

**Title** Effect of gaseous chlorine dioxide treatment on killing *Alicyclobacillus acidoterrestris* spores on apples

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### Abstract

*Alicyclobacillus acidoterrestris*, a thermoacidophilic spore-forming bacterium, has been isolated from spoiled acidic fruit juices and is recognized as an economically important spoilage microorganism. *A. acidoterrestris* spores are very resistant to conventional pasteurization treatments and can germinate and grow in bottled fruit juice products. Apples can become contaminated with this microorganism in the orchard and cause spoilage of apple juice. Therefore, this study was undertaken to investigate the effectiveness of gaseous chlorine dioxide treatment in reducing levels of *A. acidoterrestris* spores on apple surfaces. *A. acidoterrestris* spores were inoculated onto apple surfaces followed by treatment with chlorine dioxide gas, generated from a gas sachet for 30 min, 1, and 3 h at room temperature in a tightly sealed 20 liter container. After treatment, surviving spores were enumerated with K agar. Gas-treated apples were stored at 4°C to assess the effect of gas treatment on fruit quality. Non-treated apples were used as a control. The chlorine dioxide concentration generated by gas sachets was 5, 10, and 12 mg after 30 min, 1 and 3 h, respectively. After 30 min of exposure, spore levels were reduced by 1 log<sub>10</sub> however, there was no significant difference from the control ( $P > 0.05$ ). After 1 and 3 h, there were about 2.7 and 4.5 log<sub>10</sub> reductions of spore counts, respectively. Regarding apple quality, after 7 days storage some small black spots were found on the surfaces of apples treated with gas for 3 h, however, there was no significant difference between control and treated apples after 30 min or 1 h as treatment. Gaseous chlorine dioxide was effective at killing *A. acidoterrestris* spores on apple surfaces, and the gas sachet was designed for use simple and ease use. Therefore, it is expected that this product can be used in shipping boxes or containers during storage and transport of foods to improve microbial safety of foods.