Desinfection of the botlIle neck finiish with ClO_2 treated water

Chlorine dioxide in the beverage industry

The importance of hygiene, particularly with respect to the elimination of micro-organisms, has, since the advent of cold aseptic filling, been a regular topic of discussion in the beverage industry. One option, of increasing popularity, is the use of chlorine dioxide (ClO_2).

Chlorine dioxide is a synthetic, yellowish green gas. In the gas state it is unstable and rapidly decomposes to chlorine and oxygen, with the generation of a certain amount of heat. It does however dissolve readily in water and forms a stable aqueous solution. The instability of ClO_2 gas means that it cannot be produced and shipped in cylinders but must be produced at the location where it is to be used. Despite this seeming disadvantage the advantages of ClO_2 are many. When produced and handled correctly it is an extremely powerful and effective biocide with properties considered superior to chlorine.

Food and beverage industry

In the food and beverage industries a major task is to kill potentially harmful bacteria, or to prevent them from multiplying. Some of the steps taken with this aim in mind are:

- the addition of bactericides where permitted by legislation
- ensuring that the initial level of microbial contamination is as low as possible
- maintaining a low pH level (acidic products)
- high temperature treatment (pasteurisation)
- oxygen-free storage conditions
- reduction of the moisture level such that bacterial growth is not supported.

Even where the water supply into a bottling plant is bacteria-free there is no guarantee that it will remain so. This is a particular consideration where water is recycled within the plant. Tanks and processing machinery are some of the main culprits when it comes to re-infecting clean water, particularly in places where mechanical cleaning and visual checks are very difficult, e.g. inside water pipes and ducts. The use of chlorine dioxide can be a useful tool in the fight against bacterial contamination and bio-film in tanks and pipework. At a concentration of 0.2 ppm is not only effective in inhibiting the multiplication of bacteria, yeasts and spores, but is also within the limits set by, for instance, the German drinking water regulations. In addition, at this concentration level there is, with very few exceptions, no impact on the quality of the beverage.

Produced on-site

A supply of chlorine dioxide sterilising solution is produced on-site at the bottling plant in specially designed, proven and safe installations. It is estimated that in Germany alone there are now some 750 chlorine dioxide plants installed and running, principally in the beverage industry. The ClO_2 is produced from hydrochloric acid and sodium chlorite, which results in chlorine dioxide, sodium chloride (common table salt) and water.

ClO_2 has an oxidative disinfectant action and is also able to combat certain bacteria, spores and viruses that are not attacked by chlorine. Also, unlike chlorine, ClO_2 does not react at all with water. It has a constant efficacy at a pH level between 4 and 10, with the speed of sterilisation being greater at the higher pH levels. The company ProMinent Dosiertechnik of Heidelberg installs complete systems and ensures a supply of high purity ClO_2 from the most suitable quality ingredients.

Applications

ProMinent has been developing the use of ClO_2 in food and beverage applications for over 35 years. It is used in brewing, and in the bottling of soft drinks and wine, principally for the production of sterile water and in bottle washing. Other applications

PET mineral water bottles in the rinser

include CIP, and PET bottle rinsing. In CIP applications it is claimed that ClO_2 can replace almost all other disinfectant media and today whole plants are operated using only ClO_2 as the sterilant. In concentrations of between 0.1 and 0.5 mg/litre the solution inhibits escherichia coli, wild yeast (saccharomyces diastaticus), saccharomyces cerevisiae, lactobacillus brevis and lindneri, pediococcus damnosus, pectinatus, bacillus subtilis, aspergillus niger, and the single celled cryptosporidium parvuum and giardia lamblia. However, at only 0.1 mg/l the bactericidal effect of ClO_2 is hardly strong enough to guarantee a rapid and effective action. It is important therefore that reliable metering and control systems are in place. It is also important to ensure that the water itself does not contain substances such as nitrites and sulphides which tend to weaken the action of the ClO_2 as they are oxidised. In these case a greater concentration level will be required.

Whilst it may be necessary to consider the quality of stainless steel or plastic components used in the construction of ClO_2 installations there are no problems associated with its use to sterilise plastic bottles.

Further detailed information is available from www.prominent.de in German and in English