Chlorine Chemistry:

Contributing to a sustainable future

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Each year, over 9500 kilo tonnes of chlorine are produced in Europe and are used in nearly every branch of the chemical industry as well as in base chemicals for many products we use on a daily basis. Given it's importance in such a diversity of applications, we recognise our social, environmental and economic responsibility in maintaining the planet for future generations.

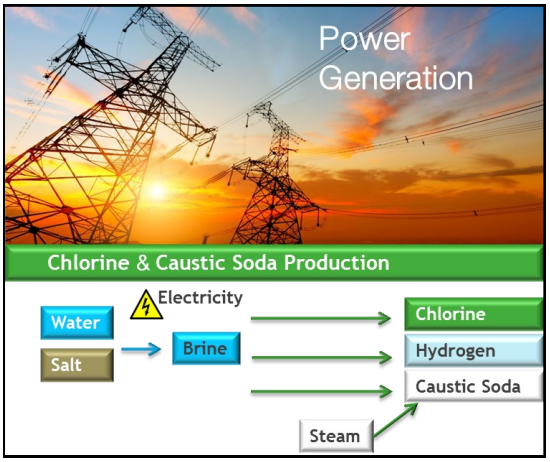
From basic soap production...

The chlorine industry stands as one of the first examples of a truly 'circular economy'. In the 19th century, alkali (or lye) was being produced in large quantities for 'novel' chemicals like soap. Interestingly, the word 'lye' actually comes from an ancient Indo-European word meaning 'to wash'.

...chlorine was a waste...

Originally, lye was produced by treating sodium carbonate with calcium hydroxide but this was then replaced by the Solvay Process, whereby sodium chloride solutions (or brine) were mixed with calcium carbonate (from limestone), however both of these required a lot of mineral raw material. The Solvay process developed into the more efficient, modern chlor-alkali process whereby an electric current is passed through brine leading to sodium hydroxide.

An overview of the production of chlorine, caustic soda and hydrogen



During this early manufacture of lye, 'wastes' such as hydrogen and chlorine were also produced. These wastes were of obvious economic value and as such industries developed in order to use these wastes. This resulted in the industry as we know it today and also led to the enhancement of our modern lifestyles.

...now used in sophisticated PVC materials

Chlorine in particular is used in products from cards to computers, from dyestuffs to detergents, from paints to pharmaceuticals (whereby 85% of pharmaceuticals used today are manufactured using chlorine) and PVC (which is used in window frames, flooring and cables). PVC itself is actually very easy to recycle. Indeed, one firm is currently recycling 800,000T per year, cutting down on the waste disposal requirements.

Some chlorinated additives which produce 0.8kg CO_2 per kg of product beat other additives which can have as much as 2.2kg CO_2 per kg. In Europe, virtually all PVC cable waste is now recycled (around 100,000 tonnes). Some of these 'wastes' also contain plasticisers which do not impede the recycling but actually impart vital flame retardancy features.

What about water?

One of the best-known uses of chlorine is in the provision of safe, clean drinking water. One of the post-2015 UN Sustainable Development Goals (SDG2015) is the provision of clean water and sanitation. Chlorinated water helps people to avoid the often fatal effects of waterborne illnesses such as typhoid and cholera. Whilst other water disinfection methods exist, none are as affordable, proven, long lasting, scalable or measurable as chlorine.

Affordable? Chlorination is generally more affordable than other methods and can be applied with less investment.

Proven? Chlorine based disinfection has been used since the late 1800s to provide drinking water free from a wide-range of bacteria, viruses and parasites.

Long-Lasting? Unlike other forms of water treatment, chlorinated water provides a 'residual' level of disinfectant that prevents microbial regrowth in treated water as it moves through (the often long distance) pipes to the end-users tap.

Scalable? Drinking water chlorination can be applied in a range of water supplies, from domestic to community level treatment of water.

Measurable? People can trust chlorinated waters as they have the ability to detect its presence in water. The 'chlorine residual' is a scientifically verifiable indicator of water quality that can demonstrate drinking water safety (one of the post-2015 SDGs).

In much of the developing world, young girls and women often walk many miles to obtain safe water for their families. Using chlorinated supplies, 'frees' their time to focus on education and employment.

See our Information sheet on chlorine for safe water for more information.

Modern Best Practice Example of Driving a Circular Economy with Chlorinated Solvents

Chlorinated solvents are used amongst others for high precision metal cleaning, for example in the aerospace, automotive or medical industry.

However, despite these products having specific risks, many examples can be found within the industry of how to use these materials in a safe and sustainable way. Once such example is from SAFECHEM Europe GmbH, a subsidiary of The Dow Chemical Company, who has developed a holistic and sustainable risk management concept by applying circular economy principles.

The core of the concept is a closed-loop system for the solvent's lifecycle. Fresh solvent is delivered to the customer and the used solvent is taken-back for recycling. In order to make the application safe and prevent emissions, the solvents are handled, stored and transported in a double-walled 'SAFE-TAINER™' system, a Best Available Technology used in combination with state-of-the-art closed cleaning equipment.

The cleaning machines are constructed in a way so that the solvent is recycled continuously on-site for reuse. If the solvent bath is properly maintained using a wide range of available service elements, the solvent's life span in the machine can be extended significantly.

SAFECHEM also provides test kits to test the solvent quality and comprehensive trainings for the staff to enable process optimization, reduced chemical consumption and waste prevention enabling more efficient solvent use.

Finally, by applying a proprietary monthly Chemical Leasing system, focus changes from volume- to performance-oriented usage. As a result the leasing company has an interest in reducing solvent consumption and increasing efficiency by optimizing the process and quality.

SAFECHEM has received several best-practice recognitions from international organizations. The company is seen as example for eco-innovation and resource efficiency. It stands as one of many great chlor-alkali industry cases of efficient chemical usage of chlorinated chemicals and a practical model on how to implement a circular-economic way of working.

More information at www.safechem-europe.com and www.chemaware.org.

Much more about chlorine at **www.eurochlor.org**

Chlorine chemistry applications: **www.chlorinethings.eu**

Euro Chlor Communications
Rue Belliard 40 (box 15)
B—1040 Brussels
Tel. +32.2.436.9502
eurochlor@cefic.be

A Sector Group of cefic