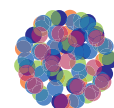


C4 CHLOR-ALKALI

CHLORINE DERIVATIVES

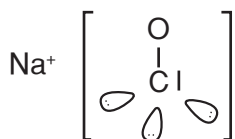


CHEMICAL
INDUSTRIES
RESOURCE PACK

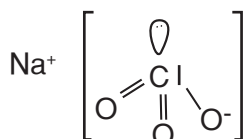
Bleach

Sodium hypochlorite is a chemical compound with the formula NaClO. Sodium hypochlorite solution, commonly known as bleach, is frequently used as a disinfectant or a bleaching agent.

Sodium hypochlorite



Sodium chlorate



Source: Wikimedia Commons

Hypochlorite was first produced in 1789 by Claude Louis Berthollet in his laboratory on the Quay Javel in Paris, France, by passing chlorine gas through a solution of sodium carbonate. The resulting liquid, known as "Eau de Javel" ("Javel water"), was a weak solution of sodium hypochlorite.

The Hooker process is the only large scale industrial method of sodium hypochlorite production. In this process sodium hypochlorite (NaClO) and sodium chloride (NaCl) are formed when chlorine is passed into cold and dilute sodium hydroxide solution. It is prepared industrially by electrolysis with minimal separation between the anode and the cathode. The solution must be kept below 40°C (by cooling coils) to prevent the undesired formation of sodium chlorate.



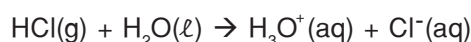
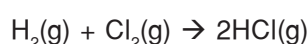
Sodium hydroxide and chlorine are commercially produced by the chlor-alkali process, and there is no need to isolate them to prepare sodium hypochlorite.

Household bleach sold for use in laundering clothes is a 3-6% solution of sodium hypochlorite at the time of manufacture. A 12% solution is widely used in waterworks for the chlorination of water and a 15% solution is more commonly used for disinfection of waste water in treatment plants. High-test hypochlorite (HTH) is sold for chlorination of swimming pools and contains approximately 30% calcium hypochlorite. The crystalline salt is also sold for the same use; this salt usually contains less than 50% of calcium hypochlorite.

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Hydrochloric acid

Hydrochloric acid is amongst the top 25 industrial chemicals produced and used globally and in South Africa. It is used for mineral processing, metal pickling, regenerating water purification systems, and swimming pool neutralisation. Most chlor-alkali plants have a hydrochloric acid production plant on the same site.



hydrogen chloride gas \rightarrow hydrochloric acid (HCl(aq))

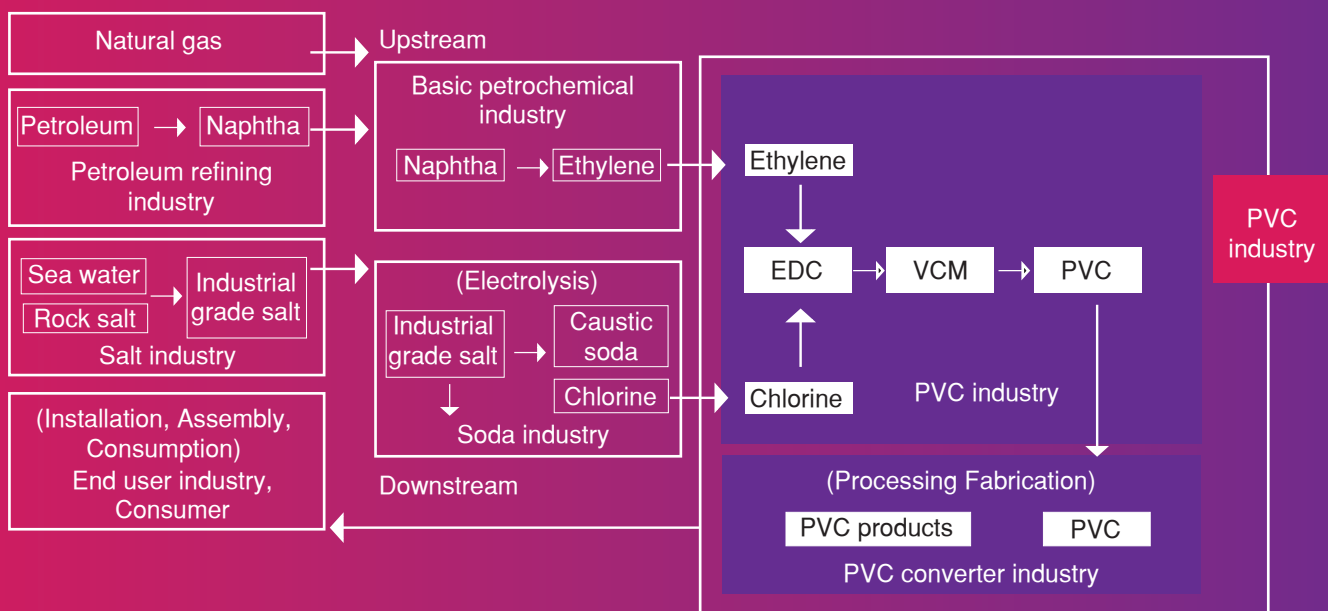
This material was obtained from Sasol Group Services. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: UCT Chemical Engineering Schools Project. 2010. Chemical Industries Resource Pack. Cape Town.



Bottle of hydrochloric acid



Bottle of bleach



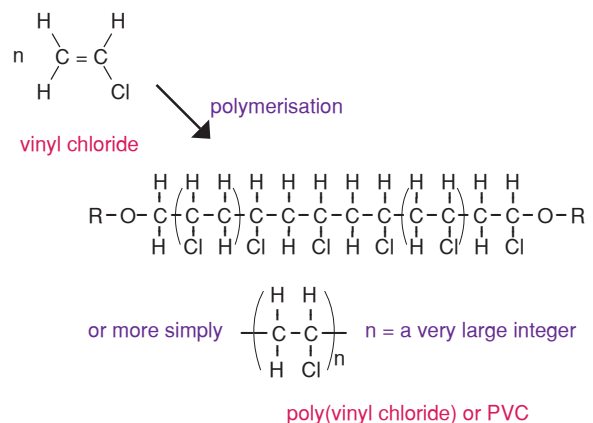
How is PVC made?

The chemical process for making polyvinyl chloride (PVC) involves taking the simplest unit, called the monomer, and linking these monomer molecules together in the polymerisation process. Long molecular chains, called polymers, are formed. This is the case for PVC, which is made from vinyl chloride monomer (known usually by its initials VCM), through polymerisation. Polymers such as PVC, which are manufactured from monomers through polymerisation, are solid and chemically stable substances. VCM is a gas at room temperature but is usually stored in liquid form under pressure. It is also known as chloroethene or ethylene chloride. Ethylene and chlorine are raw materials for PVC. Upstream industries are those that provide these materials. They include producers of basic petrochemicals, which supply ethylene; and the chlor-alkali (caustic soda) industry, which supplies chlorine.

By thermal cracking of naphtha or natural gas, the basic petrochemical industry manufactures ethylene and propylene amongst other products. Naphtha is mainly supplied from the petroleum refinery industry, which uses crude oil as raw material. The chlor-alkali industry produces caustic soda, chlorine and hydrogen via electrolysis using industrial grade salt as main raw material. As a first stage in the PVC production process, ethylene and chlorine are combined to produce an intermediate product called ethylene dichloride; this is then transformed into vinyl chloride, the basic building block of polyvinyl chloride or PVC. The process of 'polymerisation' links together the vinyl chloride molecules to form chains of PVC. Most commodity plastics have carbon and hydrogen as their main component elements. PVC differs by containing chlorine (around 57 per cent by weight), in addition to carbon and hydrogen. The presence of chlorine in the molecule makes PVC particularly versatile because it makes it compatible with a wide range of other

materials. The chlorine content also helps to make PVC flame retardant.

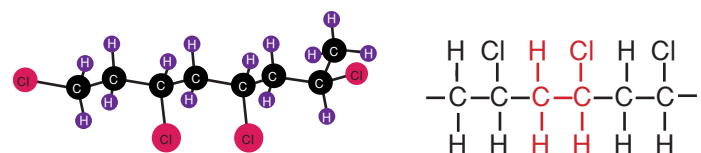
The formation of PVC can be represented with the following equations:



The uses of PVC

As a hard plastic, it is used as vinyl siding, magnetic stripe cards, window profiles, gramophone records (which is the source of the name for vinyl records), pipe, plumbing and conduit fixtures. The material is often used in plastic pressure pipe systems for pipelines in the water and sewer industries because of its inexpensive nature and flexibility. It can be made softer and more flexible by the addition of plasticisers, the most widely used being phthalates. In this form, it is used in clothing and upholstery, and to make flexible hoses and tubing, flooring, roofing membranes, and electrical cable insulation.

The formation of PVC



Different representations of polyvinylchloride or PVC

This material was obtained from www.pvc.org. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: www.pvc.org. 2010. How is PVC made? [Online]. Available: <http://www.pvc.org/What-is-PVC/How-is-PVC-made>. [19 July 2010].