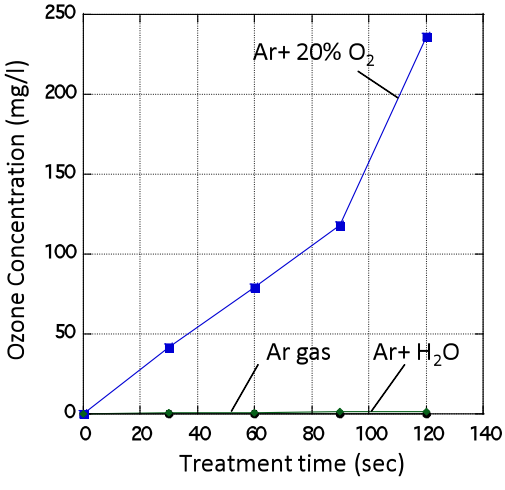

Fig. 3 Ozone concentration during discharge.