Inactivation of *Penicilium degitatum* spores by reactive oxygen radicals employing atmospheric-pressure oxygen radical source

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Reactive oxygen species (ROS) including ground-state oxygen atom, hydroxyl radical, excited-state oxygen molecule, and so on, are effective to inactivate microorganisms. It is important to investigate the roles of ROS based on quantitative analysis of the gas phase. We reported that the spores of *Penicillium digitatum* were rapidly inactivated by high density non-equilibrium atmospheric pressure plasma (NEAPP) [1][2]. In this study, we have investigated the efficiencies of ROS on the inactivation of the spores of *P. digitatum* by using an atmospheric-pressure oxygen radical source. The absolute densities of ground-state oxygen atom and excited-state oxygen molecule were measured by vacuum ultraviolet absorption spectroscopy using a micro-discharge hollow cathode lamp and deuterium lamp.

$O_2/(Ar+O_2)$ flow rate ratio of the oxygen radical source was changed between 0 to 1.2 % in the chamber purged with Ar gas at atmospheric pressure as shown in Fig. 1. The densities of O (^{3}P) and O_2 (^{1}D) were from 10^{14} to 10^{16} cm^{-3}. At the $O_2/(Ar+O_2)$ mixture flow rate ratio of 0.6 % , O (^{3}P) density was the highest, while the D value estimated by the colony counting method was the lowest. On the other hand, O_2 (^{1}D) density increased monotonically with increasing $O_2/(Ar+O_2)$ flow rate ratio. Since the D value is in inverse relation to the inactivation efficiency, these results indicated that ground-state oxygen atom is the dominant species in the inactivation of *P. digitatum*.

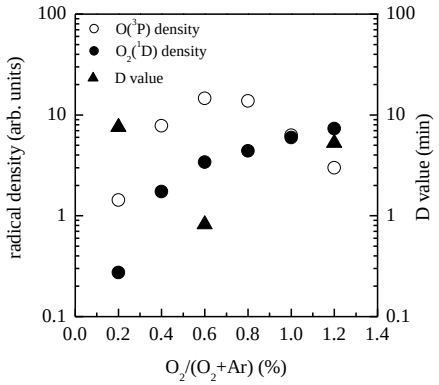

Figure 1: *Densities of O(^{3}P) and O_2(^{1}D), and D value as a function of $O_2/(Ar+O_2)$.*

This work was partly supported by the Knowledge Cluster Initiative (Second Stage), Tokai Region Nanotechnology Manufacturing Cluster, and a Grant-in-Aid For Scientific Research on Innovative Areas, “Frontier Science of Interactions between Plasmas and Nanointerfaces” (No. 21110006) from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

References

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