

**Title** A comparative study on the effectiveness of chlorine dioxide gas, ozone gas and e-beam irradiation treatments for inactivation of pathogens inoculated onto tomato, cantaloupe and lettuce seeds

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### **Abstract**

The increase in reported food-borne outbreaks linked with consumption of raw fruits and vegetables has motivated new research focusing on prevention of pre-harvest produce contamination. This study evaluates and compares the effectiveness of three non-thermal technologies, chlorine dioxide gas, ozone gas and e-beam irradiation, for inactivation of *Salmonella enterica* and *Escherichia coli* O157:H7 on pre-inoculated tomato, lettuce and cantaloupe seeds, and also their corresponding effect on seeds germination percentage after treatments. Samples were treated with 10 mg/l ClO<sub>2</sub> gas for 3 min at 75% relative humidity, with 4.3 mg/l ozone gas for 5 min and with a dose of 7 kGy electron beam for 1 min. Initial load of pathogenic bacteria on seeds was ~ 6 log CFU/g. Results demonstrate that all treatments significantly reduce the initial load of pathogenic bacteria on seeds ( $p < 0.05$ ). In particular, after ozone gas treatments 4 log CFU/g reduction was always observed, despite the seeds and/or microorganisms treated. ClO<sub>2</sub> and e-beam treatments were noticeably more effective against *Salmonella* on contaminated tomato seeds, where 5.3 and 4.4 log CFU/g reduction were respectively observed. Germination percentage was not affected, except for cantaloupe seeds, where the ratio was significantly lowered after ClO<sub>2</sub> treatments. Overall, the results obtained show the great applicability of these non-thermal inactivation techniques to control and reduce pathogenic bacteria contamination of seeds.