Combating contamination with whole room disinfection

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Food manufacturers are under more pressure than ever before to ensure that factories and processing areas are as clean and hygienic as possible. As always, safety is paramount and good hygiene is an essential component of assuring product safety.

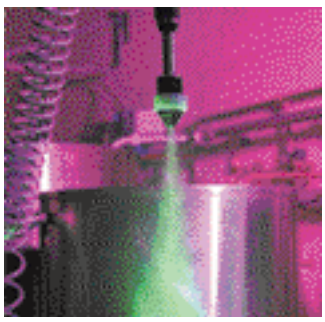
Cleaning and disinfection in food processing plants and factories has always been vitally important but as expectations rise, there are more demands within the food industry for higher standards of micro-organism control.

While traditional methods for controlling contamination have primarily focused on specific areas such as surfaces which come into contact with food and food processing equipment itself, this approach can leave large areas of the processing environment vulnerable to bacterial growth.

This is a particular cause for concern for the food manufacturing industry given that previous research from Campden BRI demonstrates that microbial strains, including pathogens, can become persistent in food processing areas for several years.

It is clear that while the routine, day-in, day-out cleaning and disinfection systems that food processors typically have in place at a basic level, are adequate approaches to pathogen control, they are insufficient to combat contamination risks in areas that are harder to reach, such as vertical areas and the underneath of surfaces.

Chemical fogging.



Preparing tests for a research project.

This is borne out by Campden BRI membership subscription-funded research which investigated the efficacy of conventional methods of disinfection with novel 'whole room' techniques such as gaseous ozone and hydrogen peroxide vapour (HPV).

The results demonstrated that while methods such as chemical fogging are effective at reducing airborne microbial populations and horizontal surfaces, they do little to clean and disinfect other surface orientations and have smaller effects on vertical surfaces, overhead structures and ceilings as well as harder to reach areas such as underneath equipment.

Clearly, this presents a potential risk to food safety and manufacturers are increasingly recognising the need to supplement routine cleaning processes with whole room disinfection techniques to reduce persistent microbial strains such as Listeria monocytogenes.

The pharmaceutical and clinical sectors have long been targeted by a range of whole room decontamination systems, however less research has been undertaken to date into their practical application in the food and drink industry.

Campden BRI has therefore been working to address this imbalance by investigating the practical use, safety and effectiveness of whole room disinfection methods in food processing plants and factories and assessing the latest cleaning and disinfection developments.

Whole room disinfection

There are several kinds of whole room techniques available – from various types of chemical fogging including nebulisers, to hydrogen peroxide vapour, ozone and chlorine dioxide gas, ultraviolet light, titanium dioxide coating and ultraviolet light and ionisation.

Each commercially available whole room technique will differ slightly in its application and there may be differences in their overall performance.

Key considerations before using any of the above whole room techniques include the identification of specific areas where the decontamination processes can be applied, any health and safety implications related to using the technique, and the practical issues related to their use in a food processing environment.

It is also important to assess exactly how the whole room disinfection technique will be used in the food production area. The methods can be used proactively on a daily basis, after routine cleaning and disinfection procedures have been implemented or as part of periodic cleaning and disinfection processes that occur monthly, quarterly or annually. These measures may sometimes only be employed reactively to decontaminate an area after a specific pathogen contamination incident.

Another factor is the level of disinfection that the whole room systems can achieve – this needs to be determined as some may achieve the decontamination of all exposed room surfaces such as ceilings, walls, floors and food processing equipment but others may include some penetration into equipment to contact indirectly exposed surfaces.

A significant advantage to using whole room disinfection techniques is that for some, the decontamination process can be certified, providing detailed microbiology efficacy evidence that the procedure has taken place.

This is an invaluable tool for demonstrating that particular food processors are regulation compliant and ensures that the demands of enforcement authorities or supply chain partners' customers are met – including Environmental Health Officers, the Food Standards Agency, retailers and third party auditors.

Chemical fogging

Applying chemical disinfectants in the form of fogs or mists to food processing areas is a routine method for controlling cross contamination and it is a very effective decontamination technique, particularly on

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horizontal surfaces where droplets deposition is maximised.

Fogging is usually implemented by using either a static, purpose-built system in an area of a factory with strategically placed nozzles, or more commonly, via a mobile unit.

For whole room disinfection, chemical fogging is only effective if sufficient chemical is deposited onto all of the food contact surfaces.

As long as a suitable disinfectant is used, research has suggested that fogging is effective at reducing airborne microbial populations by two to three log orders in 30-60 minutes and horizontal surfaces up to six log orders in 60 minutes, with minimal effect on vertical surfaces and underneath equipment.

This method is therefore particularly beneficial when it comes to supplementing routine cleaning and disinfection procedures as an additional safeguard, ensuring all food processing areas are scrupulously clean and hygienic. The effectiveness of chemical fogging can be greatly improved with the use of electrostatic fogging nozzles, which help ensure a greater surface coverage of the aerosol droplets, even on non-horizontal surfaces.

***Swabbing* to test.**

Vapours and gases

Vapours and gases, such as hydrogen peroxide and ozone, have several advantages over chemical fogging because they can effectively penetrate every part of a room, including sites that might prove difficult to gain access to with conventional liquids, applied either by fogging or via manual disinfection procedures.

Another major benefit of using hydrogen peroxide and ozone in the food industry is that they are environmentally friendly. Hydrogen peroxide rapidly breaks down into water vapour and oxygen and residual ozone spontaneously decomposes to oxygen, leaving no problematic residues.

An important point to note is that due to the toxicity of hydrogen peroxide and ozone at high concentrations, whole room disinfectant techniques can only be used in areas that can be isolated and sealed off during the decontamination process and when appropriate health and safety risk assessments have been undertaken.

However, a workable solution for a factory may be to decontaminate overnight, enabling food processing areas to be fully operational the following morning with minimal disruption to output.

Practical considerations

High concentrations of hydrogen peroxide and ozone may be able to control pathogens such as listeria in food processing environments if the high log reductions achieved in the laboratory (for example >5 log reductions) can be obtained in the field. Indeed, if these techniques were applied periodically, for example, quarterly, it may potentially be possible to eliminate pathogens from the food processing environment and/or limit their persistence.

However, further trials are needed to support this in practice. There is also a need for more research investigating the long term material interactions involved in using whole room disinfectant techniques. For example, what effect does the long term use of hydrogen peroxide or ozone have on particular materials in the food processing plant such as natural rubber?

It may be the case that certain vapours and gases are corrosive against some materials and food manufacturers would need to take this into consideration.

In addition, there is a strong case for more research looking into the number of whole room decontamination units required to effectively decontaminate an area and to determine the bearing that room size and shape, together with the level of oxidisable material, has on the levels of oxidation required.

It is clear that whole room disinfection has an important role to play in the fight against microbiological cross-contamination from surfaces and the air, which may give rise to food spoilage and safety issues.

Campden BRI is able to apply its expertise and knowledge of whole room disinfection by working with service suppliers to test different techniques against specific micro-organisms in the food and drink industry. ■

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