The amazing chlorine universe

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How chlorine contributes to innovative and sustainable solutions in many areas of modern society

You just had a good shower, applied some deodorant and took your daily vitamins. During breakfast you played your favourite CD. You're looking forwards to having a good run in the park to test your newest sports shoes. Some gardening and watering the lawn will follow. What is the common link in all these activities? It's **Chlorine** and its derived products.

Abundant in Nature

The sea is the source of life. Salt – composed of sodium and chlorine – makes up 2.9% of the world's oceans. Salt-rich 'brine' is the main raw material needed to produce chlorine. Less than a third of global salt production comes from seawater, with the majority coming from rock-salt mines.

Normal sea salt or rock salt from salt mines are the raw materials for the production of chlorine

Chlorine is the tenth most abundant of the fifteen elements that make up 99.5% of the human body. Chlorinated compounds are found in our blood, skin, teeth and, as hydrochloric acid, in our digestive system.

Chlorine is one of the most **common elements** in nature; more than 2,300 naturally occurring chlorine compounds have been identified.

Key natural sources of **organochlorines** (compounds based on carbon, chlorine, hydrogen and sometimes other chemical elements) are oceans, forest fires, volcanoes and living organisms including bacteria, fungi, plants and certain marine organisms.

The chlorine industry

Chlorine is produced from three different technologies. Membrane technology now accounts for 61% , followed by the mercury process (23%) and the diaphragm process (14%). The shift away from mercury technology is in line with Europe's regulation to phase out such technology by the end of 2017.

About two thirds of European chlorine production is used for engineering materials – polymers, resins and elastomers. The largest single end use (32.8%) continues to be PVC plastic for (primarily) the construction, automotive, electronic and electrical industries. The well-known polymers polycarbonate (construction material, car lamps etc.) and polyurethane (insulation materials, shoe soles, seats padding etc.) are the second largest family using chlorine chemistry in its synthesis.

Energy used, energy saved

Chlorine is produced by passing electricity through brine. Electricity is used as a raw material and as such cannot be substituted.

The average energy consumption is about 3.4 MWh per tonne of chlorine produced. Electricity represents up half of the cost of production. This makes the chlor-alkali industry an energy-intensive industry.

However, chlorine-based construction materials like polyurethane insulation and PVC products help to save energy and reduce CO_2 emissions, delivering part of the solution to tackling climate change.

There are no direct greenhouse gas emissions in the chlorine manufacturing process, but depending on the fuel used there may be CO_2 emissions related to the generation of electricity.

it's a chlorine thing.

Chlorine and your health

More than 90% of European drinking water is made safe with the help of chlorine, disinfectings right up to your tap. Chlorine plays a key role in controlling pathogens such as typhoid, cholera and in preventing diarrhoea.

Globally, up to 1.6 million children die each year of diarrhoea caused by waterborne microbes (WHO, 2007).

The disinfectant properties of bleach are particularly appreciated in hospitals

PVC plastic made from chlorine is used in 25% of all medical devices. These include blood bags, sterile tubing, (heart) catheters and prosthetics.

Also medicines, including many life-saving drugs, are synthesised using chlorine chemistry.

Chlorine is used in household bleach, disinfectants and antiseptics to combat a wide range of microbes in homes, hospitals, swimming pools, restaurants and other public places.

Chlorine also decontaminates public water supplies that have been damaged by natural disasters, such as floods or earthquakes.

Higher quality of life

Chlorine chemistry is used in home construction for PVC window frames and pipes, insulation, concrete, adhesives, paints and carpets.

Consumer products that depend on chlorine chemistry include toiletries and cosmetics, contact lenses, computers, televisions, DVDs and compact discs.

About half of all crop protection chemicals used to boost yields and food quality are based on chlorine chemistry.

Many leisure activities rely on equipment made using chlorine including soccer balls, tents, waterproof clothing, skateboards, tennis rackets and skis. Automotive components using chlorine include upholstery, bumpers and mats, dashboards, fan and alternator belts, hoses, gaskets and seals.

A sustainable industry

The Euro Chlor sustainability report shows that over the last decade, all relevant plants emissions have been reduced very substantially. Mercury (Hg) emissions have been reduced 98% since 1977. In 1998, the Western European chlorine industry committed to a voluntary emissions target of 1g/tonne/chlorine capacity. Emissions now stand at 0.74g Hg/t chlorine capacity (2014). Eastern European producers have committed to the same target. Mercury-based production of chlor-alkali in Europe has ceased as of 2017.

More than 94% of all chlorine manufactured in Europe is used or converted to other products on the same site limiting it's transportation.

The small amount of chlorine that is moved is mainly transported by rail. There is an increasing strong tendency to place production plants near other processing units.

Much more about chlorine on www.eurochlor.org.

Chlorine chemistry applications: www.chlorinethings.eu

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