EFFECTS OF PLASMA TREATED WATER ON PLANTS

Dayonna Park, Danil Dobrynin, Gregory Fridman, and Alexander Fridman
Drexel Plasma Institute, Drexel University, Philadelphia PA 19104 USA

Water quality, its mineralization and chemical composition, particularly pH and nitrogen compounds, play crucial role in plant’s development and growth. Treatment of water with plasma results in change of its properties and chemical composition, which in turn may affect plant growth process and subsequently agriculture produce quality.

Both thermal and non-thermal discharges generated in air or in water produce a number of reactive neutral and charged species, electric fields, and ultraviolet radiation. Plasma treatment of water results in significant change of its properties like pH, oxidation-reduction potential (ORP), conductivity, and concentration of reactive oxygen and reactive nitrogen species (ROS and RNS).

Here we report the results of an experimental study of the effect of water treated with different atmospheric plasmas on germination, growth rates, and sugar content of plants (via Brix measurement). In the study we have used 3 types of plasmas: spark discharge ignited in water, gliding arc discharge, and dielectric barrier discharge. It is shown that effects of these plasmas on chemical composition of various types of water are qualitatively different. Non-thermal DBD plasma results in lower (acidic) pH, and production of significant amount of oxidizing species (e.g. H2O2 and O2-). Gliding arc discharge also causes significant acidification of water, but accompanied by production of reactive nitrogen species (NO, NO2 and NO3). Spark discharge treatment results in neutral or higher (basic) pH depending on initial water composition, and production of RNS. The effects of plasma treated water on plant germination and growth will be presented and discussed.