Journal of Food: Microbiology, Safety and Hygiene

OPEN ACCESS Freely available online

Commentary

Augmentation Techniques for the Removal of *Bacillus* Spores from Food Matrices

Abiola Akinmoladun*

Department of Microbiology, University of Ibadan, Ibadan, Nigeria

DESCRIPTION

Bacillus species, particularly *Bacillus cereus*, are significant foodborne pathogens known for their ability to form resilient spores. These spores can survive extreme environmental conditions, making them a challenge in food safety. As the food industry continues to innovate and improve safety protocols, augmentation techniques have emerged as optimistic strategies for spore removal. This article explores various augmentation methods, their mechanisms, effectiveness, and implications for food safety.

Understanding augmentation techniques

Augmentation refers to the enhancement of existing methods or the introduction of novel approaches to improve efficacy. In the context of removing *Bacillus* spores, various techniques can be considered, including physical, chemical, and biological methods. Each of these approaches leverages different mechanisms to achieve spore inactivation or removal.

Physical Methods

High-Pressure Processing (HPP): HPP involves subjecting food products to high levels of pressure, which can disrupt cellular structures and inactivate microorganisms. Research has shown that HPP can effectively reduce *Bacillus cereus* spores in various food matrices. The effectiveness of HPP is influenced by factors such as pressure levels, treatment time, and the food matrix composition. Studies indicate that pressure levels above 400 MPa can lead to significant reductions in spore counts.

Ultraviolet (UV) light: UV light is known for its germicidal properties, particularly in inactivating bacterial spores. UV-C light, in particular, has been studied for its efficacy against *Bacillus* spores. The mechanism involves damaging the Deoxyribonucleic Acid (DNA) of the spores, preventing germination and replication. While effective, the challenge lies in ensuring uniform exposure, especially in turbid food matrices. Innovations in UV light delivery systems are helping to overcome these limitations.

Chemical methods

Chemical sanitizers: Various chemical agents, such as chlorine dioxide, hydrogen peroxide, and per acetic acid, have demonstrated efficacy against *Bacillus* spores. These agents can disrupt spore coat integrity, leading to inactivation. The effectiveness of these sanitizers depends on concentration, exposure time, and the food matrix's properties. For instance, chlorine dioxide has been found effective in reducing spore counts on fresh produce.

Essential oils: Natural antimicrobials, such as essential oils, have gained attention for their ability to inhibit bacterial growth. Oils like thyme, oregano, and clove exhibit antimicrobial properties that can target *Bacillus* spores. These compounds can disrupt membrane integrity and affect spore germination. However, the application of essential oils must be carefully managed to avoid undesirable flavors or aromas in food products.

Biological methods

Bacteriophage therapy: Bacteriophages, viruses that specifically infect bacteria, represent a novel biological approach for spore inactivation. Research is ongoing into the use of bacteriophages targeting *Bacillus cereus*. The advantage of this method lies in its specificity, reducing the risk of impacting beneficial microbiota. However, challenges remain in ensuring stability and efficacy in food matrices.

Competitive exclusion: This approach involves the introduction of non-pathogenic bacteria that can outcompete *Bacillus* spores for resources. Specific strains of *Lactobacillus* have shown assurance in inhibiting the growth of *Bacillus cereus*. This method may also promote beneficial microbial populations in food products.

Effectiveness of augmentation techniques

The effectiveness of augmentation techniques varies based on several factors, including the food matrix, spore concentration, and method parameters. Research shows that combining methods, such as HPP with chemical sanitizers or UV treatment with natural antimicrobials, can enhance overall spore reduction.

Correspondence to: Abiola Akinmoladun, Department of Microbiology, University of Ibadan, Ibadan, Nigeria, E-mail: akinmol@abiola.ng

Received: 19-Nov-2024, Manuscript No. JFMSH-24-35962; **Editor assigned:** 21-Nov-2024, PreQC No. JFMSH-24-35962 (PQ);**Reviewed:** 05-Dec-2024, QC No. JFMSH-24-35962; **Revised:** 12-Dec-2024, Manuscript No. JFMSH-24-35962 (R);**Published:** 19-Dec-2024, DOI: 10.35841/2476-2059.24.9.327.

Citation: Akinmoladun A (2024). Augmentation Techniques for the Removal of *Bacillus* Spores from Food Matrices. J Food Microbiol Saf Hyg. 9:327.

These synergistic approaches may provide a more comprehensive solution to spore contamination.

Rice products: A study examining HPP's effects on *Bacillus cereus* in rice found that treatments at 600 MPa for 5 minutes reduced spore counts by over 90%. Combining HPP with a mild heat treatment further enhanced spore inactivation.

Dairy products: Research on UV light treatment of milk demonstrated that exposure to UV-C light for 20 seconds led to a significant reduction in *Bacillus* spores, highlighting UV's potential in dairy safety.

Fresh produce: The application of chlorine dioxide wash on fresh vegetables resulted in over 99% reduction of *Bacillus* spores, showcasing the effectiveness of chemical sanitizers in produce safety.

Implications for food safety

The successful implementation of augmentation techniques can significantly improve food safety by reducing the risk of *Bacillus*-related illnesses. As consumers demand safer food products, the food industry must adapt and adopt innovative technologies. Regulatory bodies are also beginning to recognize the potential of these methods, paving the way for their acceptance in standard food safety practices.

CONCLUSION

Bacillus spores present a formidable challenge in food safety, necessitating the exploration of innovative augmentation techniques. From physical and chemical methods to biological approaches, the potential for effectively removing these spores from food matrices is vast. As the food industry continues to evolve, the integration of these techniques can help ensure safer food products and protect public health. The future of food safety lies in harnessing these advancements to create resilient systems that mitigate the risks associated with *Bacillus* contamination.