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The F-I-T opinion on using Stainless Steel for electrodes in electrolysis tanks:

There are two types of Chromium compounds that are yielded from the reduction of stainless alloys in this electrolytic process: Trivalent Chrome and Hexavalent Chrome, also known as Cr(III) and Cr(VI). Cr(VI) is toxic, and as such requires certain handling if it is held in significant quantity. This is the key. Arsenic for example is a naturally occurring element, and it must be controlled if you have a significant amount of it, but if the quantity or concentration is small (some is present in most drinking water in incredibly small amounts), it is of no consequence.

While it is true that the electrochemical reduction of stainless steel alloys can produce some Cr (VI) (Hexavalent Chrome), it is important to remember that not all Cr in the alloy becomes Cr(VI). Most remains the less toxic Cr(III). Cr(VI) will only be produced in quantity if you use an extremely hot reaction (mine stays at ambient plus 10 *F or less at all times) or in the presence of atmospheric Oxygen (not present in an aqueous solution). In an aqueous solution, very little Cr(VI) will be produced, (I have had the electrolyte from my bath tested by an environmental laboratory, and the level of Cr(VI) is virtually undetectable).

The quantity of Cr(VI) is no doubt a concern, but so is the soluble lead from the paint you are removing along with the conversion of the Fe₂O₃ to Fe₃O₄, so proper handling of this and other shop waste is always important. The quantity of Cr(VI) is what you need to determine, so that you can then adequately compare this to the CERCLA and RCRA reportable quantities as published by EPA. As of today, the reportable quantity of DIRECT release to the environment on an ANNUAL basis is 1 pound of Cr(VI) per CERCLA, RCRA, and SARA Title III. This is for non-determined Chrome compounds. This number can go as high as 1,000 pounds annually with proper analytical documentation. You can increase this amount even more with increased handling documentation. For instance, I contain my electrolyte, and only add to it, so there is no release. But, if we take this one pound and compute that the Cr(VI) component of the waste sludge is 5% of an original 18% (a very high percentage of chrome) of the Chrome by weight present in the original stainless steel, I would have to digest and then pour into the ground water, the equivalent of 111.11 pounds of electrodes PER YEAR, and I will not digest that much stainless steel in my lifetime. This is why I feel that the continuing statements from some authors that any and all electrolysis baths that use stainless steel as sacrificial anodes are creating hazardous waste that needs to be handled, transported, and processed and by a hazardous material hauler is alarmist.

Also important to remember is that the carcinogenic attribute of Cr(VI) is given as inhaled, as other contact studies have been deemed to be inclusive. In this electrolysis process it is difficult if not impossible to inhale the non-boiling electrolyte. You must not compare the release of Cr(VI) in this electrolysis process with that that takes place in the Chrome electroplating process using Chromic Acid. The amount of fuming and airborne Cr(VI) in that process is exponentially higher than from this mild form of electrolysis.

Many folks read or hear from someone that didn't really know in the first place that Cr(VI) is dangerous, and began to assume that Cr(III) or Cr(VI) in any amount is a concern. While it is true that Cr(VI) is dangerous enough as to dictate proper control in certain quantities, it is also true of many household chemicals such as Chlorine Bleach, paint remover, brake cleaner, MEK, lead paint dust sanded from old tractors, gasoline, lacquer thinner, Stoddard Solvent, all old crankcase products, and many, many more.

Many people are eager to leap to a conclusion that is not supported by regulations or good science. It is important to understand that the EPA regards hazardous as relative to the particular process you are using, and the specific chemical compounds released over a given period of time. Again, for example, Arsenic is a poison, but it also naturally occurring. If you concentrate it, it can be harmful. But once you understand the minimum or Rf (Reference dosage) limits as published by EPA, you should be able to see that only an amount exceeding that specified over a given period of time will determine ultimate toxicity. Reference: 40 CFR, Table 302-4, page 293 and 334 for Chromium Compounds.

I have operated electrolytic processes on and off for over 30 years. I have served as a line supervisor, process engineer, materials manager, manager of technical services, and environmental officer for a jet engine component manufacturing facility for 26 of those 30 years, so I feel that I have more than a little

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experience, but there is always someone who can teach me more. Any way, we used an electrochemical machining process on stainless alloys including Inconel 718 and AMS 5616. I was in charge of disposing of the filter cake precipitated from the electrolyte, and I never failed a Cr(VI) filter cake analysis over all those years, yet we were digesting over ten tons of stainless steel per month.

I also have a degree and an industrial background in Chemistry, and it has served me well in understanding this process as well as the pertinent environmental regulations. I feel confident that I am observing care well within prescribed guidelines, and I base this on regulatory facts and science, and not internet conjecture, but I invite anyone out there to develop their own opinion as to how they manage their personal electrolysis tanks. It is after all, your responsibility.

Some people mentioned their concern about using Lye, a.k.a. Caustic Soda, chemically named Sodium Hydroxide because it is, well, caustic. As far as my choice of using Sodium Hydroxide as an electrolyte, if used properly, I am confident that there is no concern. At the rate of one tablespoon per gallon, it is less than .1 Molar, yet I find that a small amount will help to emulsify fats, oils, and grease, and increase the efficiency of the reaction while held at or slightly above ambient temperature.

So, in conclusion, if you have any reservations about using stainless steel electrodes in your electrolysis tank, then don't. Common steel or cast iron will work fine, but will require very frequent cleaning to maintain good current flow. Also, if you have any concerns about how to handle the electrolyte (which if filtered from time to time through cheese cloth to extract the junk and leaves and pieces of gasket and sheets of peeling paint, can be used forever) then set it to the side to evaporate and put the powder residue that is left in a can for a future hazardous waste clean up day. By the way, you should also be doing this with all of your household hazardous waste like car batteries, flashlight batteries, laptop batteries, spent paint remover, motor oil, antifreeze, computers, rat baits, old leaded paint containers, pesticide containers, toilet bowl cleaners, brake fluids, oil based paint containers, etc. I bet there is whole lot of decaying Ni-Cad and Alkaline flashlight batteries rotting in the city dump ready to contaminate the ground water than there is Cr(VI) powder swept up from the last time every mechanic in town cleaned out his electrolysis tank.

If you want to be a good steward to the environment, you need to be one all the time.

Anyway, enjoy the process and be careful as it involves electricity and fluid in a highly conductive state. And if you are the least bit concerned about the mysteries of Cr(VI), just use some steel fence posts, but be prepared to clean them at least once a day.