Safeguarding quality in the vacuum packaging of red meat

Vacuum packaging of red meat has been in widespread use for many years. In the late 1980s, however, a new type of spoilage emerged as a serious economic problem and involving vacuum-packed beef from southern Africa and the USA.

The bacteria responsible for these two outbreaks were later identified as a new species of psychrophilic Clostridium: Cl. estertheticum, so-named because it produced a complex array of esters.

The meat had a normal pH, was processed in abattoirs with excellent standards of hygiene and had been stored at well-controlled chill temperatures.

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Clostridia are anaerobic spore-forming bacteria. They cannot grow in the presence of oxygen, but grow well in its absence. Their spores are more resistant than the vegetative forms of bacteria to various conditions including heat, disinfectants and damage due to oxygen.

They can also multiply in relatively small concentrations of nutrients (soil) with moisture and localised anaerobic conditions in the environment of abattoirs and cutting plants. They are likely to survive and grow best in cool places, such as in the cutting rooms and chillers.

Recommendations for removal of Cl. estertheticum

Holchem recommends the following steps to remove Cl. estertheticum from a food processing environment. This should be completed as a one-off procedure and should not replace the normal recommended daily procedure of clean.

Abattoir/boning hall

Equipment should be fully stripped down and foamed, along with the walls, ceiling, doors and floor with a chlorinated alkali foam detergent suitable for the soiling and water hardness (for example 5% Holchem Maxichlor or 5% Rapier). Surfaces should be hand-padded. After 20 minutes all surfaces should be fully rinsed and then disinfected with an oxidising biocide, preferably peracetic acid (for example 1% Holchem Perbac OPD). The environment should then be fogged.

Chillers

All products should be removed from the chiller. All surfaces should be foamed with a chlorinated alkali detergent taking care to ensure compatibility with any soft metals. After 20 minutes, rinse off the detergent and disinfect all surfaces with peracetic acid. The environment should then be fogged.

Chiller evaporator units

Deep clean the chiller evaporators as per the normal procedure. Disinfect all surfaces of the evaporator with peracetic acid solution followed by an application onto all fins and accessible surfaces of a slow-release corrosion inhibitor/detergent that slowly dissolves washing away debris and micro-organisms (for example Holchem Cold Shield).

Vacuum packing units

Manually clean all areas using a bucket and cloth wrung dry with peracetic acid. Strip down the air unit and all associated plastic ducting or pipework from the air pump to the waste plastic swarf receptacle. Clean the inside of the pipework using a peracetic acid solution and brush. Disinfect all areas, especially the inside of the pipework, using peracetic acid applied with a sprayer. Leave for 20 minutes and rinse. Allow pipework to dry. Re-assemble all pipework once dry and re-disinfect using peracetic acid solution.

Fogging

Fogging is undertaken to disinfect the air and to apply disinfectants to surfaces not usually treated in routine disinfection of food production equipment. The number of foggers required and their positioning within the processing area to maximise the distribution of fogged chemical droplets should be pre-established.

This can be achieved by placing paper disinfectant test strips, which change colour in the presence of disinfectant droplets, at key points within the processing area.

Once distribution of fogging droplets has been established, the fogging procedure can be validated by replacing the disinfectant paper test strips with microbiological spore strips. Following fogging the spore strips can be incubated and enumerated to ensure acceptable spore destruction at the key test points.

Prior to fogging, turn all evaporators in the environment off. Fogging is usually undertaken with a disinfectant at a higher concentration than used routinely (for example 2% Holchem Perbac OPD).

Fog approximately 1 litre of solution per 100 cubic metres of airspace. When fogging has been completed and the environment is safe to re-enter, rinse all surfaces with fresh water. Turn any evaporators back on.

Note: Please ensure peracetic acid and chlorinated detergents do not come into contact with one another, as this has the potential to liberate chlorine gas.

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Where physical spoilage and/or positive results have not been identified

Plant management should conduct an environmental hygiene swabbing exercise utilising sampling sites normally used for general hygiene monitoring but, in addition, swabs should be taken from the vacuum pack machine and associated pipework. Where any of these results are positive, then appropriate corrective actions must be taken. Plant cleaning schedules/procedures must be modified to take a precautionary/ prophylactic approach to control of this organism.

On a defined frequency (minimum once every three months) in all areas of the facility; from lairage through to finished product storage and despatch, then:

- Deep clean to be conducted utilising chemicals (as described above).
- As this organism is associated with hides/skins/feet (it is known that the organism is carried on hides and hooves), particular consideration should be given to cleaning of these areas and robust segregation between hides/skins/feet handling and food production. Segregation controls should not be limited to operational issues; management should also give consideration to air flows throughout the slaughter hall, airflows should be under positive pressure from clean to dirty.

Where physical spoilage and/or positive results have been identified

If product is detected manifesting chronic symptoms (evidence of gas production, or swollen/distended vacuum pack bags) this must be destroyed (rendered) and records kept. Do not open affected product and, furthermore, do not attempt to re vacuum pack affected product as this may exacerbate the problem and cause further contamination to the factory and equipment.

All product packaged from the date of manufacture of the isolation must be considered as potentially spoilt and should be quarantined. Investigations should be undertaken, and a risk assessment made to determine the extent of such spoilage and the fate of quarantined product.

Arrange for confirmatory analysis of product (if necessary) and conduct swabs for environmental analysis, throughout the entire factory.

These specific cleaning measures must be implemented immediately and aggressively and followed up by repeated cleaning (and swabbing minimum weekly) until all results are negative. Plant cleaning must be rigorously enforced; any compromises will affect the efficacy of cleaning.

Vacuum pack machines (and similar) obviously cannot be cleaned and disinfected in the normal manner as applied to food contact surfaces. All such equipment should be cleaned using a single use cloth or cleaning pad moistened with appropriate chemicals. Seals and other components (such as air filters) on such equipment may need to be replaced as part of this exercise.

Pipe work, lagging etc may provide harbourage for these organisms where present in the factory environment.

In relation to pipe work for vacuum packer pumps (for example exhaust pipes), in the event of an outbreak consideration should be given to removal and disinfection; if disinfection cannot be achieved, consider replacement.

Plant cleaning fogging should be conducted on a repeating cycle with weekly swabbing until all results are negative. Swabbing to be conducted again one month thereafter. If these results are negative then plant may revert to swabbing and deep cleaning on a three-monthly basis.

Specific requirements for disinfectants targeting Cl. estertheticum

All disinfectants used in the food industry, as a minimum, should satisfy the requirements of the European Disinfectant Tests EN1276 (bactericidal test), EN1650 (fungicidal test) and EN 13697 (surface test for bacteria).

In addition, if the disinfectants are to be used in chilled conditions, typical of meat production facilities, the above tests should be undertaken at 10°C: the default test temperature is 20°C. To demonstrate sporicidal action, the disinfectant should meet the requirements of EN13704 (Sporicidal test). In addition, specific action against Cl. estertheticum spores should also be demonstrated using the EN 13704 protocol.

If the disinfectant is claiming no-rinse status, evidence to demonstrate that it is unlikely to taint food subsequently processed on that unrinsed surface should be available. In the UK, Campden BRI can undertake such validation using a protocol based on the Triangle Contact Taint test (BS5929 Part 3:1984).

Holchem Perbac OPD has been demonstrated to meet all the above mentioned requirements and has been successfully used to control Cl. estertheticum in many meat processing facilities. ■