

Disinfection and Chlorine Facts

Disinfection is a process of killing disease-causing organisms (or pathogens). Chlorine (Cl_2) is a very [desirable](#) disinfectant because, when mixed with pure water, it reacts to form hypochlorous acid (HOCl) and hydrochloric acid (HCl). HOCl (free active chlorine) is the most effective form of chlorine for disinfection.



However, some of the HOCl dissociates to form hydrogen (H^+) and hypochlorite ions (OCl^-).



Chlorine residual is the disinfectant that is left over after substances in water react with chlorine. The more of these substances there are, the more chlorine it takes to react with those substances. As more chlorine is added, more pathogens are killed.

The chlorine that reacts with the substances in the water is known as "combined chlorine." The point at which the initial [chlorine demand](#) is met is called the chlorine breakpoint.

The term "Combined Chlorine" is also used to describe chlorine that has reacted with ammonia or other organic compounds.

When chlorine reacts with ammonia, chloramines are formed.

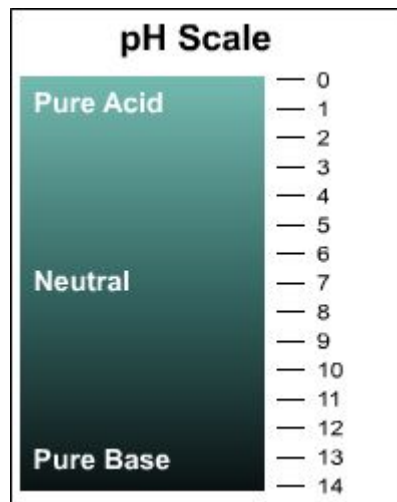
The free chlorine residual and the combined chlorine residual make up the total residual chlorine.

$$\text{Total chlorine} = \text{free chlorine} + \text{combined chlorine}$$

For example, if the free chlorine residual is measured as 1 mg/L and the total chlorine residual as 3 mg/L the difference of 2 mg/L is the combined chlorine residual.

There are several factors that can affect disinfection efficiency. The pH greatly influences disinfection because it influences the [ratio](#) of hypochlorous acid (HOCl) and hypochlorite ions (OCl^-).

Low pH favors the formation of HOCl (the more effective disinfectant), while high pH values favor the formation of OCl^- (the less effective disinfectant).



Besides the pH level of the water, chlorination efficiency is also affected by [temperature](#), [contact time](#), and [chlorine concentration](#).

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