BACILLUS SPP.

PRODUCTION AND STABILITY OF CHLORINE DIOXIDE IN ORGANIC ACID SOLUTIONS AS AFFECTED BY pH, TYPE OF ACID, AND CONCENTRATION OF SODIUM CHLORITE, AND ITS EFFECTIVENESS IN INACTIVATING *BACILLUS CEREUS* SPORES

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Aqueous chlorine dioxide (ClO_2) has been approved as a disinfectant in beverage bottling plants and food processing, handling, and storage plants and as a sanitizer for food processing equipment. Because of its bactericidal activity over a wide range of pH, rapid action, and limited reaction with organic materials, ClO_2 has been effectively used to kill *Escherichia coli* O157:H7, *Enterobacter sakazakii*, *Listeria monocytogenes*, *Bacillus cereus*, and *Bacillus thuringiensis*. One of the disadvantages of ClO_2 as a sanitizer, however, is its instability during production and storage. Because of its low stability, ClO_2 should be prepared on site and cannot be stored for long periods of time. We studied the production and stability of chlorine dioxide (ClO_2) in organic acid solutions and its effectiveness in killing *B. cereus* spores. Sodium chlorite (5,000, 10,000, or 50,000 µg/ml) was added to 5% acetic, citric, or lactic acid solution, adjusted to pH 3.0, 4.0, 5.0, or 6.0, and held at 21°C for up to 14 days. The amount of ClO_2 produced was higher as the concentration of sodium chlorite was increased and as the pH of the acid solutions was decreased. However, the stability of ClO_2 was enhanced by increasing the pH of the organic acid solutions. To evaluate the lethal activity of ClO_2 produced in various acid solutions as affected by acidulant and pH, suspensions of *B. cereus* spores were treated at 21ºC for 1, 3, 5, or 10 min in hydrochloric acid or organic acid solutions (pH 3.0, 4.0, 5.0, or 6.0) containing ClO_2 at concentrations of 100, 50, or 25 µg/ml. Populations of viable spores treated with ClO_2 at concentrations of 100 or 50 µg/ml in organic acid solutions decreased more rapidly than populations treated with the same concentrations of ClO_2 in HCl. Rates of inactivation tended to increase with higher pH of ClO_2 solutions. Results show that ClO_2 formed in organic acid solutions has higher stability and is more lethal to *B. cereus* spores than ClO_2 formed at the same concentration in HCl solution. This finding emphasizes the benefits of using organic acid solutions to prepare ClO_2 intended to be used as an antimicrobial.