

Effect of minute amount of nitrogen oxides in pure oxygen plasma on sterilization efficacy

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An atmospheric pressure plasma has been studied as an alternative sterilization methods, because it generates reactive species which have high reactivity against microorganisms [1-4]. However, an effect of nitrogen oxides among reactive species on sterilization is still unclear. In this study, we aim at clarifying the effect of nitrogen oxides in ozone gas on sterilization bacterial spores by generating pure oxygen plasma with mixing small amount of nitrogen gas.

A dielectric barrier discharge (DBD) was used to generate plasma. The plasma source consisted of an alumina plate in thickness of 0.2 mm. The applied voltage was ± 1.4 kV with a frequency of 40 kHz and the pure oxygen gas was fed. The volume of sterilization vessel was 5 mL. Verification of sterilization efficacy was performed by biological indicators using spores of *Geobacillus stearothermophilus* (ATCC 7953) which guarantees 5-log reduction. The bacteria spores were sterilized in 7 min (in-gas) and in 25 min (in-water) when the maximum ozone gas concentration was 35,000 ppm at 15 min and the dissolved ozone concentration was ~ 6.00 mg/L at 20 min as shown in Fig. 1. On the other hand, the spores were sterilized in 10 min (in-gas) and in 30 min (in-water) when the minute amount nitrogen gas was fed. Because the ozone gas concentration decreased down to 15,000 ppm at 30 min and the dissolved ozone concentration reaching to ~ 6.0 mg/L took 25 min. This result showed the ozone concentration is more important than the increase of nitrogen oxides for sterilization of bacterial spores.

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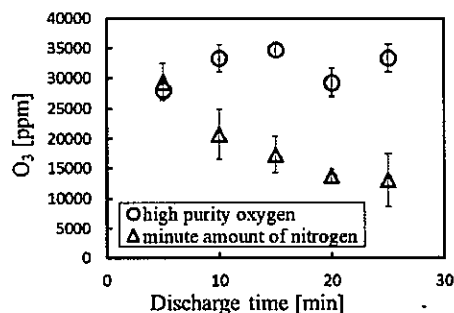


Fig. 1. Dissolved ozone concentration.

Reference

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