

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 play your favourite CD. You're looking forward to have 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 brine is the main raw material to produce chlorine. Less than one third of global salt production stems from seawater, most comes from rock salt mines.



Normal sea salt or rock salt from salt mines are the raw materials for the production of chlorine. They are very abundant in Nature.

Chlorine is the tenth most abundant of the fifteen elements which make up 99.5% of **the human body**. Chlorinated compounds are found in our blood, skin, and 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** (these are compounds based on carbon, chlorine, hydrogen and sometimes other chemical elements) are the oceans, forest fires, volcanoes and living organisms

including bacteria, fungi, plants and certain marine organisms.

THE CHLORINE INDUSTRY

Chlorine is produced with three different technologies. The membrane technology now accounts for 52% followed by the mercury process (31%) and the diaphragm process (14%). The shift towards membrane technology is in line with Euro Chlor's voluntary agreement to phase out the installed mercury capacity by 2020.

About two thirds of European chlorine production is used in engineering materials – polymers, resins and elastomers. The largest single end use (35%) continues to be PVC plastic for primarily the construction, automotive, electronic and electrical industries.

ENERGY USED, ENERGY SAVED

Chlorine is produced by leading 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 to 50% of the cash 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 save energy and reduce CO₂ emissions, delivering part of the solution to the climate change.

There are no direct greenhouse gas emissions in the chlorine manufacturing process, but depending

on the fuel used there are CO₂ emissions related to the generation of electricity.

CHLORINE AND YOUR HEALTH

More than 90% of European drinking water is made safe with the help of chlorine, which disinfects right up to the tap. Chlorine plays a key role in controlling pathogens such as typhoid, cholera and 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 with chlorine is used in 25% of medical devices. These include blood bags, sterile tubing, heart catheters and prosthetics.

Most 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 decontaminates public water supplies damaged by natural disasters, such as flood or earthquakes.

MORE 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 crop protection chemicals used to boost yields and food quality are based on chlorine chemistry.

Many leisure activities rely on equipment made using chlorine: 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

Emissions of chlorinated organic chemicals from production sites to air have been cut by 50% since 2001 and to water by 69%.

Mercury (Hg) emissions have been reduced 97% since 1977. In 1998, the Western European industry committed to a voluntary emissions target of 1g/tonne/chlorine capacity on a national basis by 2007 with no individual plant exceeding 1.5g/t capacity. Emissions now stand at 0.93g Hg/t chlorine capacity (2009). Eastern European producers have committed to the same target.

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

The small amount of chlorine that is moved is mainly transported by rail. There is a strong tendency to place production plants together with other processing units.

Much more on chlorine at www.eurochlor.org.