The Chemistry of Swimming Pools

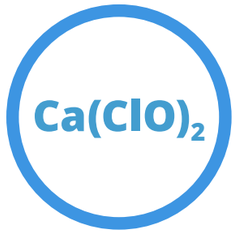
COMPOUND INTEREST

Chlorinating agents

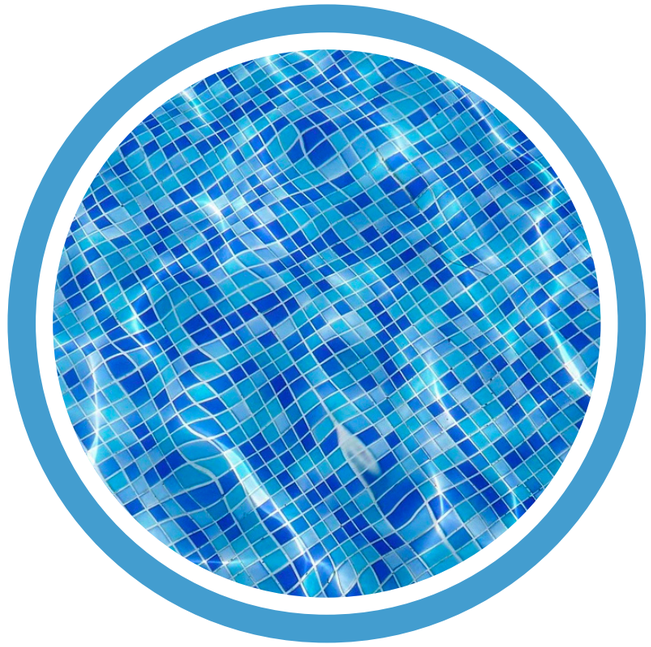
Due to the hazards associated with its storage and use, chlorine gas is rarely used for chlorination of pools. Instead, hypochlorite salts tend to be used. Calcium chloride is also often added to pool water; this prevents calcium sulfate, which is a slightly soluble component of the grouting between tiles in pools, from dissolving. Ozone and UV light are sometimes also used to disinfect pools.

Chlorine

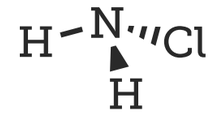
Sodium hypochlorite



Calcium hypochlorite

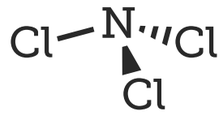


Pee in the pool and chloramines



Monochloroamine

Dichloroamine



Trichloroamine

Ammonia and ammonia-like compounds found in human sweat and urine react with hypochlorous acid, producing chloramines. It is these, not chlorine, that cause the characteristic smell of swimming pools. They can cause wheeziness and sore eyes for some swimmers.

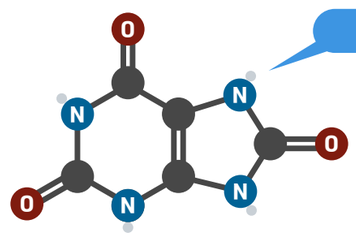
Pool smell

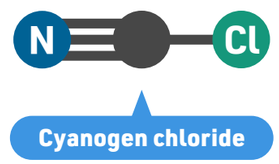
Respiratory effects

Sore eyes

Peeing in the pool produces more trichloroamine, as the uric acid present in urine helps to create it. It also produces small amounts of cyanogen chloride. Chlorine contained in these by-products of chlorination is referred to as 'combined chlorine' (CC).

KEY: Carbon O Oxygen N Nitrogen Cl Chlorine Hydrogen





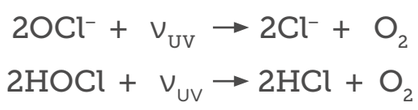
The chemical reactions involved in chlorination

Chlorine and hypochlorite salts both react with water to produce the strong oxidant hypochlorous acid, the major bactericidal agent in pool water. In water, hypochlorous acid exists in equilibrium with the weaker oxidant, the hypochlorite ion. The combined concentration of these chemicals in pool water is referred to as 'free available chlorine' (FAC).

Hypochlorous acid

Hypochlorite ion

Hypochlorite ions are quickly broken down by the UV light present in sunlight and this causes 90% of the FAC loss from outdoor pools. This means that outdoor pools require more frequent chlorination – or the addition of other chemicals to stabilise the FAC levels.



UV light photolysis

Hypochlorite breaks down faster than hypochlorous acid