

## GUIDELINES FOR CHLORINE\* USE IN THE FOOD INDUSTRY

Currently, there is no requirement to register disinfectant products or seek approval for chemical compounds for food industry use. The emphasis lies with the end user to ensure the products are fit for purpose. This may change if the UK adopts the EU Biocidal Products Directive. Until then, Chlorine compounds are widely used in the food industry to kill bacteria and disinfect. Examples include treating pasteurizer cooling water, washing fruit and vegetables and disinfecting food contact surfaces. Prosan Chlorine Tablets are used throughout the world by the catering industry to meet HACCP guidelines which require that all raw non-peelable fruits and vegetables are washed with suitable sanitisers before preparation and consumption.

Chlorine is usually combined with inorganic compounds to produce stable hypochlorite solutions, which are easy to handle and very effective broad spectrum disinfectants.

### Common chlorine sanitiser compounds

Chemical	Synonyms
sodium hypochlorite ~5% active chlorine	hypochlorous acid, sodium oxychloride, bleach
sodium dichloroisocyanurate (Prosan)	Sodium Dichloro -1,3,5 - Triazinetrione Anhydrous. Sodium Dichloro - S - Triazine -2,4,6 1H,3H,5H)-Trione. Trosclosene Sodium. Sodium salt
calcium hypochlorite	calcium oxychloride
chlorine dioxide	chlorine oxide, chlorine peroxide

### Factors effecting chlorine efficacy in the Food Environment

Certain factors can affect the sanitizing (cleaning & disinfection) performance of chlorine compounds. They include the presence of organic material, pH, temperature, concentration, and contact time. When using chlorine as a sanitiser, note the following:

- Presence of organic material** - Organic material such as food residues decreases the effect of chlorine. For proper disinfection, use chlorine on cleaned surfaces only. Make sure you remove all visual traces of organic material residue including fat and protein, before you apply chlorine as a sanitiser. Clean surfaces with a neutral (ionic or non-ionic surfactant – NOT Cationic).
- The pH of a chlorine solution** - The pH level affects the antimicrobial activity. Prosan Tablets in solution have a pH of ca 6.5. The optimum chlorine solution range is 6.0 to 7.0 for optimum antimicrobial activity. At pH values near 4.0, hypochlorite solutions are most effective, but very unstable. At high pH values, the efficacy of chlorine is reduced. (Note: If you are using a highly alkaline cleaner to remove protein and fat residues, rinse the surfaces thoroughly before using a Prosan chlorine solution because high pH residues will reduce the chlorine activity.
- Water Temperature** - Generally, chlorine antimicrobial activity increases with warmer temperatures. Warm (not hot) water also speeds up Prosan tablet dissolution time. However, at very high water temperatures, chlorine compounds may release chlorine gas which will reduce efficacy but at the low concentration of use, highly unlikely to prove toxic.

- d. **Concentration** - Depending on task, a chlorine concentration of 50 to 200 parts per million (ppm) is recommended to disinfect food contact surfaces including utensils, equipment, and work surfaces. One Prosan Chlorine Tablet gives 200ppm available chlorine per litre of water in 5 Litres.
- e. **Contact time** - Solution strength and contact time are directly related. Generally, the higher the solution strength, the less the contact time required to achieve disinfection. The bactericidal activity increases with longer exposure time. If the chlorine solution you are using does not exceed 200 ppm, no rinsing of the surface is required. If using a solution stronger than 200 ppm, rinse the surface with clean water after a few minutes of application. Do not let the chlorine solution stay in contact with equipment for more than 30 minutes. Prosan is non-corrosive to 315 Stainless Steel even after prolonged contact at high concentrations.

## The storage of chlorine

Aqueous chlorine solutions such as commercial household bleaches are not stable and will degrade with age and exposure to heat and light. This means that chlorine may dissipate rapidly, reducing its content and effectiveness. So, chlorine tablets should be used to sanitize in food processing plants, restaurants, etc as these give an accurate dose of chlorine up to 3 years after production if stored correctly and can form a major reference in any "due diligence" issue.

## Preparing a chlorine solution

Hypochlorite Aqueous liquid solutions commonly used in the food industry can be diluted with water until they reach the right concentration desired however an assay must be taken before each dilution to check the concentrated solution strength so that accurate dilutions can be calculated.

### **Example using liquid sodium hypochlorite concentrate:**

*To prepare 100 litres of a 50 ppm solution from a 12.5 per cent sodium hypochlorite (Liquid bleach/NaOCl), the following calculations are needed:*

*Assay the 12.5% sodium hypochlorite concentrate using a titration to ensure the strength of the concentrate. Assuming it is 12.5%, calculate as follows:*

- a. *Final chlorine solution volume= 100 litres = (100,000 millilitres/ml)*
- b. *Final chlorine solution concentration desired = 50 ppm*
- c. *Initial chlorine solution concentration = 12.5% solution = 125,000/1,000,000 which can also be expressed as 125,000 parts per million (ppm) because 1 ppm = 1 ml in 1,000,000 ml*
- d. *Initial chlorine solution volume = Z*
- e. *Initial chlorine solution concentration x Initial chlorine solution volume = Final chlorine solution volume x Final chlorine solution concentration desired*

$$125,000 \text{ ppm} \times Z = 100,000 \text{ ml} \times 50 \text{ ppm} \quad Z = 40 \text{ ml.}$$

*Therefore, to prepare 100 litres of a 50 ppm solution of sodium hypochlorite, dilute 40 ml of a 12.5% sodium hypochlorite solution with water*

**Example using Prosan Chlorine Tablets to prepare the same 100 Litres of Water at 50ppm chlorine using:**

100 Litres Water x 50ppm available chlorine = 5,000 ppm chlorine in total

Each Prosan Tablets gives 1,000 ppm available chlorine per litre water therefore 5 tablets (5 x 1000) in 100L water gives 50 ppm.

## References

<https://www.gov.mb.ca/>

<https://cot.food.gov.uk/>

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

\*All solution references are for Prosan PN501 3.2g (1.77g NaDCC) Chlorine Tablets

**Legal disclaimer:** The above information is offered as a guide only and the operator should satisfy themselves as to the effectiveness of the above guidelines and the suitability for their application. The information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide – no warranty or indemnity is implied.