Disinfection Facts about Hypochlorous Acid

Sourced from Aerosia Interpac, http://www.aerosia.com/popup_article.php

Chlorine – A Great Disinfectant!

There are distinct differences between a Sodium Hypochlorite solution, a Calcium Hypochlorite solution and an onsite generated Hypochlorous Acid solution.

Sodium Hypochlorite Solution (NAOCL)

Sodium Hypochlorite solution (often called bleach and usually containing lye) is manufactured at a factory, stored, shipped to distribution centers, stored again and then sold.

Calcium Hypochlorite Solution (CAOCL)

Dry Calcium Hypochlorite tablets produce a "FRESH" Hypochlorite solution when mixed with water. In tests done, a solution produced with the proper Calcium Hypochlorite tablet, can maintain "Free Available Chlorine" or Hypochlorous Acid (the active disinfectant in this Calcium Hypochlorite solution), for ONLY about 4 hours - then it starts rapidly degrading.

Hypochlorous Acid Solution (HOCL)

Hypochlorous acid is one of the chlorine byproducts that is obtained by dissolving chlorine in water. It is a weak acid. HOCL is the most active ingredient in chlorine solution and its bactericidal effect is 80-100 times more powerful than hypochlorite ion (OCL^-). Only 10-30 ppm of HOCL is enough for use as a bactericide. The bactericidal effect of 10ppm of HOCL solution is equivalent to 100ppm of NaOCl solution.

Free available Chlorine content

For chlorine solution to be a good disinfectant it must meet the chlorine demand. The chlorine demand is the amount of Free Available Chlorine (FAC) often called *Hypochlorous Acid* (HOCl), needed to disinfect or oxidize organic matter before a FAC residual is reached. If the chlorine demand is not met, then complete disinfection has not been obtained. One of the best signs that the chlorine demand has not been met is the strong chlorine odor.

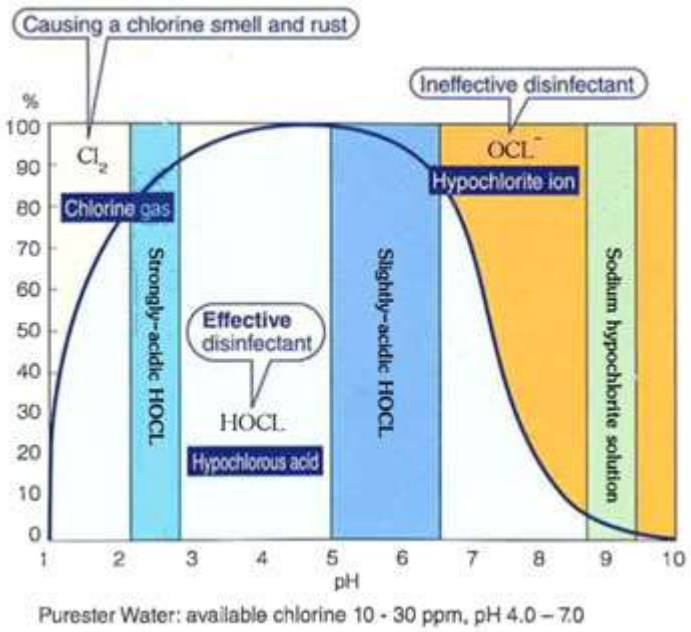
If chlorine solution does not contain enough HOCl to satisfy the chlorine demand of the surface or product to be disinfected, chloramines will form as chlorine and nitrogen-based materials combine. Examples of nitrogen-based materials are proteins and blood. Chloramines are responsible for the obnoxious odor sometimes associated with chlorine disinfection. The obnoxious, pungent, eye-stinging smell of chloramines, mistakenly identified as free chlorine, indicates that the chlorine/water mix is not effective. There is not enough HOCl to satisfy the chlorine demand.

Chlorine Efficacy Determined by pH

Chlorine in water splits into two forms, *Hypochlorous Acid* (HOCl) and *Hypochlorite Ion* (OCl-). How much of each is present in a chlorine solution is totally dependent upon the pH of the solution. As pH rises, less *Hypochlorous Acid* and more *Hypochlorite Ion* is in the solution. As the pH rises, less germ killing power is available. According to a University of Illinois study, HOCl is 120 times more effective as a sanitizer than the -OCl ion. The ideal pH of a disinfecting chlorine solution is a pH of 6-7.

Most FRESH Calcium *Hypochlorite* solutions have a pH between 7 and 8. ALL (fresh or old)
Sodium *Hypochlorite* solutions, ("bleach") have a pH of 10.25+ producing very little HOCL. These solutions produce mainly the OCl- ion, a very poor disinfectant which is from 80 to 120 times less effective as a disinfectant than HOCl, providing that there is any chlorine left in the stock solution.

Slightly Acidic Hypochlorous Acid



Purester Water: available chlorine 10 - 30 ppm, pH 4.0 – 7.0

The above chart explains the "Equilibrium chart on chlorine in solution" and also shows how chlorine exists in solution. Three phases of Cl2, HOCL and OCL- are shown in this chart and its composition changes according to pH value. If pH is 4.0 to 7.0, a lot of HOCL will be formed. Since it is proven that the main disinfecting agent is HOCL, hence it can be used to disinfect effectively although the concentration of chlorine is only 10-30 ppm. On the other hand, sodium hypochlorite solution contains only around 5% of hypochlorous acid; therefore a very high concentration of chlorine of 100 to 200 ppm should be used. The rest 95% is OCL-, whose bactericidal effect is very low, remains unused and will be discarded in wastewater.

Advantages of slightly acidic hypochlorous acid water

1. It contains very low concentration of chlorine and is nearly odorless and has no negative impact on foods.
2. It is very effective to micro-organisms, even to spores.
3. It is very gentle on the environment and also to human beings who handle it.
4. Wide range of applications, food industry, agriculture, medical field etc.
5. It does not contain any toxic substances such as chloroform, chloric acid and bromic acid.

Reference: George Clifford White Handbook of Chlorination and Alternative Disinfectants, 3rd edition, 1999