

Kudo's to your insight!

Corrosion

A major factor in water chemistry from nuclear power plants and stainless steel to water chemistry constituents, and microbiology.

Did you know 4 mils of metal loss a year on mild steel is classified as non-corrosive?

Did you know sulfate reducing bacteria, also known as black layer in soils, can create nodules on metals and corrode mild steel at the rate of ¼ over 10 years?

That same bacteria can invade the intergranular carbon on stainless steel and cause pitting corrosion failure? It happened at the TVA Nuclear Power Plant.

Coca-Cola is corrosive, so are lemons. Pool acid is corrosive, you swim in it diluted in water, it's in your ear drops, eye drops, and also in your stomach, but at levels that are either so low, they are not so corrosive, it they are inhibited to prevent their corrosion.

So pH of zero is corrosive? Not necessarily the case when I can have a solution of zero that will not dissolve scale, or burn your skin, or eat a hole in your stomach. pH of sulfuric acid will do all of that, even at a higher pH - cause damage! Inhibited pool acid, will too, unless you know how to inhibit it. The fumes of any acid are hard to "inhibit", sorta like acid reflux in humans, that acid gets up in the airways and yikes, it's bad.

pH is not corrosion! pH is a measurement of the hydrogen ion concentration, and conventionally used to imply corrosion, imply the ability of a solution to dissolve scale. But the solution has to be right, it can't be saturated, it can't be biologically compromised. Things like biofilms can block acid, just like epoxy coatings, fiberglass, glass and polymers – including chemical inhibitors, like what your body does as well.

Corrosion is the "ionization potential" – the ability to convert something to an ion, like steel to rust, or stripping galvanization or chrome. Like deionized or ultrapure water to normal metal piping.

Every situation is a different set of criteria for corrosion. There is also generalized (uniform) corrosion, pitting corrosion galvanic corrosion (different metals attached to each other).

So it all begins with a substrate, that over time slowly degrades exposed to various forms of potential corrosion (a steel light pole buried in the ground, pipes and canals run across the country through hot spots of soils which are the saturated with zinc and watered regularly to minimize the corrosion), eventually leaks occur and the last person to use the equipment is the culprit. That's usually how it goes.

The monitoring of corrosion is an ASTM Standard – corrosion is a business in its own with an organization named NACE, the National Association of Corrosion Engineers. There is such a device called a corrosion coupon rack, by ASTM design and specifications, that is used to track and measure corrosion of defined alloys and processes.

Being that we use a very "corrosive" acid, a VERY powerful acid, very fummy, yet chemically modified to even more effective, technically non-corrosive, and it can get on your skin, and be left there all day without damage. But how does that relate to its perceived impact on various alloys like zinc, galvanization, 416 stainless steel versus 303 or 316 stainless steel, copper/nickel alloy like us US war ships, copper, etc.? Zinc, super soluble in acid, so is 416 stainless steel.



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Pure water is very corrosive. The more hardness the less corrosive. The corrosion can be implied using the Langelier Saturation Index (LSI), and or the Rizner and Pukorius Indexes. Municipalities use LSI nowadays, where HCT latched onto it many years ago.

From a water perspective, reclaim water is even less corrosive as it has buffering constituents in the water, yet constantly exposed to alloys, the reclaim biology can set in and cause pitting corrosion.

Where corrosion is most prevalent is by several mechanisms;

1. Under-deposit microbial corrosion
2. Under-deposit galvanic corrosion
3. Deposit galvanic corrosion
4. Sulfate Reducing Bacteria Corrosion (exudates of sulfurous acid, centralized and localized)
5. General corrosion
6. Erosion corrosion from insolubles scarifying (complexed physical matter)
7. Pitting corrosion, usually into the granular structure of alloys, including various stainless alloys (especially 416 stainless)
8. Galvanic corrosion (from differing ionization potential of alloys joined by some conduit, i.e. water, or within soils where there are current or soil deficiencies.

Most substances subject to chemical corrosion made of metals, exposed to oxidation, air, water and or moisture, that gradually "rust", oxidize, gradually returning to their elemental state. We call the cycle – everything seeking equilibrium. An epoxy coating stops that process from the outside. But between the coating and alloy, if the alloy is not conditioned, it can corrode from within. (T Eden US Patent – Chloride Corrosion Mitigation)

We address all of these factors with our chemistry. We do tons of laboratory research studies, we do failure analysis consultation, we are scrutinized in this this area of which carries a lot of liability when we applying chemistry to a system on its last leg, whereby removing the corrosion yields leaks.

This web page has a great video about the corrosivity of chlorine. Who would have thought!
<https://www.hctlc.com/copy-of-disinfection-versus-bioreme>

This web page has data on a corrosion study/comparison;
<https://www.hctlc.com/stop-sulfuricacid>

and; <https://www.youtube.com/watch?v=3GHBXHwpj00>

Our conditions of sale regarding corrosion;
<https://www.hctlc.com/conditions-of-sale>

Attached is a recent image of sulfuric versus our Curative acid, after descaling sea shells and soaking for a week. The top is our chemistry, the bottom is sulfuric acid.

What's the answer, solution?

1. Whether you are the owner of the equipment or not, corrosion can be very costly. Alleviate any risk, the potential loss is, even if documented not to be your fault, can cost time and resources, of which you cannot replace.
2. Apply product through product qualified equipment. For example, pivots. The pivot companies sell galvanization services, they also now produce runner lined piping. Why not inject the chemistry through inexpensive secondary tubing to alleviate the chemistry from going through the pivot.
3. Blending fertilizers with the alkalinity reduction chemistry, the running it through the lines.
4. Topical application to the vegetation or soil – the chemical reaction is complete, so it works, even better than alternative chemistry. But, plants do better with constant hydration and available nutrition so any slug feeding might stress crop productivity.
5. pH and ORP – pH is one measurement, where ORP measure the ionization potential. Any pH under 6.5 to 6.8 would be considered negatively, ORP greater than 250 to 300 +mV would be considered

the same. We can apply the Curative effectively at pH values of 7.0 and above and make significant achievements. However, you want to document those pH and ORP readings to assure you've mitigated any concerns.

6. All decisions should be in alignment with the asset owner.

Sulfuric acid after descaling everything it could,
Soaking on mild steel coupon for about 1 week.

HCT's coupon top

Sulfuric acid coupon below, same conditions



Clearer view of the sulfuric acid coupon
(both coupons mild steel C1010 alloy)



Our Hand-in-acid image.

Zero pH, 30% vol., 32% hydrochloric acid, 70% water, dissolving shells
And calcite crystals.

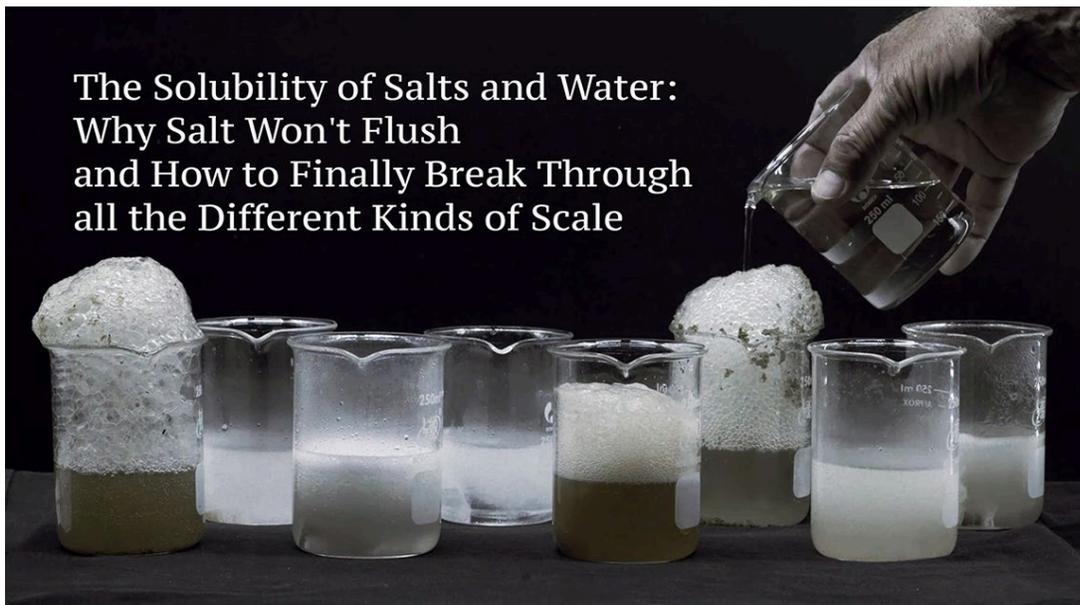


Galvanized coupons exposed to the acid. Rusting disposition about 7 weeks later



SOILS: Just so you know, clean water, even rain, does not remediate soils, does not break down minerals and metals bound by bicarbonate, valence and chlorides, except for sodium, the toxin, and zinc.

The flush of growth is from rain is from oxygen, water and nitrogen, days later followed by vegetation from the uptake of sodium. The last, if ever to be up taken are Ca, Fe, and K – p tends to make it!



We do all sorts of research. See our YouTube page as well.

