

Pulsed Power Applications for Agriculture and Food Processing

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Repetitively operated compact pulsed power generators with a moderate peak power were developed for the applications in several stages of agriculture and food processing. Pulsed high-voltage produces intense high-electric field which can cause some biological effects such as stress response (stimulation) and electroporation. Types of pulsed power that also have biological effects to plants are caused with gas and water discharges which include reactive species. The repetitive pulse discharge was used for promoting growth of the vegetables and fruits. The growth rate of the vegetables and sugar content in the strawberry harvested after the cultivation increased by the plasma irradiation to the hydroponic solution using a magnetic-compression pulsed power (MPC) generator. The leaf size of the plants increased with the treatment time using pulsed power discharges. In addition, number of colony forming units (CFU) of *R. solanacearum* in the liquid fertilizer decreased from 10^7 to 10^2 CFU/mL using the pulsed discharge treatment. Seedlings with plasma treatment were relatively healthy; in contrast, all seedlings in the positive control wilted and died from infection of *R. solanacearum* after 12 days. The μ s-pulse high-voltage was used for improvement of mushroom yield. The yielding rate of Shiitake mushroom (*L. edodes*) was also improved with the high-voltage stimulation using compact Marx-type pulsed power generator and Cockcroft-Walton circuit-based capacitor discharge circuit. *L. edodes* in the stimulated log grew faster than that in the bed-log without stimulation. The intense electric field was also employed for inactivation of enzyme in food processing. The applications are based on protein conformational change by electrostatic force. The α -amylase activity decreased with the increasing electric field. The electrostatic effects can contribute to remove airborne bacteria and fungi spore from the storage house and container. This removal contributes to reduce the infection risk with fungi and bacteria. Some kinds of fruit and vegetable emit the ethylene gas which accelerate a degradation of other kind fruits and vegetables. The repetitive μ s-pulse DBD remediation of air and liquid to inhibit degradation of agricultural products via ethylene removal via oxidization reaction. These applications have potential to contribute a modern food supply chain.