CLEANING AND SANITISING OPTIONS – W6

Eco-efficiency resources for the food processing industry

Alternatives to traditional practices

Food processors are continually looking for economical cleaning and sanitising methods and chemicals that meet food safety standards while also:

- *reducing the volume of water used for cleaning and sanitisation*
- *reducing the pollutant load of the wastewater*
- *providing a safer and healthier environment for employees by reducing exposure to harsh chemicals.*

It is important that processors take a holistic approach to selecting cleaning and sanitising products and methods that consider not just the purchase costs but also the many hidden costs.

Chemical management

Review chemical use

Food processing plants should regularly review chemical use on the site including:

- exposure times, temperatures and concentrations of chemicals
- impact of chemicals on the environment, and wastewater pollutant loads
- toxicity and the impact it has on operator health and safety
- impact on maintenance, for example corrosiveness.

Chemical control

Savings can be made through automatic dosing machines which can be programmed to provide an accurate amount of chemical depending on the cleaning activity. This reduces human error, saving money as well as improving health and safety.

Service-based agreements and performance contracting can be used to help reduce chemical and water usage by including environmental objectives and targets in agreements.

BETTER CHEMICAL MANAGEMENT

Priestley's Gourmet Delights, a bakery product manufacturer, worked with their chemical supplier to consolidate cleaning chemicals and improve the dispensing system, reducing costs from $4,000 to $2,000, a saving of 50 per cent in the first year. (Priestley's Gourmet Delights is an ecoBiz participant.)

CONTROLLED DISPENSING SAVES CHEMICALS AND MONEY

Prepared Foods Australia, a supplier of pre-prepared foods and value-added products, have worked closely with chemical supplier Applied Chemicals to implement systems that promote both water and chemical efficiency.

One is a chemical dispensing system with pre-set programs depending on the cleaning and sanitising requirements of different lines. Operators type in their line code and the chemicals are automatically dispensed. This prevents the use of the wrong types of chemicals and provides the correct amount of chemicals to meet the needs of the quality and food safety system.

The system was installed as part of the service agreement with Applied Chemicals and reduced chemical costs by 65 per cent per year. (Prepared Foods is an ecoBiz participant.)

Waste can be reduced by purchasing chemicals in bulk or in higher concentrations, whilst keeping operator heath and safety in mind. Chemicals must be correctly labelled and stored in bunded, dry, well ventilated areas to reduce the risk of environmental harm and improve health and safety of staff.

Cleaning and sanitising alternatives

Steam

Steam, under pressure, has traditionally been used by many food processors to clean and sanitise. The heat has the solvent power to dissolve fats and oils and kill harmful microbes, while the pressure helps to dislodge the soiling.[1] Dry steam cleaning which operates at lower pressures but heats the water far in excess of boiling point (around 150 °C) is becoming increasing popular for cleaning sensitive areas in food processing plants. The dry steam is very water efficient as it contains only five to six per cent moisture and the lower pressures reduce the negative side effect of pressure spread airborne bacteria throughout the plant.

Ozone

The use of ozone in the food industry is an emerging field. The ability of ozone to oxidise gives it strong antimicrobial properties. As ozone rapidly degrades to oxygen at room temperature in both air and water, it needs to be generated on site immediately prior to application and care must be exercised so it is not discharged into ambient air.

Ozone has been proven effective against a broad spectrum of microbial agents including bacteria, fungi, viruses, protozoa and bacterial and fungal spores.[2]

USE OF OZONE BY AUSTRALIAN WINERIES

Ozone is being used as an alternative to chlorine for disinfecting oak barrels used for the wine aging process. Wine makers have found that it can kill microorganisms but not affect the taste of the wine. The cleaning process starts with a high pressure hose-down using hot water to dissolve the tartrates, followed by an ozonated rinse to sanitise the barrel.

In addition, ozonated water is used to spray the floor, sumps, walls, fruit bins and other wettable surfaces in the winery. It is also used in clean-in-place systems, reducing the water and chemical consumption.

Ozone can be used to sanitise equipment, increase the shelf life of fruit and vegetables and disinfect poultry carcasses. It can also be used in wastewater treatment systems to reduce the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) levels leading to lower tradewaste costs and can be used to neutralise some odours.

1 Pehanich, M., 2006, Cleaning without chemicals www.foodprocessing.com/articles/2006/052.html
2 Pascual, A., Llorca, I. and Canut, A., 2007, "Use of ozone in food industries for reducing the environmental impact of cleaning and disinfection activities." Trends in Food Science and Technology 18, S29–S35.

Ozone can also be used to purify cooling tower water or incorporated into clean-in-place systems, where it can also save water as it does not leave a residue negating the need for a final rinse.

High concentrations of ozone can cause degradation, especially on surfaces such as rubber. However, plastic and some stainless steels are quite resistant to corrosion by ozone.[3]

While capital and maintenance costs for ozone systems are generally higher than those of chemical methods, such as chlorine, operation is cheaper, with the only cost being electricity.[4]

Ultraviolet Radiation

Ultraviolet radiation (UV) is a method of disinfecting water, air and surfaces to inactivate microorganisms such as protozoa, bacteria, moulds and yeasts. It is a clean, chemical free process that is effective on a broad range of contaminants. The effectiveness of the system can be increased with the simultaneous use of ozone particularly in water sanitation.[5] UV radiation needs frequent maintenance and replacement of the lamps which can be costly and is not effective in all situations. In addition, there is no residual UV radiation to provide an ongoing sanitation compared with chlorine.

Ultrasound

An emerging technology is the use of ultrasound or sonication to assist in the removal of fats with applications for cleaning as well as treating wastewater. The vibrations loosen the material off hard surfaces making it easier to remove fats from equipment. Similarly, the use of ultrasound in wastewater can emulsify fats, making them easier to remove by treatment methods such as 'dissolved air flotation' (refer to Other treatment options (W9) fact sheet for more information).

Recent research in the United Kingdom found ultrasonic cleaning was a viable method to clean cheese moulds compared to the lengthy soaking in hot detergent solution which disrupts production schedules.[6]

Enzymes

Enzymes speed up specific chemical reactions in mild conditions of temperature and pH and are thus currently limited to unheated surfaces.[7] The advantage of enzyme detergents is that they produce fewer contaminates in the wastewater stream and often require less energy input in the form of heat.[8] An initial clean with low doses of chemicals is often required. Sometimes longer residence time of the enzyme cleaners is required to ensure effective cleaning.

ENZYME USE TO REDUCE CAUSTIC-BASED CLEANERS

Australian dairy processor Murray Goulburn reduced caustic-based cleaners using a combination of enzymes and mild detergents for the cleaning of cold surfaces. Whilst these new cleaners required more frequent rinsing with acid, operators' health and safety has benefited by the reduction in exposure to caustic cleaners. The environment also benefits by reducing caustics in the wastewater stream.

Enzymes may not be suitable for plants using live cultures in their process, such as dairies or breweries and enzymes may impact on wastewater treatment systems that use bacteria as part of the process.

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3 Pascual et al, 2007.
4 Safe and hygienic water treatment in food factories, 2007, Trends in Food Science & Technology 18 S93–S100.
5 EHEDG Update, 2005, "Safe and hygienic water treatment in food factories" Trends in Food Science & Technology 16, 568–573
6 Salo, S. and Wirtenen, G, 2007, Ultrasonic cleaning applications in dairies, www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/0701090103.html
7 Arizona Department of Health Services, 2004, Food Equipment Cleaning and Sanitizing, www.azdhs.gov/phs/oeh/fses/fecs_wcq3.htm
8 Palmowski, L., Baskaran, K., Wilson, H. and Watson, B., October 2005, Deaken University, Clean in Place – A Review of Current Technology and its Use in the Food and Beverage Industry.

Electrolysed Water

Electrolysed water is a product being used more frequently as a sanitizer to increase shelf life and even to improve the health of animals. It is generated from the electrolysis of a brine solution using single phase power. The two electrodes are separated by a membrane producing an alkaline and acidic solution.

The caustic solution, sodium hydroxide, is an effective washing liquid with a pH of approximately 11–13. The acidic solution contains oxidising agents, oxygen and chlorine, which have biocidal properties against bacteria, viruses, protozoa, algae, fungi and spores. These properties are stated to be more effective than sodium hypochlorite at similar concentrations.[9]

Electrolysed water can help to reduce water and chemical costs as it does not require rinsing. There are also workplace, health and safety benefits as only salt and water are required to produce the sanitizer so no hazardous chemicals need to be handled or stored on site.

Unlike ozone, the sodium levels in the solution do increase wastewater total dissolved solid (TDS) levels, which may impact on the site's water reuse options.

In addition, the system will require backwashing due to calcium build up on the membrane from residuals in the mains water. Water treated with membranes such as reverse osmosis could be used as the feed to reduce this impact.

Silver

The use of silver ions as a biocide may be useful as it kills bacteria such as *salmonella* and *E. coli*. It has been found to kill species within 10 minutes of exposure and can be impregnated into cutting boards, surface tiles and sealants.[10]

Potassium substitute

Sodium-based solutions, such as sodium hydroxide (NaOH) commonly used by food processors, is a chemical that contributes to high TDS levels in wastewater streams. TDS levels are difficult to reduce in wastewater and often require energy intensive treatment systems such as reverse osmosis.

If wastewater is to be used for irrigation it can contribute to high salinity and sodicity levels in soils. As more municipal water treatment plants are recycling or reusing water, methods to reduce TDS levels on incoming wastewater are being investigated.

Future tradewaste charges are likely to include TDS levels as part of the wastewater characterisation and are already applied in some parts of Victoria and New South Wales.

An alternative is the direct replacement of sodium with potassium. While more expensive, irrigating with wastewater containing low levels of potassium can provide nutrient benefit to the plants. It does, however, still contain salts, which at high concentrations can have a detrimental impact on soil structure and function.

This series of fact sheets provides examples and suggestions to the modern food processor on how to achieve both economic and environmental benefits from eco-efficiency. Visit the project website www.ecofficiency.com.au for more ideas and case studies.

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9 Envirolyte Industries International Ltd, 2005, Electrochemical Activation (ECA) Technology, Water Purification System of the Future, Tallinn, Estonia.
10 Pehanich, M. 2006, Cleaning without chemicals www.foodprocessing.com/articles/2006/052.html

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