Pollution Prevention P2
Eliminate Acid Disposal - It's Environmental - It's Profitable

Imagine - - -
Never Disposing Of An Acid Bath Again

John C. Wagner, Ph. D. Chemistry
February 12, 1923 - May 2, 1997

As unbelievable as it might seem, it is true; Galvanizers, Anodizers, Electroplaters, all metal finishers can use their existing acids indefinitely.

Acid waste and disposal is eliminated. Productivity stabilizes and current operating costs become savings captured as profits.

How is this possible?

Look to inorganic chemistry and the life's work of an innovative chemist, Dr. John C. Wagner.

Visiting the Petrified Forest as young boy, little Johnny Wagner held a piece of rock that had once been wood and asked the question everyone asks, ***"How did this piece of wood become stone?"*** As a young man and a chemist, Dr. Wagner asked the same question. Now with a chemist's curiosity of how wood might petrify, he asked, ***"How does something organic, become inorganic?"***

Intrigued by the fact that a chemical reaction provided by "Mother Nature" could turn wood, an organic material, into stone, an inorganic material, Dr. Wagner was certain the process could be duplicated by science. This became the basis for a lifetime of R& D, invention, innovation and solutions which suggests science may only have half of the answers when looking at Organic Chemistry.

Organic - Inorganic Chemistry

The other half of the answers are found in Inorganic Chemistry. Most research to date has focused on organic chemistry, while very little attention has been devoted to inorganic chemistry. Why is this? It is because our technologies are organic based. Petroleum, the current father of energy, plastics, textiles, asphalt, etc., is organic. All pathogens, bacteria, fungus, mold, and most identified virus are organic in nature. So science looks for organic solutions to organic problems. The pollutants industry releases into the land, air and water, are largely organic. Most chemical toxins and pollutants have no real solution for a safe long term clean up. That is, if one looks at traditional approaches for these issues.

What is so different about inorganic chemistry? Organic substance, stated simply, is anything derived from a living organism and measures below 7 pH, as acid. Inorganic substance measures above 7 pH, as alkaline. Since the earth is basically inorganic, it breaks down organic

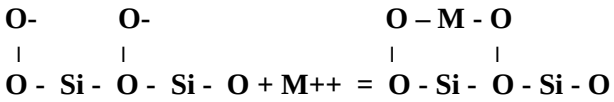
substance and over time destroys it. Nature always prevails. Eventually, organic substance degenerates into inorganic and inorganic generates into organic. This is the ongoing life and death cycle of elements.

Dr. Wagner's explorations into this application of chemistry lead him to the relatively new science of Catalytic Chemistry. In a major scientific breakthrough, Dr. Wagner formulated a proprietary catalyzed reagent which seems to cause a chain reaction which promotes the degradation of organic materials into inorganic.

The first proof of this success is the fact that the process of petrifaction can be repeatedly assimilating under laboratory conditions. This change takes place in minutes instead of the hundreds of thousands of years required by nature. From this breakthrough, Dr. Wagner developed a series of chemistries activated by catalyzed reagents. A natural progression in his research and product development, was the experimentation with reactions of various catalyst and inorganic materials.

Catalyzed Reagent Process

The Catalyzed Reagent Process, is a proprietary blend of soluble silicates, which allows for effective immobilization of soluble metals by reacting with them to form metal silicates. Silicon is a member of the carbon family and like carbon can form polymers. These polymers are a unique class of compounds in which sodium Oxide (Na_2O) is associated with silicon dioxide (SiO_2) generally in ranges varying from 1:1 to 1:3.22. In dilute solutions, these compounds depolymerize to form chains of silica and oxygen With negative charges on some oxygen, reaction occurs with metal ions having positive charges to form stable, insoluble metal silicates:



The ingredients in the catalyzed reagents will also react with volatile and non-volatile organic compounds producing a non-volatile, non-toxic, non-hazardous waste. The carbon dioxide (CO_2) formed reacts with the silicates and does not escape, thus no off-gassing occurs and the treated waste is non-volatile.

Precipitate Contaminating Soluble Metals

Once Dr. Wagner understood and could assimilate the petrifaction process in controlled conditions, the question became apparent, **"How can this knowledge be beneficial for humanity? How can this science serve mankind?"**

In Dr. Wagner's lifetime, he developed remediation solutions for contaminated wastewater, effluent, soil and sludge streams; non-toxic sealers for wood and later, a sealer for concrete. He formulated chemistries and applications providing solutions for waste by products to be recycled and made into environmental, fire retardant building materials. Each of these solutions are non-hazardous, non-toxic, environmentally sustainable solutions for issues challenging the environment today.

As early as 1988, Dr. Wagner was able to precipitate contaminating soluble metals from acid baths. The process involves introducing a decarboxylation product which causes contaminating metals, organic materials and other contaminates to become encapsulated and precipitate as inert silicates. This precipitate is easily filtered, enabling the acids to remain relatively uncontaminated, therefore, extending the acid's productive live indefinitely.

In 1999, Gwen Wagner, Dr. Wagner's widow, began marketing this chemistry under the product name, ***PRO - pHx*** (pronounced, "pro fix"). "In 2002, it was estimated that more than six (6) billion gallons of spent contaminated acid are disposed of each year in North America alone. The implication of this is that the greater part of 6 billions gallons of acid impacts our environment each year and every year. This makes industrial acid use and its acid disposal a major environmental issue." Gwen Wagner is an environmentalist but she is one with solutions for the problems. "There is an excellent and cost effective solution for this challenge. It is in the form of a unique reagent chemistry, developed by the late Dr. John C. Wagner. It is an additive for acids which allows filtration to remove the organics, metals and contaminates; acids do not contaminate or become spent. Acids continue to perform as a new acid, indefinitely and this eliminates the need for acid waste and acid disposal. Seldom has there been an opportunity for an environmentally sustainable solution to provide such a positive impact and such beneficial results for industry and for the environment."

Zero Acid Disposal. Zero Acid Waste

In late 1999, Amplate, Inc., an electroplating company in Charlotte NC, became the first company to introduce the reagent additive into on-line working acids. With filtration an acid bath which had been disposed of each 7 to 10 days, has not been disposed of to date. Over the next 2 years, Amplate introduced the chemistry to all of their hydrochloric, sulfuric, nitric and citric acid tanks and found the acids were restored to a nearly like-new condition. The reagent chemistry was used in their plating lines, pickling tanks, passivation and activating acids, and acid strips with highly successful results. The purification of acid is accomplished by a 1% addition of the reagent to the total acid / water volume. This removes the organics while filtration (with reusable cartridges) is applied for the removal of solids and dissolved metals. The only new acid required to maintain an acid bath, is the small amount of acid needed to make-up for drag-out and evaporation. No contaminated or partially spent acids were disposed of, dumped or decanted in more than 4 years. Eliminating the time, expense and record keeping associated with acid disposal and replacement, Amplate eliminated acid disposal and had zero acid waste. Pollution prevention is the solution for contaminates disposal. Hundreds of electroplaters are now zero acid disposal companies thanks to Dr. Wagner's Catalyzed Reagent Process.

Big Benefits for the Galvanizing Industry

In a White Paper entitled, "The Elimination Of Acid Dumps," presented at the
American Galvanizers' Association, TECH FORUM 2004, 10/6-8/04 (Cleveland, Ohio, USA),
prepared by: Ken Lemke, President, Canadian Finishing Systems and C. Tom Philipp, President Enviroscience, Inc.,
five (5) galvanizing applications are featured as examples of eliminating acid disposal;
acids maintained without disposal up to two years and performing as relatively new acids.

Current Applications – Galvanizing Industry

One of the first applications of the chemistry in the galvanizing industry was in Canada. Ken Lemke, with Canadian Finishing Systems, supervised the applications at the following plants.

Filtration with reusable filters to keeps the acids free of precipitated metals and organics.

1. Canadian Electro-Galvanizing Plant – Rack Line: *Since 01/09/03*

The plant uses 40% HCl in a 350 gallon tank to remove mill scale and to activate the metal surface for their pipe fittings. This plant previously dumped the bath weekly when the iron concentration reached 4%. The plant has been using the catalyzed reagent chemistry since 1/9/2003 and has not dumped the bath in 21 months. The average iron concentration has stabilized at 2.8% Fe. A Flo-King filter is used to remove the iron precipitate and the filter is cleaned daily. Cost savings of $12,490 CND per year have been verified and these savings do not include reduced downtime and reduced amounts of F006 filter cake generated.

Date	% HCl	% Fe
1/09/2003	24.6	3.24
1/20/2004	28.9	2.82

2. Canadian Hot Dip Galvanizing Company – 3,000 Galllon HCl Tank*:* *Since May, 2003*

This galvanizing company began using the chemistry on a 3,000 gallon 20% HCl pickling tank in May 2003. Prior to using the precipitation chemistry, the iron concentration would increase to 6% Fe within 3 months. The cost to dispose of this bath was $5,000 CND or $20,000 CND per year. This does not include the costs for labor and acid to clean and refill the tank.

Using the catalyzed reagent, the reagent cost to make the initial 1.5% charge on the 3,000 gal tank is $3,645 for 45 gallons of reagent.

On an annual basis, this will consume approximately 3,350 gallons of 32% HCl, which requires 33.6 gallons of reagent. The total first year reagent cost is $7,725 CND, as compared to a disposal cost of $20,000. Second year reagent costs are projected at $4,080 CND a year, which would give an 80% savings. Over the last ten months, the iron concentration has gradually increased and stabilized at 7% Fe. Because the acid is clear and free of organics, the customer reports superior pickling results at this higher Fe concentration. String wound cartridges were originally used and later changed to poly-spun cartridges, as this reduced the iron concentrations from 9% to 7%. A 15-40”cartridge 20-micron filter is used with weekly cartridge changes.

The customer also reports another important benefit. The amount of iron drag-out into the flux tank has been reduced, which reduces the solids formation in the flux tank. This has reduced the maintenance time to clean the flux and has contributed to more consistent quality control of the galvanized parts.

3. Canadian Hot Dip Galvanizing – 9,000 Gallon HCl Tank: *Since April, 2004*

The chemistry was initially added to one 3,000 gal tank in April 2004. Later, a second 6,000 gallon tank was coupled to the first tank so that one 10,000 gph cartridge filter could serve the two tanks. The filter chamber holds 10-40" cartridges and the customer alternates between 75-micron and 20-micron poly-spun cartridges. Typical analytical data is as follows:

DATE	HCl	Fe	ZN
April 20, 2004	30.93%	6.08%	2.03%
April 27, 2004	23.84%	6.53%	3.75%
May 11, 2004	31.32%	7.72%	4.75%
May 17, 2004	14.38%	6.64%	4.58%
June 1, 2004	4.53%	7.48%	7.28%
June 14, 2004	10.44%	6.05%	7.65%
June 30, 2004	12.21%	5.47%	8.44%
July 22, 2004	6.11%	6.67%	8.25%
Aug. 23, 2004	2.76%	6.78%	10.88%

On 8/27/04, two 6,000 gal tanks were coupled together with the 3,000 and 6,000 gal tanks giving a total combined volume of 21,000 gal being serviced by one filter system.

4. Canadian Hot Dip Galvanizing – 15,000 Gallon HCl Tank: *Since 05/11/04*

The chemistry was added to this tank on 5/11/2004. On 5/15/04 the tank sprung a leak and the tank contents were salvaged from the sump (sump materials dissolved which increased the Fe and Zn levels). This solution is filtered with a chamber holding 26-40" cartridges at a pumping rate of 21,000 gph. Poly-spun 75-micron and 20-micron cartridges are alternated. The 75-micron cartridges last 3 days and the 20-micron cartridges last 2 days. Typical analytical data:

DATE	HCl	Fe	ZN
May 11, 2004	21.47%	6.84%	4.2%
May 17, 2004	10.64%	10.74%	5.4%
June 15, 2004	10.05%	11.22%	5.78%
June 23, 2004	12.02%	10.05%	5.81%
July 25, 2004	10.24%	11.61%	5.06%
Aug. 24, 2004	12.02%	11.72%	6.0%

Prior to the use of the chemistry on the 15,000 gal tank, the galvanizer would decant and haul away 5,000 gal of partially spent HCl. This was at a cost of $5,000 CND/week or $250,000/yr. Since starting the chemistry on 5/11/04, no decants have been made.

5. USA Hot Dip Galvanizer – Two 1,500 Galllon H_2SO_4 Tanks*: Since 06/01/04*

This Clevealnd company has two 1,500 gal tanks operated at 10% and 160°F. This summer they decided to use the chemistry in Tank # 1 and use Tank # 2 as the control tank. In the past, normal production required that each tank be dumped one a month at an annual cost of $12,750 for disposal. A Flo-King BX1200-16 in-tank filtration system was installed in Tank 1. Reusable 10 to 40-micron mesh pads are used for filtration. The chemistry was started in Tank 1 on 6/1/2004. The attachment contains a summary of the data***. Please Note: The Untreated Tank # 2 has been dumped and replaced five (5) times since 06 / 01 / 2004.***

Adrienne Klein at The Art Galvanizing Works, Inc. reports the following benefits:

- $15,000 / Yr Saving from 1 Line
- Elimination of Off-site Acid Disposal
- Cleaner Pickle Tanks
- Increased Flux Bath Life
- Reduced Acid Consumption
- Potential Small Quantity Generator Status

Summary and Conclusions

The catalyzed reagent has been used commercially for over 4 years in approximately 300 plant locations. Economic and environmental benefits have been substantiated by end users, such as. plant managers, operating personnel and management.. Benefits and results consistently attributed to the use of the catalyzed reagent are that it:

Eliminates Acid Dumps and Disposal

Reduces Acid Consumption

Eliminates On-site Neutralization or Off-site Hauling

Increases Pickling or Surface Activation Rates

Reduces Iron Drag-in to the Flux Tank

Removal of Organics

Eliminates Acid Inhibitors and Wetters

Reduces Contaminants in Rinse Waters Dumps

Minimal Capital Investment – Filtration Only

Reduces Environmental Liabilities

Lower Acid Concentrations

Reduces fuming from Hot Acid Baths

Low Energy Requirements Compared to Crystallizers

Elimination of Production Downtime Due to Tank Dumps

Tests have also been run on sugar waste sludge having both low and 20% solids content. Results show very significant reductions in metal concentrations as well as hydrocarbon and COD levels.

Trials run on paper mill sludge have resulted in decreased, metal contents as follows: As - 43%, Cd - 89%, Cr - 44%, Pb - 54%. This reduction allowed the final product to be fabricated as a board material similar to particleboard.

Sewage plant waste was also tested with results showing decreases in Ca - 42%, Cu - 53%, Zn - 32% and over 99% in Total Coliform and Standard Plate Count.

PRO - pHx appears to be a win-win product. Not only does it save plating, galvanizing and anodizing companies money by extending the working life acids, it reduces the cost of acid replacement, decreases the expense of hazardous waste handling and disposal costs. It is an environmentally sustainable solution which solves a number of environmental issues as it prevents the pollution (P2) eliminating the problem altogether.

To learn more about ***PRO - pHx*** and its availability contact:
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