



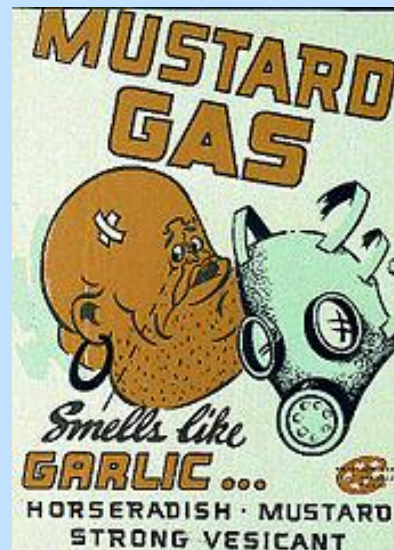
Chlorine

THE RISKS AND BENEFITS OF USE

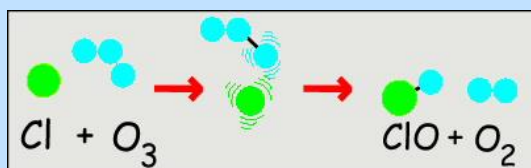
Adam Suttle | Chemistry: Elements from the Sea | 17.02.2017

The risks of chlorine

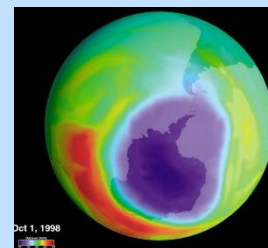
- Chlorine is a toxic gas; in small concentrations, it may that irritates the eyes, lungs and respiratory tract. Concentrations above 40 ppm can cause severe damage to the bodies tissue (respiratory system/mucous membrane/eyes etc.). Chlorine gas, when inhaled, reacts with moisture in the lungs to form hydrochloric acid damaging tissues.
- Chlorine gas has been used in the past as a poisonous gas in warfare. Chemical weapons such as e.g. phosgene gas, COCl_2 , in WW1 and $(\text{Cl}-\text{CH}_2\text{CH}_2)_2\text{S}$, mustard gas.
- Organochlorine compounds are used in pesticides which are associated with pollution of the land.



- Chlorofluorocarbons (CFCs) are used in the manufacture of aerosol sprays, packaging, blowing agents for foams and in old refrigerants. This gases would rise high up into the stratosphere and the chlorine would dissociate from the organic molecule by photodissociation (bonds in the molecules breakdown due to the higher amount of energy received by UV radiation). The chlorine then goes on to react with the natural ozone gas (O_3) to make chlorine monoxide and oxygen. The ozone layer is important as it helps to block harmful high energy wavelengths of electromagnetic radiation from the sun reaching the troposphere/earth surface.
- It may also trigger an asthma attack and the effects of exposure are not always instantaneous but may be delayed for some hours.
- Chlorine is very toxic for the environment, typically aquatic life. It reacts with water to form hydrochloric acid and Hypochlorous acid (HClO). Hypochlorous acid reacts with a wide variety of biomolecules, including DNA, RNA, fatty acid groups, cholesterol and proteins so may harm organic matter.
- Chlorine gas is highly volatile and does not dissolve particularly effectively in water so when warmed, chlorine gas easily escapes.
- Chlorine is transported under a high pressure as a liquid in tankers. IN accidents vast volumes could potentially escape as a gas to the atmosphere (damaging ozone layer).



- Chlorine dissolved in solution escapes easily when exposed to ultraviolet light and so is stabilized using cyanuric acid which greatly reduces the decomposition of hypochlorous acid and so reduces chlorine escaping.



The benefits of chlorine

- Chlorine is very useful in water treatment. When added to water it forms Hypochlorous acid. It is this acid, not chlorine, that gives the water the ability to oxidise and disinfect. It not only eliminates bacteria and algae by disinfecting action (denaturing biomolecules like pathogens), it also oxidizes (chemically destroys) other materials such as dirt and chloramines.
- The use of chlorine in water treatment in the late twentieth century meant that there was a large reduction in deaths from typhoid due to contaminated drinking water.

- Chlorine is reacted with sodium hydroxide to make sodium chlorate (I), NaClO (Bleach). The bleach can be used as a household cleaning product, disinfecting surfaces and removing stains from clothing by breaking bonds in coloured compounds to form colourless products. Bleach is an oxidizing agent.



- The disinfection of drinking water helps prevent (disease-causing) microorganisms that cause such illnesses as typhoid fever, dysentery, cholera, and gastroenteritis. However, at normal dosage rates,, it does not kill all viruses, cysts, or worms. When combined with filtration, chlorination is an excellent way to disinfect drinking water supplies.

- Large amounts of chlorine are used in many industrial processes, such as:
- In the production of paper products (the bleaching of wood pulp to make it appear whiter)

- Plastics (polychloroethene PVC comes in rigid or flexible forms and is used in construction/windows frames/pipes)



- Dyes and textiles (tetrachloroethylene for dry cleaning of fabrics)

- Medicines, antiseptics, insecticides (pesticides such as chlordane a chlorinated cyclic hydrocarbon - paints.

