



Evolutions of Pathogenic Bacteria in Food Contact Surfaces

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DESCRIPTION

Pathogenic microorganisms can be transferred to food through contact with a contaminated surface. Biofilms are generally composed of single or multiple species, forming multi-species biofilms, which have higher antimicrobial resistance and may contain spoiling and pathogenic bacteria. The characteristics of the involved bacteria (i.e., cell surface appendages, surface charge strain, metabolic activity), the attachment surface (material, wettability, roughness etc.) and the surrounding environment (pH, temperature etc.) all play a role in biofilm. In many studies, it was also observed that the biofilm pathogens were resistant to the anti-microbial agent, indicating that the food contact surface was not reacting against the microbes and needed to change its coating. To assure the quality and safety of food, the quality assurance systems enable the verification and application of control measures.

The way to limit the spread of these microorganisms is to restrict their survival on contact surfaces. However, the emerging designs of antibacterial surfaces provide the opportunity to reduce or eradicate the adhesion of microorganisms. The major purpose of these modified Food Contact Surfaces (FCS) is to prevent microorganism attachment or eradication. The surface modification could be done *via* variable approaches like adsorption, covalent binding or surface topography modification. Several antimicrobial agents have been used to alter the properties of the surface, such as enzymes, peptides, essential oils and polymers.

Challenges of the food industry with respect to food contact materials

Various conditions in the food processing industry, such as the availability of nutrients, moisture content, and microbial inoculum derived from the raw material, favor the adherence of microorganisms on the food contact surface. Biofilms are developed on the surfaces, escalating the complex ecosystem and causing contamination. Recent research discovered that the viable *L. monocytogenes* biofilm remained even after cleaning

and disinfectant application. Bio-deterioration is also considered as a major challenge for the food industry as all food will deteriorate to some extent once it is slaughtered or harvested. Any undesirable change in the property of a material because of a microorganism is known as bio-deterioration. The deterioration of food could be the loss of its nutritional value, change in colour and becoming vulnerable.

One of the concerns for the management of microbiological food safety issues is to implement effective controls without increasing prices unnecessarily or compromising taste and nutritional value. As a result, microbial risk management necessitates a detailed awareness of the entire food supply chain. Screening the microbial load in the final product is often ineffective in terms of hazard control, as it is impossible to test enough samples to provide the statistical power required to identify pollutants at levels that pose unacceptable health hazards.

Raw material, such as raw meats, fish and poultry, may contain pathogenic bacteria. During storage or food preparation, pathogenic bacteria could be transmitted to other food materials, such as cooked or ready-to-eat foods. Various studies suggested the contamination of microbes such as *L. monocytogenes*, *S. aureus*, *E. coli*, etc. in food from the food contact surface. Contamination could also occur between the allergens and the allergen free food commodities. Formation and dispersal of the biofilm are affected by various factors such as the surface material and its properties, specific bacterial strain temperature, pH, and nutrient content. A proactive strategy is necessary, beginning with the manufacturer assuring a safe process and product design, as well as anticipating potential problems instead of detecting them after they have developed.

Microorganism transfer from food contact materials

It is a well-known fact that a high percentage of foodborne illnesses are caused by a failure to maintain hygiene during food preparation. A common practice that is the major cause of the contamination is the use of the same kitchen equipment for both raw material and ready-to-eat foods. It may lead to the

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contamination of fresh fruits and vegetables by the pathogenic microorganisms from the raw meat, which does not go through any thermal processing before consumption.

The consequence of contaminated surfaces as a mode of pathogen transfer to food is very common in domestic settings. However, according to a survey by Gkana, Lianou, and Nychas carried out in, the majority of people realise the importance of

cleaning and maintaining the hygiene of the food contact surfaces while preparing ready to eat food. A significant number of consumers also admit to being victims of poor food handling practices. These inappropriate practices include the use of inefficient washed or unwashed cutting boards during food preparation, as well as the reuse of the same surfaces for handling both raw meat and ready to eat foods.