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イオン交換樹脂を併用した三次元集積化マイクロソリューションプラズマによるオンサイト過酸化水素生成

On-site Synthesis of H_2O_2 Using 3D Integrated Micro Solution Plasma Combined with Ion Exchange Resin

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1. Introduction

Hydrogen peroxide is available for decomposition of harmful organic matter in water but it is an unstable substance. Thus, research on on-site synthesis have been conducted. We examined the possibility of on-site synthesis using underwater plasma. It has been found that plasma generation efficiency decreases due to the influence of increased electric conductivity of water by plasma treatment in 3D integrated micro solution plasma (3D IMSP) that we developed independently [1, 2]. In this study, we introduced ion exchange resin in order to suppress conductivity rise and to improve hydrogen peroxide production efficiency.

2. Experimental Set up

Fig.1 shows a 3D IMSP reactor. Comparison was made using ion exchange resins adjusted by the two methods this time. One was prepared by passing a solution of NaCl (3g) and Na_2CO_3 (6g) dissolved in deionized water (60mL) at a rate of approximately 120 mL/min. Another was prepared by dissolving only $(NH_4)_2CO_3$ (2g) in deionized water (500mL) the same rate.

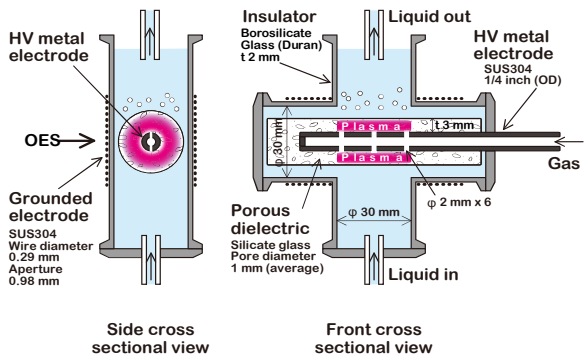

Fig.1 Schematic illustration of a 3D IMSP reactor.

In this experiment, Ar was used as a discharge gas (2L/min). The applied voltage is supplied from a bipolar pulse power supply (Haiden SBP-5K-HK), its amplitude is 5 kV, the frequency is 20 kHz, and the pulse width is 2 μs. The volume of the target solution for plasma treatment was 200 mL and the circulation rate of the treatment solution was 120 mL/min. In the process of circulating the treatment solution, it is passed through the ion exchange resin. We investigated the usefulness of ion exchange resin by measuring hydrogen peroxide and conductivity of treatment solution.

3. Result and Discussion

Fig.2 shows the result. The increase in conductivity in the solution was suppressed by the ion exchange resin, and the result that the amount of hydrogen peroxide produced increased. By measuring ions in the treatment solution by ion chromatography, it was confirmed that ions could be removed from the treatment solution by the ion exchange resin and increase in conductivity could be suppressed.

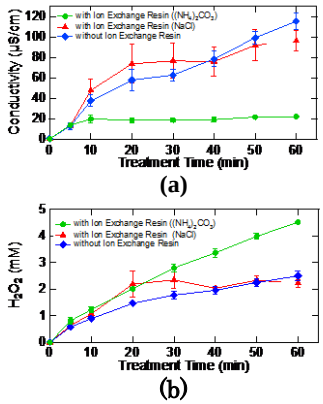

Fig.2 (a) Conductivity and (b) H_2O_2 concentration as a function of treatment time.

Acknowledgements

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References

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