

Hexavalent Chromium

As due diligence to you, our potential customer, we have explained here why we have hazardous waste stickers on our products, on the reservoir. Read the links if you wish to read further information.

A by-product of electrolysis of water with stainless steel electrodes can be hexavalent chromium compounds. These compounds are reported as being hazardous to health and care needs to be taken to eliminate exposure when dealing with used electrolyte solutions, ie the water solution in the reservoir after the Hydrogen Generator has been in use.

A Hydrogen Generator produces hydrogen gas from the electrolysis of water, using a catalyst and stainless steel electrodes. There are many other industrial processes using or producing hexavalent chromium compounds (CrVI);

for example

for rust removal

<http://www.locostbuilders.co.uk/viewthread.php?fid=7&tid=9158&action=printable>

<http://www.sciencemadness.org/talk/viewthread.php?tid=6099>

for stainless steel production, chromium plating

<http://www.fas.org/sgp/othergov/doe/lanl/pubs/00818050.pdf>

also used in the manufacture of photographic films, flavours, essential oils, saccharin, pharmaceuticals, pyrotechnics, explosives, safety matches, chrome glues and adhesives, wood stains, poison fly paper, process engraving and lithography, synthetic perfumes, chrome alum manufacture, alloys, ceramic products, depolarizers in dry cell batteries, bleaching fats and waxes.

http://www.primaryinfo.com/sodium_dichromate.htm

electrolysis of water using stainless steel electrodes is a school experiment

<http://pubs.acs.org/doi/abs/10.1021/ed072p912#citing>

Sodium dichromate (a CrVI compound) is available to buy from

<http://www.sciencelab.com/page/S/PVAR/SLS4465>

Studies have shown that repeated and long term exposure to CrVI compounds increases the risk of skin problems and repeated, long term inhalation of fumes increases the risk of possible lung cancer. Users of small hydrogen generators are not exposed to levels that apparently should cause this level of concern. The studies have been performed on those who work closely with chromium compounds as a daily industrial job over a long period. The toxicity of CrVI compounds was brought to the public attention with the release in 2000 of the real life story film Erin Brockovich, where a Californian Power company were taken to court for allowing CrVI into the drinking water.

Symptoms after extreme, prolonged exposure include

- Inhalation can lead to irritation of the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum
- ingesting large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, death
- skin contact with certain chromium compounds can cause skin ulcers. Some people are extremely sensitive to chromium or chromium (III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

See also http://oehha.ca.gov/air/chronic_rels/pdf/hexChroms.pdf

Or <http://www.natscience.com/Uwe/Forum.aspx/chem/918/Hexavalent-Chromium-concerns-re-electrolysis>

With stainless steel electrodes if you are concerned about CrVI in the used electrolyte; there are 2 options when disposing of or handling the solution.

The used electrolyte solution can be tested for CrVI, test kits available from

www.camlab.co.uk

Any CrVI present can be reduced to the relatively harmless CrIII with ferrous sulphate

http://www.era-test.lib.ed.ac.uk/bitstream/123456789/672/2/Farmer_1.pdf

Our recommendation is that the used solution be disposed of at your local hazardous waste site, contact your county council for details in your area. It can be disposed of either as a solution from the reservoir, or it can be left to evaporate to leave a yellowish powder that can also be taken to the hazardous waste site. Up to 5 litres a day/visit of these wastes can be accepted from householders at the permanent Recycling Centres only, where measures to handle and store such wastes are in place. Those that we have contacted have said there is no charge for this disposal.

When handling the used electrolyte solution the following precautions must be taken

Wear gloves to avoid skin contact

Ensure adequate ventilation and wear a mask

Do not swallow

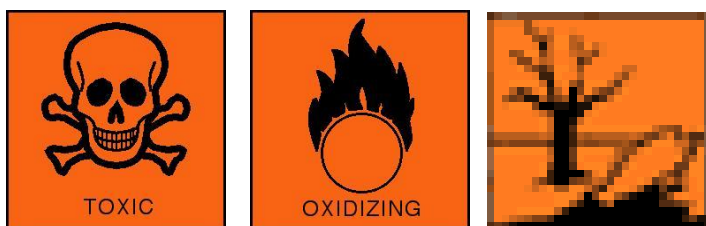
In case of emergency

Eye contact: Immediately flush the eye with water. If irritation persists, call for medical help.

Skin contact: Wash off with soap and water.

If swallowed: Call for immediate medical help.

The above references show that hydrogen generators with stainless steel electrodes produce toxic CrVI compounds. From our own analysis the amount in the used electrolyte solution is low (at 50µg/litre) and unlikely to cause any health problems unless large quantities are ingested or inhaled over long periods. Many people in other circumstances are being exposed to greater levels on a more regular basis. By taking adequate precautions and heeding the warning labels any exposure should be nonexistent. In normal use the used electrolyte solution is rarely removed from the reservoir anyway. We offer a cleaning service in our workshops if you wish us to dispose of the used electrolyte.



Report prepared for Hydrogen Cars Ltd 2011

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