Control methods of RONS in Dielectric Barrier Discharge

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Plasma in natural air condition can produce reactive oxygen and nitrogen species (RONS) simultaneously but ROS (Reactive Oxygen Species) and RNS (Reactive Nitrogen Species) has different application in the field of postharvest. ROS is a powerful disinfectant and RNS is an inhibitor of agri-food ripening. Therefore the production rate control of RONS is important. Frequency and flowrate of air can be methods of RONS concentration control factor. Applied frequency range was from 0.1 to 8 kHz and atmospheric air flow rate was from 0 to 20 l/m. The generation rates of O_3, NO and NO_2 were measured by the gas analysers. As external air flow rate was increased, the generation rate of O_3 was increased from 0 to 3.61 mg/min. In the contrary, the generation rate of NO was decreased from 0.21 to 0 µg/min. Frequency can control the production rate of RONS and optimum ozone and NO generation frequency was 3 and 8 kHz respectively.

1. Introduction

32% of all agri-food in the world was lost or wasted per year. The big two cause of food waste is rottenness by fungi and ripening by hormone. Ozone, OH radical, O radical, hydrogen peroxide are called as ROS and it is powerful disinfectant of fungi [1]. NO and NO_2 are called as RNS and considered as a key species in hormone-regulated processes [2]. Plasma discharge of air produces complex RONS but, only particular chemical reactive species might be useful to special purpose therefore, it is necessary to produce appropriate ROS or RNS. The flow rate and frequency was selected as affecting factors of RONS production rate.

2. Experimental Set-up

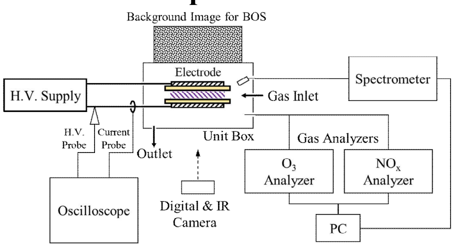

Figure 1. Experimental Set-up

Figure 1 shows the experimental set-up for measurements of electrical, optical and chemical properties of plasma discharge with different flow rate and frequencies.

3. Experimental Results

Figure 2 shows the results of ozone and NO concentration changes with different flow rates. As external air flow rate was increased, the generation rate of O_3 was increased from 0 to 3.61 mg/min. In the contrary, the generation rate of NO was decreased from 0.21 to 0 µg/min. Figure 3 shows the optimum frequency for generating maximum ozone or NO generation. 3 kHz is best to produce ozone and 8 kHz to nitric oxide.

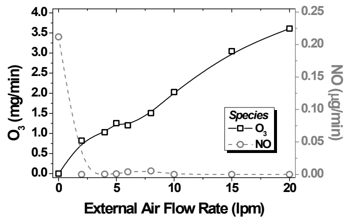

Figure 2. Generation rates of O_3 and NO by flow rates

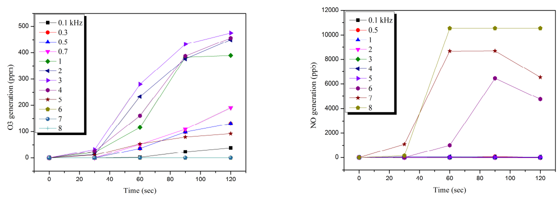

Figure 3. Concentration of O_3 (a) and NO (b) according to the frequency

4. Discussions

Frequency and air flow rate might be related to the plasma region bulk temperature. Temperature can be one key factor of RONS production and it is necessary to study further.

5. Acknowledgement

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6. Reference

[1] S. Horvitz, M. J. Cantalejo, *Food Science and Nutrition*, **54** (2014) 312-339

[2] Lili Deng et al., *Postharvest Biology and Technology* **84** (2013) 9–15 -NO