Environmental Pathogen Monitoring Program in Food Manufacturing

The following article is a part of FIFP webinar series 29th edition on the topic "Environmental pathogen monitoring program in food manufacturing" held on 27th May, 2023.

Note from the Chief Editor:

Ms. Greena Tino made a presentation on the topic "Environmental pathogen monitoring program in food manufacturing" on 27th May, 2023. Food safety and quality are of paramount importance in the food manufacturing industry. Environmental pathogen monitoring programs play a critical role in preventing the contamination of food products and safeguarding public health. This article discusses the significance of such monitoring programs and their contribution to maintaining high standards in food production. As per FAO and WHO data, unsafe food causes 600 million cases of foodborne diseases and 4,20,000 deaths every year worldwide. In this backdrop, information on various aspects of Environmental pathogen monitoring program (EPMP) in food manufacturing is very timely and relevant. Ms. Greena brought out the importance of environmental pathogen monitoring in the production of high quality and safe food products. This program aims to assess the effectiveness of the overall hygienic practices in a facility and provide necessary information to prevent possible microbial contamination of food products. The article provides details of components and benefits of an effective environmental pathogen monitoring program. The EPMP recognizes 4 different zones based on their risk level and the likelihood of harboring pathogens to systematically monitor and manage potential sources of contamination. Zoning Concept in EPMP has been well explained with examples. Key considerations for zone designation and sampling methods are described and corrective actions suggested. The vital role of these programs in upholding the industry standards and protecting public health by preventing contamination, ensuring compliance, and maintaining consumer trust has been highlighted.

Introduction

The production of safe and high-quality food products requires meticulous attention to hygiene and sanitation throughout the manufacturing process. Environmental pathogens, including bacteria like Salmonella, Listeria, and *E. coli*, can pose serious risks to consumers if they contaminate food products. To mitigate these risks, food manufacturing facilities implement rigorous monitoring programs to detect and prevent the presence of pathogens in their environment. Food safety can be compromised by microbiological contamination caused by a variety of pathogenic and spoilage microorganisms present in the production environment. The combination of monitoring both food products and the production environment is a lever to increase food safety and quality. Environmental Pathogen monitoring programs (EPMPs)

implemented in food industries allow evaluating the clout of the microbial controls in food processing plants.

Importance of Environmental Pathogen Monitoring

As per FAO and WHO data source, each year worldwide, unsafe food cause 600 million cases of foodborne diseases and 4,20,000 deaths. These outbreaks also undermine consumer confidence in affected products, result in large recalls, and diminish market demand.

A substantial number of foodborne illness outbreaks result from poor-hygiene practices. Microorganisms can survive in food processing and handling environments. They are generally introduced into the food environment through raw materials, pests, air, water, and employees. Usually, the routine applications of good sanitation practices can control these microorganisms. However, if contamination levels are high or sanitation procedures are inadequate, microorganisms may establish and can contaminate food products leading to foodborne illness outbreak.

Various pathogenic microorganisms such as *E. coli, Listeria monocytogenes,* and *Salmonella* spp. have well-established histories of being potential contaminants in food-handling environments. Hence, it is critical to monitor the hygienic environment in the food manufacturing facility to produce high quality and safe food products. An environmental Pathogen monitoring program (EPMP) will assess the effectiveness of the overall hygienic practices in a facility and provide necessary information to prevent possible microbial contamination of food products. The environmental Pathogen monitoring program does not make the food safe. Rather, it provides valuable data (source and concentration) on indicator organisms, spoilage organisms, and pathogens of concern in a timely manner.

Environmental pathogen monitoring programs help in preventing outbreaks; ensuring quality and compliance with government standards. Regular monitoring helps identify potential sources of contamination, preventing outbreaks of foodborne illnesses. Maintaining a clean environment reduces the likelihood of product spoilage and ensures consistent product quality. Food manufacturers must adhere to regulatory standards set by governmental bodies. Monitoring programs ensure compliance with these standards.

Key benefits of an effective environmental Pathogen monitoring program

- Provides information (source and concentration) about indicator organisms, spoilage organisms, and/or pathogens
- Acts as an early warning system
- Helps to identify harborage niches and hot spots
- Validates the sanitation program and helps in determining the frequency required for cleaning and sanitation.
- Overall effectiveness of sanitary design, personnel practices, and operational methods

Key Components of a Monitoring Program

An effective environmental pathogen monitoring program typically includes the following components:
Sampling protocols: Establish a systematic plan for collecting samples from various areas of the facility such as processing lines, equipment surfaces, and employee areas.
Pathogen detection methods: Utilize advanced techniques such as polymerase chain reaction (PCR) and enzyme-linked immunosorbent assay (ELISA) to detect pathogens accurately and rapidly.
Frequency: Determine the frequency of sampling based on risk assessments, production volume, and historical data.
Data analysis: Analyze collected data to identify trends and patterns, enabling timely corrective actions.
Corrective actions: Develop protocols for responding to positive pathogen findings. These actions may involve sanitation, equipment adjustment, or process modifications.

Zoning Concept in EPMP

In an environmental pathogen monitoring program within the context of food manufacturing, different zones are established to systematically monitor and manage potential sources of contamination. These zones help categorize different areas of a food production facility based on their risk level and the likelihood of harboring pathogens. Here are the typical zones you might find in such a program:

Zone 1: High-risk areas (Critical Control Points - CCPs)

These are areas directly involved in food processing, where the risk of pathogen contamination is the highest. Examples include

- Processing lines, cutting and slicing areas, filling stations, conveyor belts and buckets; utensils; employee hands (if touching the product); slicers and dicers; product hoppers, bins and bin liners; and discharge chutes / Fillers.

Monitoring in this zone is frequent and intensive, often in real-time, to ensure immediate detection and action.

Zone 2: Medium-risk areas

These areas have the potential for indirect food contact or where contamination could occur via equipment or personnel. These are nonfood contact areas closely adjacent to product contact surfaces. Examples include

- equipment framework; drip shields and housings; control panels and buttons; overhead pipes directly over Zone 1 surfaces; and maintenance tool

Monitoring frequency is lower compared to Zone 1 but remains regular and thorough.

Zone 3: Low-risk areas

These are non-processing areas with minimal risk of direct or indirect contamination.

Nonfood contact surfaces not close to zone 1. Examples include

- Floors, walls, ceilings, hoses, air handling units, condensate drip pans, trolleys, forklifts, walk-along, carts, trash containers, pallets, foot mats and foot baths, drains, brooms, mops and squeegees, toolbox etc.

Monitoring frequency may be lower in these areas, with a focus on periodic verification.

Zone 4: Exclusion areas

These areas are off-limits to unauthorized personnel and may include maintenance and utility rooms. Access is restricted to trained and authorized personnel only. These are areas remote from processing area. Examples include

- Hallways, loading docks, warehouses, wash area, locker rooms, cafeteria and break rooms, office area etc.

Key considerations for zone designation

Hygienic practices: Zone designations should align with hygienic practices and potential pathways for contamination. Areas with direct food contact or proximity to food processing should be classified as higher risk.
Flow of personnel and equipment: Zones should be organized to reflect the flow of personnel, materials, and equipment within the facility. This helps identify potential cross-contamination points.
Cleaning and sanitization: The ease of cleaning and sanitizing each zone should also influence its risk classification. Hard-to-clean areas may require higher monitoring frequency.
Historical data: Historical data on pathogen prevalence in different areas can guide the designation of zones and the frequency of monitoring.
Risk assessment: Conduct regular risk assessments to ensure that the zone designations and monitoring frequencies remain effective and aligned with potential risks.

Sampling methods

Steps to be followed are

1) Wash and sanitize hands
2) Put on sterile gloves before handling swabs
3) Change gloves or sanitize between swabs
4) The swab should touch only the sample site
5) Always submit a negative control swab.
6) Submit samples as stipulated (Transport <45 ° F and Test <48 hrs)

Establish a baseline/ corrective action

Corrective actions are crucial in an environmental pathogen monitoring program to address positive findings in different zones and prevent the spread of pathogens in

food manufacturing facilities. Following is the procedure for implementing corrective actions in response to positive results in various zones:

1. Zone identification

Identify the specific zone in which the positive pathogen result was detected. This will determine the severity of the situation and the appropriate corrective actions to be taken.

2. Isolation

Isolate the affected area to prevent any potential cross-contamination with other zones. This may involve restricting access and temporarily halting production activities in the zone, if necessary.

3. Notify relevant personnel

Notify the appropriate personnel, including quality control managers, production supervisors, and maintenance staff, about the positive result. Clear communication is crucial to initiate swift corrective actions.

4. Root cause analysis

Conduct a thorough investigation to identify the root cause of the pathogen contamination. This may involve examining equipment, personnel practices, cleaning procedures, and potential sources of contamination.

5. Immediate Sanitization

Initiate immediate and thorough sanitization of the affected area. Use approved sanitizers and cleaning protocols to eliminate the presence of pathogens. Ensure that sanitation practices are validated and properly executed.

6. Validation of cleaning

Verify the effectiveness of the cleaning and sanitization process by conducting follow-up testing. This step ensures that the corrective actions taken have successfully eradicated the pathogens.

7. Preventive measures

Implement preventive measures to avoid future occurrences of contamination. These measures might include enhanced sanitation protocols, improved personnel hygiene practices, and equipment maintenance.

Contributions to food safety

An effective environmental pathogen monitoring program significantly enhances food safety by:

- Early detection: Identifying pathogens early prevents contaminated products from reaching consumers.
- Risk mitigation: Minimizing the risk of recalls and potential legal liabilities associated with contaminated products.
- Consumer confidence: Demonstrating a commitment to food safety improves consumer trust in the brand.

Challenges and future directions

Implementing a successful monitoring program comes with challenges such as resource allocation, training, and keeping up with evolving technologies. However, advancements in automation and rapid testing methods are making monitoring more efficient and accurate.

Conclusion

In the food manufacturing industry, an environmental pathogen monitoring program is a cornerstone of food safety and quality assurance. By preventing contamination, ensuring compliance, and maintaining consumer trust, these programs play a vital role in upholding the industry standards and protecting public health. As technology and knowledge continue to advance, these programs will evolve, enabling even safer food production practices in the future.

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