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プラズマ放電による模擬病害土壌の酸化処理
Oxidation treatment for simulated soil contaminated with bacteria by plasma discharges

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INTRODUCTION

Plant pathogenic bacteria such as *Fusarium oxysporum* causes a continuous cropping injuries [1]. Discharge plasma has been attracting much attention as a promising technology for inactivation of bacteria. A pulsed discharge enables the instantaneous production of a non-thermal plasma which various chemical species. These chemical species play an important role on sterilization effect. In this paper, oxidation treatment for simulated soil contaminated with *F. oxysporum* by plasma discharges was investigated.

EXPERIMENTAL SETUP

The simulated soil was prepared using glass beads with diameter ranged from 0.063 to 0.090 mm and placed on a grounded plate electrode. A tungsten wire was placed over the glass beads and used as a high-voltage electrode to generate discharge plasma which propagates to the surface of glass beads from the wire. A magnetic pulse compression (MPC) pulse generator was used to generate high-voltage pulse. The maximum voltage, pulse width and pulse repetition rate were 13 kV, 250 ns and 2000 pps, respectively. Indigo carmine solution was used for the evaluation of oxidizing ability by the decolorization of the solution. *F. oxysporum* were used as a specimen for the evaluation of inactivation effects. The moisture content of the simulated soil was changed to 10% and 20% by adding the indigo carmine solution and the suspension. The discharge treatment was carried out for 30 seconds to 7 minutes.

RESULTS AND DISCUSSION

Figure 1 shows the decolorization rate of indigo carmine solution in the simulated soil as a function of treatment time. In the case of moisture content of 10% the solution was almost decolorized at treatment time of 3 min. The decolorization rate in the case of 20% is much lower than that of 10%.

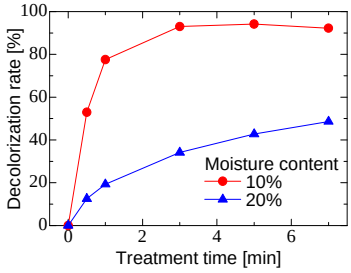

Fig. 1 Transition of decolorization rate of IC by treatment time

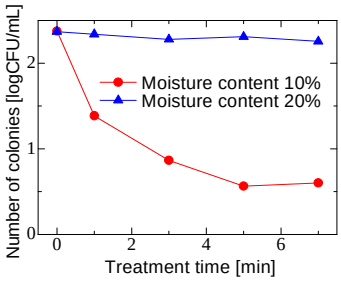

Fig. 2 Transition of the number of colonies of *F. oxysporum* by treatment time

Figure 2 shows number of colonies as a function of the *F. oxysporum* suspension in the simulated soil as a function of treatment time. More than 90% of colonies were inactivated by discharge in the case of moisture content of 10%. On the other hands, the number of colonies was not changed with discharge plasma treatment in the case of moisture content of 20%.

The void ratio in the simulated soil decreases with increasing the moisture content. The active species such as ozone and hydroxyl radical produced by plasma discharges were hard to diffuse into the simulated soil with low void ratio. Therefore, the lower moisture content was the higher the oxidizing ability and the bactericidal activity.

REFERENCES

[1] Q. Zhao *et al.*, Appl Soil Ecol, 47, 67-75 (2011)