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平板状非平衡大気圧マイクロ波プラズマ装置の開発
Development of Planar Non-equilibrium Atmospheric Pressure Microwave Plasma Device

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1. Introduction

Recently, from the point of view of food safety, various seeds, such as soybean, wheat, sesame, pepper and granular, powdered foods, required sterilization process. Heat sterilization and irradiation method with ultraviolet light are general methods for sterilization of food. However, the heat sterilization method has problem with the food flavor and taste which is deteriorated and the irradiation method is not simple method because it need to use a container and a wrapping for food sterilization. Compared with conventional methods, atmospheric pressure plasma technology has more advantages, for examples low temperature, low cost and easy to use [1]. In this study, we aimed at developing the non-equilibrium atmospheric pressure plasma device for disinfection of granular, powdered foods, such as tea powders or seeds.

2. Experimental setup and results

In our laboratory, we have carried out a preliminary experiment to inactivate *Escherichia* coli (*E*-coli) by using dielectric-barrier discharge (DBD) non-equilibrium atmospheric pressure plasma. Figure 1 shows experimental apparatus schematic and the experimental results of *E*-coli applied on a sterilized nutrient medium using colony counting method. From Fig.1, double-digit

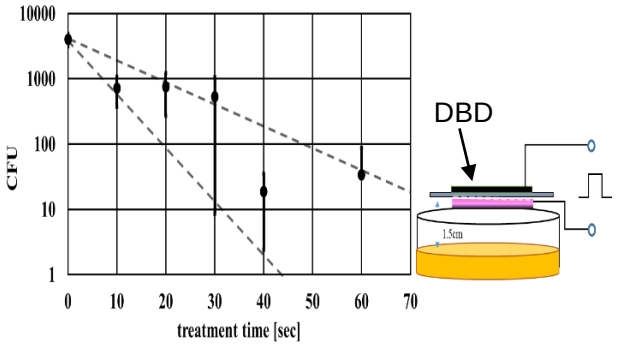

Fig.1 Experimental apparatus schematic (DBD) and experimental results of colony counting method.

of *E*. coli was inactivated by the plasma irradiation of 60 seconds.

In this study, we aimed to develop flat board-formed non-equilibrium atmospheric pressure microwave plasma devices which can sterilize more effectively and safely for a large quantity of the granular powder-formed food, such as various seeds. Figure 2 shows experimental apparatus schematic intend in this study.

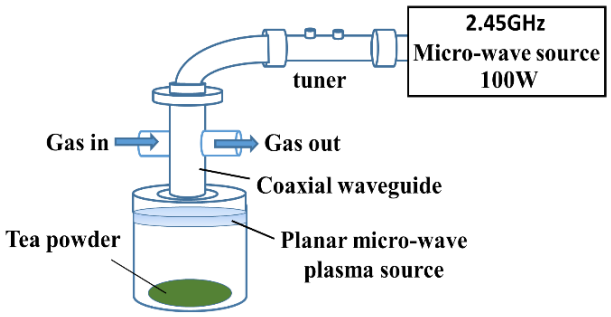

Fig.2 Experimental apparatus schematic(Atmospheric pressure microwave plasma device)

For non-equilibrium microwave plasma device under atmospheric pressure, the behavior of electromagnetic filed was firstly simulated using Finite-Difference Time-Domain method (FDTD) to analysis electromagnetic field of the device. Then, the inactivating characteristic of the plasma was checked by doing direct non-equilibrium microwave plasma irradiation to *E*-coli which was applied on a nutrient medium. Moreover, the experiment focused on the realization of the best electrode structure and the optimum flow quantity of the electric discharge of the microwave plasma. The details of the result of the simulation and the *E*-coli inactivation experiment will be presented at conference site.

References

[1] H. Eto, Y. Ono, A. Ogino and M. Nagatsu Plasma Processes and Polymers 5 (2008) pp.269-274.