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Perspective

Using the Chemical and Microbiological Exploration to Determine Biofilms in Food Items

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DESCRIPTION

Biofilms are an important reason for contamination in food industry, although the composition of biofilms in practice is still mostly unknown. To differentiate between free-living bacteria and the attached bacteria in biofilms, surface samples collected after cleaning and disinfection must be chemically and microbiologically characterized. In this work, sampling techniques that could be helpful for surface sample chemical and microbiological tests were assessed. After cleaning and disinfecting, surfaces in the production facilities of eight Belgian food companies were sampled using two different techniques: the scraper-flocked swab method and the sponge stick method. These samples were subjected to microbiological and chemical analysis to determine whether the sampling techniques were suitable for the quantification of extracellular polymeric material components and bacteria emerging from biofilms in these facilities. The material in these swabs did not interfere with the detection of the chemical components, making the scraper-flocked swab method the most appropriate for chemical analyses of the samples. The sponge stick approach was marginally, but not considerably, superior to the scraper-flocked swab method for microbiological enumerations. At least 20% of the sampled surfaces were present in all but one of the facilities. Proteins were discovered in 20% of the surface samples that underwent chemical analysis, whereas carbs and uronic acids were discovered in 15% and 8% of the samples, respectively. When the chemical and microbiological findings were combined, 17% of the investigated surfaces were found to be carrying biofilm because they were contaminated with microorganisms and at least one of the chemical components that had been examined. Generally, there are significant differences in microbiological contamination in the food business by food sector and even within a facility at different sample points and sampling intervals.

A matrix of independently created extracellular polymeric compounds surrounds biofilms, which are sessile colonies of bacteria (EPSs). On practically any surface, biofilms can develop. Polysaccharides, proteins, lipids, and extracellular DNA make up the majority of EPSs, which are essential to a biofilm's emergent features. These newly discovered characteristics have increased interest in biofilms as a potential source of contamination in facilities that produce food. Disease outbreaks brought on by microorganisms including *Salmonella*, *Escherichia coli*, *Pseudomonas* spp., lactic acid bacteria, *Enterobacteriaceae*, and *Listeria monocytogenes* are common, and microbial contamination can result in goods having a shorter shelf life and diseases being spread through food. Many of these food-related outbreaks have been connected to biofilms, primarily on the equipment's surfaces.

After cleaning and disinfecting the surfaces that come into contact with food, hygiene monitoring and biofilm sampling are frequently carried out simultaneously in food manufacturing facilities. In food production facilities, a variety of sampling and monitoring techniques, including the plating of swab, sponge, or wipe samples, agar contact plates, and dip slides, can be used to check for microbial contamination on surfaces. Due to its simplicity and ability to sample broad surfaces and hard-to-reach places, swabbing with a sponge stick is frequently utilized.

Biofilms are frequently extracted with a cell scraper in a lab setting. These techniques are used to gather samples for the identification and counting of microorganisms; however, because biofilms are made up of both EPSs and bacteria, both must be sampled and counted. Understanding the composition of EPSs can shed light on the distinctive qualities of biofilms because EPSs are crucial to these properties. The microbiological data only indicate the degree of contamination and the types of microorganisms present in biofilms, whereas chemical characterization reveals the existence and make-up of EPSs.

To distinguish between free-living bacteria and attached bacteria in biofilms, it is crucial to combine microbiological and chemical characterization of surface samples collected following Cleaning.

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