ELIMINATION OF ACID DUMPS

AMERICAN GALVANIZERS' ASSOCIATION

TECH FORUM 2004

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Abstract

A catalyzed silicate reagent has been used commercially for over four years to remove organics and dissolved metals from inorganic acids. The purification of these acids is accomplished by a 1% addition of the reagent and solids removal via cartridge filtration. The chemistry provides a viable alternative to capital intensive technologies such as ion exchange, diffusion dialysis, crystallization or thermal systems, which are energy intensive.

Introduction

The basic catalyzed silicate chemistry was developed over 15 years ago by the late Dr. John Wagner and was first used commercially in 1999 at Amplate in Charlotte, NC. Over the next 2 years, Amplate was using the chemistry in all of their hydrochloric, sulfuric, nitric and citric acid pickling tanks. No partially spent acids were dumped or decanted in more than 4 years. Filtration with reusable filters was necessary to keep the acids free of precipitated metals and organics.

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.

1. Canadian Electro-Galvanizing Plant – rack line: 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 Co. – 3,000 gal HCl Tank: 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: 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: 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 gal H_2SO_4 Tanks: This Clevealnd company has two 1,500 gal tanks operated at 10% and 160^oF. This summer Adrienne Klein 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 that the untreated Tank #2 has been dumped five times since 6/1/2004.

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

- $15,000/Yr Saving
- 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 250 plant locations. Economic and environmental benefits have been substantiated by plant operating personnel and these benefits can include many of the following:

Eliminate Acid Dumps

Eliminate On-site Neutralization or Off-site Hauling

Increased Pickling or Surface Activation Rates

Reduced Iron Drag-in to the Flux Tank

Removal of Organics

Eliminate Acid Inhibitors and Wetters

Reduced Contaminants in Rinse Waters

Elimination of Production Downtime Due to Tank Dumps

Minimal Capital Investment – Filtration Only

Reduces Environmental Liabilities

Lower Acid Concentrations

Reduced fuming from Hot Acid Baths

Low Energy Requirements Compared to Crystallizers