C12 CHLOR-ALKALI

ENVIRONMENTAL ISSUES

CHEMICAL INDUSTRIES
RESOURCE PACK

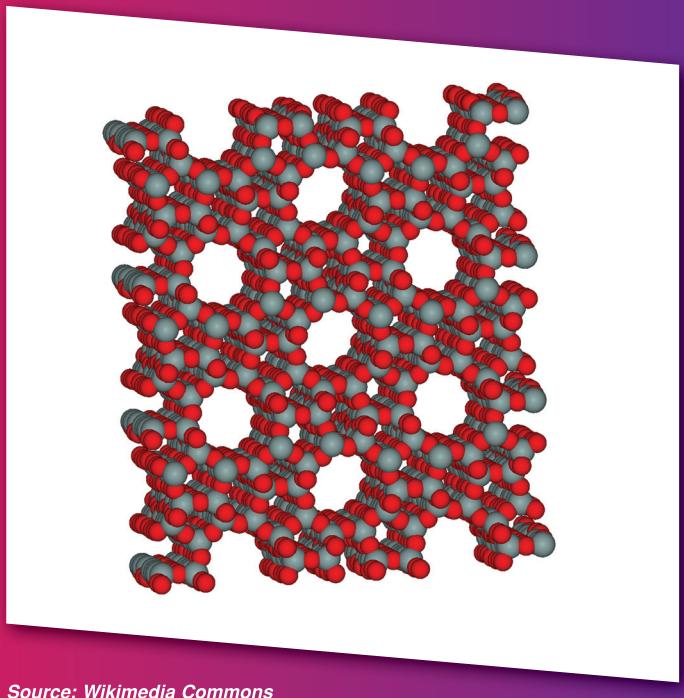
Detergent making a mess?

In recent years, the laundry detergent industry has been faced with two environmental challenges, both of which seem to have been dealt with successfully. Environmentalists were concerned that phosphate builders added large amounts of phosphorus compounds to the nation's waterways. Acting as a fertiliser, the phosphorus stimulated the growth of algae, and these unnaturally large crops of algae significantly depleted the amount of dissolved oxygen in water. This decrease in free oxygen harmed other marine life, thus threatening to disrupt normal ecological patterns.

This problem, and the environmental pressure and legislation it prompted in the late 1960s, led manufacturers to develop effective builders that did not contain phosphates. Today, detergents sold in many countries are phosphate-free. Although this adjustment did not entail a change in the manufacturing process, it did require a research effort to devise a satisfactory alternative that took several months. An earlier environmental problem was that of excess detergent foam appearing in the nation's waterways. In the early 1950s, when home use of washing machines and laundry detergents grew at an explosive rate, there were several instances of large amounts of foam appearing in rivers and streams, although detergent may not have been the only cause of the foaming. Over a period of five years, from 1951 to 1956, it was found that a common surfactant, ABS (alkyl benzene sulphonate), the detergent ingredient that contributed to foaming, was responsible. ABS's complex molecular structure did not biodegrade rapidly enough to keep it from foaming once washing water was discharged. A proven replacement was not immediately available. Beginning in 1956, however, manufacturers replaced ABS with LAS (linear alkylate sulfonate), which biodegrades rapidly, and since that time, LAS has been the primary foaming agent in detergents.

This material was obtained from www.madehow.com. 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.madehow.com. 2010. Laundry Detergent. [Online]. Available http://www.madehow.com/Volume-1/Laundry-Detergent.html. [19 July 2010].

A model of a zeolite



Source: Wikimedia Commons

Environmental impact of synthetic detergents

The first soapless detergents caused pollution problems because they could not be broken down by bacteria. The foam they created caused pollution in rivers and streams. We now have biodegradable detergents that can be broken down by bacteria. Detergents that contain phosphates still create pollution problems. When the phosphates enter streams and rivers they act as fertilisers and water plants grow rapidly. When the plants die, bacteria in the rivers feed on them and use up all the oxygen in the water. Fish and other animals die from lack of oxygen. This process is called eutrophication.

Trends in world markets in respect of laundry detergent formulations have focused on (a) the volume of surfactant in the formulation, (b) environmental pressures on phosphate builders, and (c) the use of bleaches. In the Northern Hemisphere, there has been a move to liquid and super concentrated laundry detergents leading to changes in the surfactant, bleach, filler and enzyme concentrations in formulations. However, in developing countries, where product price is a major factor, there has been a more gradual decline in the consumption of phosphate builders, such as sodium tripolyphosphate, and a slower crossover to zeolite-built formulations.

This material was obtained from the 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.

Getting the balance right

The key to any understanding of the chlor-alkali industry, either in Europe or any other region, is an understanding of the inseparable production of caustic soda and chlorine in approximately equal volumes. Electrolysis of common salt (sodium chloride) or brine solution accounts for in excess of 99% of all production of caustic soda and chlorine. While supplies of chlorine and caustic soda are in approximately equal quantities, the end-use profiles of demand for chlorine and caustic soda are quite different. Thus, as economic cycles influence chemical demand, with different industries experiencing up-cycles and down-cycles at different points in the general economic cycle, demand for chlorine and caustic soda are rarely balanced.

Normally, one of the products is in greater demand than the other. Furthermore, chlorine gas cannot be readily stored in large volumes, whereas substantial inventories of caustic soda can be held at any one time. This feature also affects the chlorine and caustic soda supply-demand balance.

Production of either chlorine or caustic soda is always limited by demand for and ability to store the other. Pricing of each of the two materials is heavily influenced by whether chlorine or caustic soda is in greatest demand at any one time.

Any contraction in chlorine production would eventually impact on PVC manufacture, since chlorine cannot be transported over large distances. This would also have a knock-on effect on hydrochloric acid availability as a by product from some chlorination processes.

DID YOU KNOW?

The demand for chlorine did not equal the demand for sodium hydroxide until the 1970s!

This material was obtained from an article by Stephen Harriman on www.icis.com. 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: Harriman, S. 2002. Getting the balance right. [Online]. Available: http://www.icis.com/Articles/2002/10/04/181939/getting-the-balance-right.html.[19 July 2010].

Minamata mercury poisoning

A major factor in the development of the membrane process was the so-called Minamata incident where mercury organic compounds that were discharged into the sea entered the food chain. The mercury then poisoned the people via the fish they consumed leading to several deaths among the population of a small Japanese village. The Minamata incident sparked a ban on processes utilising mercury or mercury compounds in Japan. This forced the chlor-alkali chemical industry in Japan to phase out the mercury process for chlorine production. The last chlorine plant based on the mercury process in Japan was closed in 1984.

This material was obtained from Wikipedia. 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: Wikipedia. 2010. Minamata disease. [Online] Available: http://en.wikipedia.org/wiki/Minamata _ disease [19 July 2010].

Chlorine as a weapon

"It was Thursday evening, April 22nd, 1915. Towards evening, at around 5 pm, the bombardment began afresh - except that sentries posted among the French and Algerian troops noticed a curious yellow-green cloud drifting slowly towards their line. This was the first use of chlorine gas on the battlefield. The effects of chlorine gas were severe. Within seconds of inhaling its vapour it destroyed the victim's respiratory organs, bringing on choking attacks."

"Plainly something terrible was happening. What was it? Officers, and Staff officers too, stood gazing at the scene, awestruck and dumbfounded; for in the northerly breeze there came a pungent nauseating smell that tickled the throat and made our eyes smart. The horses and men were still pouring down the road, two or three men on a horse, I saw, while over the fields streamed mobs of infantry, the dusky warriors of French Africa; away went their rifles, equipment, even their tunics that they might run the faster.

One man came stumbling through our lines. He was frothing at the mouth, his eyes started from their sockets, and he fell writhing at the officer's feet."

This article was adapted from a memoir from www.firstworldwar.com. 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: Hossack, A. R. 1930. Everyman at War. [Online]. Available http://www.firstworldwar.com/diaries/firstgasattack.htm. [19 July 2010].