The role of microbial biofilms in food processing and the importance of foodborne disease surveillance.

Chenglin Gong*

Department of Microbiological Analysis Lab, University of Cape Town, South Africa

Introduction

Food safety remains a critical concern worldwide, with microbial contamination being one of the leading causes of foodborne illnesses. Microbial biofilms, which are communities of bacteria embedded in a self-produced matrix, pose significant challenges in food processing environments. These biofilms can adhere to various surfaces, making sanitation difficult and increasing the risk of contamination. In addition, foodborne disease surveillance plays a crucial role in identifying and preventing outbreaks by monitoring microbial threats in the food supply chain [1].

Microbial biofilms are formed when bacteria attach to surfaces and produce extracellular polymeric substances (EPS), creating a protective environment. This structure enhances their resistance to disinfectants, making conventional cleaning methods ineffective. Common biofilm-forming bacteria in food processing include Listeria monocytogenes, Salmonella spp., and Escherichia coli. These pathogens can persist in food processing plants, leading to recurrent contamination and outbreaks [2].

Biofilms are particularly problematic in food processing due to their strong adherence to equipment such as stainless steel, plastic, and rubber surfaces. Once established, they serve as reservoirs of pathogens that can detach and contaminate food products. Moreover, their resistance to antibiotics and cleaning agents makes them difficult to eradicate, requiring advanced sanitation techniques and strict hygiene protocols [3].

Controlling biofilm formation requires a combination of preventive and reactive measures. Implementing rigorous cleaning and sanitation programs, using biofilm-disrupting agents, and adopting novel technologies such as enzymatic treatments and bacteriophages can help mitigate their impact. Additionally, regular monitoring of microbial contamination in processing plants is essential for early detection and intervention [4].

Foodborne disease surveillance is crucial for tracking and controlling outbreaks caused by microbial contamination. This system involves collecting data on foodborne illnesses, analyzing trends, and identifying sources of contamination. Surveillance programs help public health authorities implement timely interventions, thereby reducing the spread of diseases [5].

Various approaches are used for foodborne disease surveillance, including laboratory-based testing, epidemiological investigations, and whole-genome sequencing of pathogens. Advanced molecular techniques allow for precise identification of microbial strains, enabling researchers to trace contamination sources back to specific food processing facilities or distribution chains [6].

With advancements in technology, surveillance systems have become more efficient in detecting and controlling outbreaks. Digital tools, artificial intelligence, and blockchain technology are being integrated into food safety monitoring to enhance traceability and real-time reporting. These innovations contribute to a more proactive approach in ensuring food safety [7].

Microbial biofilms are often linked to persistent outbreaks of foodborne diseases, making their surveillance an essential aspect of food safety management. Monitoring biofilm formation in food processing environments helps in assessing contamination risks and implementing targeted sanitation measures. Combining biofilm research with surveillance data can enhance our understanding of pathogen transmission and improve food safety strategies.

As microbial threats continue to evolve, the future of food safety will rely on innovative approaches to controlling biofilms and strengthening foodborne disease surveillance. Research into novel antimicrobial agents, improved detection methods, and stricter regulations will be necessary to combat these challenges effectively. Collaboration between food industries, regulatory agencies, and scientific communities will be key to achieving safer food production and distribution systems [9, 10].

Conclusion

Microbial biofilms in food processing and foodborne disease surveillance are interconnected issues that significantly impact food safety. Biofilms contribute to persistent contamination, while surveillance systems help detect and mitigate outbreaks. By adopting advanced sanitation technologies, improving monitoring strategies, and leveraging technological advancements, the food industry can enhance its efforts in preventing foodborne illnesses and ensuring consumer health. The continuous evolution of food safety measures will be essential in addressing the ever-growing challenges posed by microbial contamination in the food supply chain.

Correspondence to: Chenglin Gong, Department of Microbiological Analysis Lab, University of Cape Town, South Africa. E-mail: chenglin@gong.com

Received: *01-Jan-2025, Manuscript No. AAFMY-25-161643;* ***Editor assigned****: 03-Jan-2025, PreQC No. AAFMY-25-161643(PQ);* ***Reviewed****: 17-Jan-2025, QC No AAFMY-25-161643;* ***Revised****: 21-Jan-2025, Manuscript No. AAFMY-25-161643(R);* ***Published****: 28-Jan-2025, DOI:10.35841/aafmy-9.1.246*

Citation: *Gong C. The role of microbial biofilms in food processing and the importance of foodborne disease surveillance. J Food Microbiol. 2025; 9(1):246*

Reference

1. Rather MA, Gupta K, Bardhan P, et al. Microbial biofilm: A matter of grave concern for human health and food industry. J Basic Micro. 2021;61(5):380-95.
2. Carrascosa C, Raheem D, Ramos F, et al. Microbial biofilms in the food industry A comprehensive review. Inter J Envir Res Pub Healt. 2021;18(04):2014.
3. Liu X, Yao H, Zhao X, et al. Biofilm formation and control of foodborne pathogenic bacteria. Molecu. 2023;28(6):2432.
4. Sharan M, Vijay D, Dhaka P, et al. Biofilms as a microbial hazard in the food industry: A scoping review. J Appl Microbio. 2022;133(4):2210-34.
5. Chitlapilly Dass S, Wang R. Biofilm through the looking glass: A microbial food safety perspective. Pathog. 2022;11(3):346.
6. Alonso VP, Gonçalves MP, de Brito FA, et al. Dry surface biofilms in the food processing industry: An overview on surface characteristics, adhesion and biofilm formation, detection of biofilms, and dry sanitization methods. Compre Rev Food Sci Food Saf. 2023;22(1):688-713.
7. Tao Q, Wu Q, Zhang Z, et al. Meta-analysis for the global prevalence of foodborne pathogens exhibiting antibiotic resistance and biofilm formation. Front Microbio. 2022;13:906490.
8. Dula S, Ajayeoba TA, Ijabadeniyi OA. Bacterial biofilm formation on stainless steel in the food processing environment and its health implications. Folia Microbiol. 2021;66:293-302.
9. Garvey M. Bacteriophages and food production: Biocontrol and bio-preservation options for food safety. Antibio. 2022;11(10):1324.
10. Pang X, Song X, Chen M, et al. Combating biofilms of foodborne pathogens with bacteriocins by lactic acid bacteria in the food industry. Compre Rev Food Sci Food Saf. 2022;21(2):1657-76.

Citation: *Gong C. The role of microbial biofilms in food processing and the importance of foodborne disease surveillance. J Food Microbiol. 2025; 9(1):246*