Chlorine Dioxide as a Surface Sanitizer for Food and Beverage Manufacturers & Restaurants

INTRODUCTION

The Significance of Surface Sanitation in Food and Beverage Manufacturing

In the food and beverage industry, maintaining high standards of hygiene is paramount to ensure the safety and quality of products.

According to the USDA, the economic burden of 15 major foodborne pathogens in the United States was about $17.6 billion; a number synthesized based on data of medical costs and economic, medical, and epidemiological literature.¹

A study by Johns Hopkins Bloomberg School of Public Health in 2018 estimated the potential costs of a single foodborne illness outbreak for different types of restaurants. For a fast-food restaurant, the costs ranged from $3,968 to $1.9 million. For fast-casual, it was $6,330 to $2.1 million; for casual dining, $8,030 to $2.2 million; and for fine dining, $8,273 to $2.6 million. These costs varied based on the size of the outbreak and included legal fees, lawsuits, and fines.²

In a Harris Interactive poll, consumers indicated that 55% would switch brands temporarily following a recall, 15% denoted they would never purchase the recalled product, and 21% would avoid purchasing any brand made by the manufacturers.

Surface sanitation plays a crucial role in preventing contamination and the spread of pathogens, which can lead to foodborne illnesses and spoilage. NSF International has pointed out a common mistake in the food industry: assuming that if a food contact surface is visibly clean, it is also sanitized. They note that bacteria like Salmonella and E. coli are resistant to soaps and detergents, indicating that more rigorous sanitation methods are required to fully mitigate the threat of bacterial contamination.³

The choice of an effective and safe sanitizer is critical in achieving these hygiene standards.
Chlorine dioxide (ClO2) has emerged as a potent and reliable sanitizer in the food and beverage manufacturing sector. Its unique properties and effectiveness against a broad spectrum of pathogens make it an attractive alternative to traditional sanitizing agents.

**Explanation of Chlorine Dioxide and Its Properties**

Chlorine dioxide is a yellow-green gas with a distinctive chlorine-like odor. It is a powerful oxidizing agent that can effectively kill bacteria, viruses, and fungi. Unlike chlorine, ClO2 is effective over a wide pH range and does not form harmful chlorinated byproducts.

Historically, chlorine dioxide has been used for water disinfection and as a bleaching agent in the paper and pulp industry. Registered by the EPA as a sterilant in 1988, its application has expanded to include surface sanitation in various sectors, particularly in food and beverage manufacturing, due to its efficacy and safety profile.

**The Science Behind Chlorine Dioxide**

Chlorine dioxide works by penetrating the cell walls of microorganisms and disrupting their metabolic processes, leading to cell death. It effectively destroys biofilms, which are often resistant to other sanitizers.

Compared to traditional sanitizers like quaternary ammonium compounds (Quats) and bleach, ClO2 is more effective at lower concentrations and over a broader pH range. It is less corrosive and does not leave toxic residues. While Quats are widely used, they have limitations in terms of efficacy against certain pathogens and biofilm formation. ClO2, on the other hand, offers superior performance in these areas and poses fewer health and environmental risks.
REFERENCES & STUDIES ON THE EFFICACY OF CHLORINE DIOXIDE

A number of peer-reviewed, published articles dive into the properties of chlorine dioxide’s uses as a disinfectant, surveying and analyzing efficacy in different applications.

A Systematic Review on Chlorine Dioxide as a Disinfectant

The systematic review conducted by Jefri et al. (2022) provides comprehensive insights into the efficacy of chlorine dioxide (ClO₂) as a disinfectant. This study is particularly relevant for food and beverage manufacturers considering the adoption of ClO₂ for surface sanitation.¹

Key Findings:

Broad-Spectrum Efficacy: The review analyzed 33 studies, with 14 specifically focusing on the disinfectant efficacy of ClO₂. It was consistently found to be effective against a wide range of pathogens, including bacteria, viruses, and fungi. This broad-spectrum efficacy is crucial in food and beverage environments where multiple types of contaminants may be present.

Effectiveness Against Resistant Strains: ClO₂ has shown remarkable effectiveness against resistant strains of pathogens. The review highlights its success in neutralizing resistant Mycobacteria and various influenza viruses, including H1N1. This aspect is particularly important as resistance to traditional disinfectants is a growing concern in the industry.

Low Concentration Efficiency: One of the standout features of ClO₂, as noted in the review, is its efficacy at relatively low concentrations (20 to 30 mg/L). This characteristic makes ClO₂ not only cost-effective but also reduces the potential for chemical exposure and residue, aligning with safety and environmental considerations.

pH Independence: The effectiveness of ClO₂ is largely independent of pH levels. This is a significant advantage in food and beverage manufacturing, where the pH of surfaces and environments can vary widely. This property ensures consistent disinfection results across different applications.

Safety Profile: While assessing the safety and toxicity of ClO₂ in humans and animals, the review found that ClO₂, when used within recommended concentrations, offers a favorable safety profile. This aspect is crucial for ensuring the health and safety of workers in manufacturing settings.
Evaluation of Stabilized Chlorine Dioxide in Terms of Antimicrobial Activity and Dentin Bond Strength

Another study by Kalay et al. (2021) provides valuable insights into the practical applications and effectiveness of stabilized chlorine dioxide (ClO2) in diverse settings. While the study’s primary focus was on dental environments, its findings are highly relevant to the food and beverage manufacturing sector, particularly in terms of surface sanitation.²

Key Findings:

**High Antimicrobial Activity**: Kalay et al. evaluated the antimicrobial efficacy of stabilized ClO2 and found it to exhibit high antimicrobial activity against common oral pathogens. This finding is significant for food and beverage manufacturers as it demonstrates ClO2’s ability to effectively eliminate a range of microorganisms that are also pertinent in food processing environments.

**Effect on Surfaces**: An important aspect of the study was assessing the impact of ClO2 on different surfaces. The results indicated that ClO2 did not adversely affect the surfaces to which it was applied. In the context of food and beverage manufacturing, this suggests that ClO2 can be safely used on various surfaces and equipment without causing damage or degradation.

**Comparison with Other Agents**: The study compared ClO2 with other commonly used disinfecting agents. ClO2 was found to be more effective in several instances, reinforcing its potential as a superior sanitizing option in environments where efficacy and surface compatibility are critical.

**Safety for Use on Equipment**: In the dental setting, ClO2 was used without any adverse effects on the equipment, including areas where there is direct contact with materials used in procedures. This aspect is particularly relevant for food and beverage manufacturers, as it implies that ClO2 can be safely used on sensitive equipment and surfaces without the risk of corrosion or damage.
IMPLICATIONS FOR FOOD AND BEVERAGE MANUFACTURERS

The findings from Jefri et al. (2022) underscore the potential of ClO2 as a versatile and effective sanitizer in the food and beverage industry. Its ability to operate effectively at low concentrations and across various pH levels makes it a practical and reliable choice for diverse manufacturing environments. The safety profile of ClO2, coupled with its efficacy against a broad spectrum of pathogens, including resistant strains, positions it as a superior alternative to traditional sanitizing agents.

The study by Kalay et al. highlights ClO2’s effectiveness in eliminating pathogens on various surfaces, a key requirement in food and beverage production facilities. Its non-damaging effect on surfaces and equipment underscores ClO2’s suitability for use in environments where maintaining the integrity of machinery and production surfaces is essential. The comparison with other disinfecting agents positions ClO2 as a more effective alternative, capable of providing superior sanitation while being safe for a wide range of applications.

Chlorine dioxide (ClO2) stands out as a highly effective and safe surface sanitizer for the food and beverage manufacturing industry. Its unique properties, coupled with its proven track record in various studies, make it a superior choice for ensuring hygiene and safety in the industry. ClO2’s effectiveness at low concentrations, broad-spectrum efficacy, and adaptability to various surfaces and equipment make it an ideal solution for the diverse needs of food and beverage manufacturers.
EXPLORE CLO2 SOLUTIONS WITH PURELINE

As industry leaders in innovative sanitation solutions, PureLine specializes in providing tailored ClO2 solutions to meet the unique needs of the food and beverage and restaurant industries. Our expertise in ClO2 technology ensures that you receive the most effective and efficient sanitation solutions, designed to enhance safety and quality in your operations.

We invite you to connect with us to explore how our ClO2 solutions can benefit your business. Whether you are looking to improve your current sanitation practices or seeking new methods to ensure the highest standards of cleanliness and safety, PureLine is here to assist. Our team of experts is ready to provide you with insights, support, and customized solutions that align with your specific requirements.

REFERENCES

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