

Hygiene checks – the next generation

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Increases in notified cases of food poisoning have focused attention on food production methods and systems. Worldwide, food legislation is incorporating the Hazard Analysis Critical Control Point (HACCP) philosophy, a proactive approach to food safety, based upon the identification and control of specific hazards.

The use of such food safety management systems has resulted in an increased awareness and understanding within the food industry of both the risks associated with microbiological contamination and the need for real-time monitoring.

In any food processing environment, the presence of residual food debris on production surfaces can both encourage and facilitate the survival and growth of micro-organisms by protecting them from the direct action of sanitisers and disinfectants and/or providing a nutritious medium for growth.

It is possible for a single bacterium with a doubling time of 20 minutes, growing in food or pockets of food trapped in equipment or machinery, to produce a population of more than 10 million cells over the course of an eight hour working day. Should these organisms become dislodged, they can easily be transferred directly or indirectly to the final product, so contributing to its microbial load.

This can result in a reduction in food shelf-life but perhaps of more concern is the possible presence of pathogens – those micro-organisms that cause disease.

Such cross-contamination has been identified as being an important contributory factor in a significant proportion of general foodborne disease outbreaks in both the UK and the USA.

Accordingly, the Centre for Disease Control and Prevention (CDC) in Atlanta, has identified contaminated equipment and surfaces as being one of five major categories of risk factors that contribute to foodborne illness.

Food residues that are allowed to accumulate can act as continuous contamination sources in which micro-organisms can reside



The VERicleen food residue surface test.

and multiply. Therefore, the hygiene of the process and processing environment is an important factor, both in assuring food quality and in protecting the consumer from pathogens.

Consequently, Good Manufacturing Practices emphasise sanitary effectiveness and hygienic practices during the processing of foods and, thus, cleaning, either as part of general hygiene or spec-

ified as a control measure within a HACCP plan, is of great importance to caterers, retailers, manufacturers and processors alike.

Within the food industry, cleaning schedules are designed to reduce the levels of food debris and micro-organisms to levels that pose minimal risk to the safety and quality of the product.

However, the structure of these sanitation programmes can vary.

Manufacturers, for example, tend to employ a two-stage cleaning process, whereas caterers and other food service establishments often use a combined detergent/disinfectant (sanitiser). Ideally, all food companies require a simple and rapid method for assessing the hygienic status of food preparation areas and the efficacy of the cleaning procedures used.

However, no ideal method exists to determine the cleanliness of surfaces and, as such, there is no standard method, technique or protocol for surface hygiene monitoring.

Traditionally, the effectiveness of sanitation procedures has been evaluated using immediate visual assessment or microbiological methods such as hygiene swabs or agar contact plates.

However, there is evidence to suggest that visual inspection is a poor indicator of cleaning and that microbiological methods, which provide no indication as to the level of residual food debris, can also considerably underestimate the number of organisms present on a surface.

Additionally, food safety management systems, such as HACCP, require hygiene monitoring to provide results rapidly and in time for remedial action to be implemented.

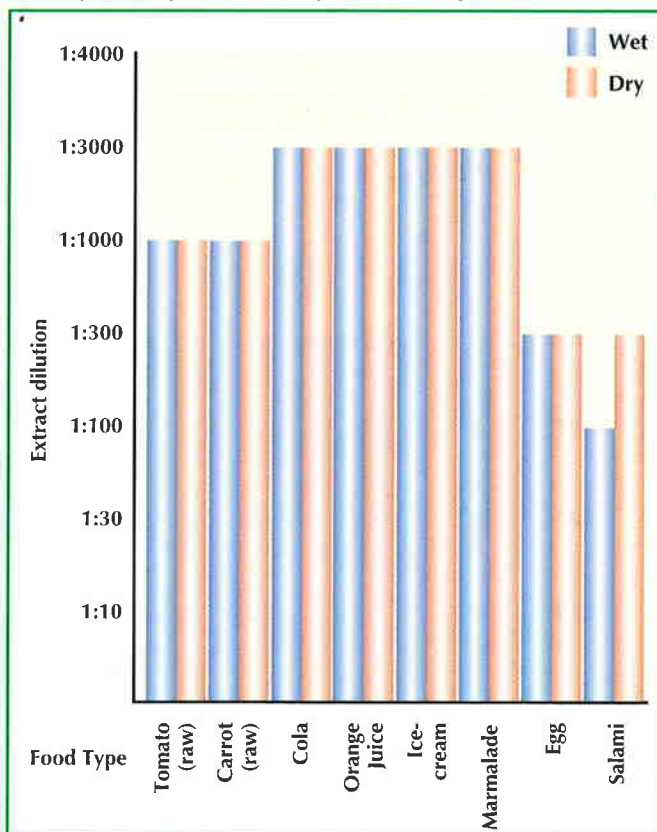
Microbiological methods are typically media and cultivation based and can take up to 48 hours to complete.

As a result, by the time a defect is discovered a large amount of unsatisfactory or unsafe food may have been produced, distributed and even sold.

Rapid hygiene monitoring methods are available to the food industry and their introduction has meant that results can be obtained within minutes allowing remedial action to be implemented before control of a product or process has been lost.

The use of ATP bioluminescence as a means to provide, in real-time, an estimate of total surface contamination has been well documented and the technique has proved particularly useful in large manufacturing plants where regular and frequent monitoring can provide management with

Fig. 1. The detection of residual food debris from a wet and dry stainless steel surface, using the VERicleen food residue surface test.



data on trends in levels of hygiene.

However, the main reason given, particularly by smaller businesses, for not using ATP analysis, is the perceived high cost of testing – the price of a single luminometer can be as much as £2000.

There has, therefore, been a continued interest in the development and use of instrument free hygiene monitoring systems, many of which detect the presence of chemical residues, such as protein and/or reducing agents, left behind on an inadequately cleaned surface.

However, the sensitivity of these hygiene monitoring methods depends upon the universality of the component residue being tested for. For example, the level of intrinsic protein within the food debris itself will influence the performance of protein detection methods.

Consequently, studies have shown that although capable of indicating that a surface is free from high protein product residues, protein detection is less suited for use within processing environments involved in the production of low protein foods such as ready-to-eat salads and/or vegetables.

This article reports on the recently developed VERIclean food residue surface test, which detects the presence of residual carbohydrates and phosphates in one minute.

This instrument free, hygiene monitoring test, was specifically designed by Charm Sciences Inc as a means to detect low protein, composite manufactured product residues as well as those associated with salad and vegetable items.

Published methods previously used for determining the limits of detection of both ATP bioluminescence and protein detection assays were adapted as a means to evaluate some of the performance characteristics of the VERIclean food residue surface test.

This involved the inoculation of stainless steel squares (100cm²) with serial dilutions of different food extracts of known chemical composition, thus simulating varying degrees of poor cleaning.

The surfaces were then sampled using VERIclean, in accordance with the manufacturer's instructions. Assays of the dilutions yielding minimum detection levels (with those dilutions immediately above and below) were repeated (x 5) to confirm the end point.

The results (Fig. 1) illustrate that

VERIclean was capable of detecting the presence, on a 'marginally unclean' stainless steel surface, of different raw vegetable homogenates, which had been diluted 1000-fold. The test proved even more effective when used to sample surfaces that had been contaminated with ice-cream and composite manufactured product residues, including cola, orange juice and marmalade.

Under these circumstances, even those surfaces inoculated with extracts diluted 3000-fold, were deemed by VERIclean as being unacceptable for food production.

The results also suggest that the use of VERIclean need not be limited to the detection of these specific product residues and although slightly less sensitive, this test method could also be used to assess the cleanliness of surfaces that had come into contact with dairy or meat based products, such as eggs or salami.

In all cases, the results obtained were consistent and easy to interpret and were attainable within one minute of sampling the surface.

Furthermore, unlike traditional microbiological methods surface dryness did not affect the ability of VERIclean to detect the presence of these product residues.

Cleaners and sanitisers have been shown to reduce the sensi-

tivity of the ATP bioluminescence technique by quenching the light signal.

Thus, to investigate the effect of residual sanitiser upon the sensitivity of VERIclean, the inoculated surfaces were also sampled in the presence of 'Impact' (Holchem), a combined detergent/disinfectant sanitiser (QAC-based), widely used within the UK food service industry.

To simulate situations where no or inadequate rinsing of the surface had occurred, Impact was either applied at its in-use concentration (2% v/v), or at the more diluted concentration of 0.02% v/v. Results were based upon three replicates.

In some cases, the presence of Impact resulted in a slight (three-fold) reduction in the sensitivity of VERIclean (Fig. 2).

However, in general, its ability to detect the presence, on either a wet or dry stainless steel surface, of those food residues used during this study, was not adversely affected by the presence of residual sanitiser. These results are probably of more relevance to the catering/food service industry where sanitation procedures usually incorporate cleaning solutions, which do not need to be rinsed from the surface.

The development of rapid hygiene monitoring methods is a particularly dynamic area of

applied food safety research. Over the past decade, time consuming, microbiological techniques have been superseded by non-microbiological methods that provide results in real-time.

Expensive, instrument based systems are, in turn, evolving into a variety of inexpensive, instrument free test kits each capable of detecting a specific component residue and which can be used either as a part of an integrated cleaning monitoring strategy or when the use of instrument based systems is impractical.

The next stage in this evolutionary process is likely to involve the design and development of single test protocols, capable of detecting an even greater variety of food components and which could be used to rapidly assess the cleanliness of food production areas within which, a wide range of different food types are prepared, for example within food service establishments.

The VERIclean food residue surface test forms part of this new generation of hygiene monitoring tests.

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Fig. 2. The effect of residual sanitiser upon the sensitivity of the VERIclean food residue surface test.

