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Analysis of Plasma Effects on Seed Germination and Plant Growth

Taesoo Kim, Daehun Park, Gyungsoon Park, Eun Ha Choi

Department of electrobiological physics, Plasma Bioscience Research Center,
Kwangwoon University, Seoul 139-701, Korea

Plasma technology has been widely used for decontamination, differentiation, and disease treatment. Recently, studies show that plasma has effects on increasing seed germination and plant growth. In spite of increasing number of studies about plasma effects, the interaction between plasma and plants has been rarely informed. In this study, we have analyzed the effects of nonthermal atmospheric pressure plasma on seed germination and growth of coriander (Coriandum sativum), a medicinal plant. We used to Ar, air, and N2 plasma on seed as feeding gases. Plasma was discharged at 0.62 kV, 200 mA, 9.2 W. Seed germination was increased over time when treated with N2 based DBD plasma for exposure times of 30 seconds and 1 minute, everyday. After 7 days, about 80～100% of seeds were germinated in the treatment with N2 based DBD plasma, compared to control (about 40%, only gas treated seeds). In order to elucidate the mechanism of increased germination, we have analyzed characteristics of changes in plant hormones and seed surface structure by SEM.

Keywords: seed germination, plant growth, DBD plasma

PT-P028

Emission Plasma Spectroscopy of High-pressure Microdischarges

이병준[1], 주영도[1], 김승환[1], 하태균[1], 공형섭[1], 박용정[1], 박종도[1], 남상훈[2]

[1]Pohang Accelerator Laboratory, Pohang 790-784, Gyeongbuk, Korea,
[2]Korea Heavy Ion Medical Accelerator Project, 75 Nowon-gil, Nowon-gu, Seoul 139-708, Korea

Micro hollow cathode discharges (MHCDs) are high-pressure, non-equilibrium discharges. Those MHCDs are useful to produce an excimer radiation. A major advantage of excimer sources is their high internal efficiency which may reach values up to 40% when operated under optimum conditions. To produce strong excimer radiation, the optimisation of the discharge conditions however needs a detailed knowledge of the properties of the discharge plasma itself. The electron density and temperature influence the excitation as well as plasma chemistry reactions and the gas temperature plays a major role as a significant energy loss process limiting efficiency of excimer radiation. Most of the recent spectroscopic investigations are focusing on the ultraviolet or vacuum ultraviolet range for direct detection of the excimer. In our experiments we have concentrated on investigating the micro hollow cathodes from the near UV to the near infrared (300 ～850 nm) to measure the basic plasma parameters using standard plasma diagnostic techniques such as stark broadening for electron density and the relative line intensity method for electron temperature. Finally, the neutral gas temperature was measured by means of the vibrational rotational structures of the second positive system of nitrogen.

Keywords: emission spectroscopy, microdischarge, high pressure discharge