



Testreports:

#4018

Milestones: Independent & Department of Defense (DoD) Scientific Testing & Application

- ➔ Non-toxic (oral), Celsis Laboratory Group, 5/00
- ➔ Non-Hazardous Disposal (Used), Trace Analysis Inc, 10/01
- ➔ Micro-etching study, US ARMY Benet Laboratories, 02
- ➔ Pollution Prevention Project for USAF - NCI Information Systems Inc., 09/02
- ➔ Not an eye irritant, Product Safety Laboratories: 10/02
- ➔ Not dermally toxic, Product Safety Laboratories: 10/02
- ➔ Not a skin irritant, Product Safety Laboratories: 10/02
- ➔ Non-Corrosive Military Testing, US Navy Norfolk Naval Shipyard, January 2003
- ➔ 1st Military process change as caustic/acid replacement chemistry, Anniston Army Depot, 04/03
- ➔ Tank track rebuild program rust remover, 10/03, Vertex Inc./US Army Ft Hood TX
- ➔ Non-Hazardous Disposal (Neat), Anachem Inc, 12/03
- ➔ US Navy engine soak tank application - SIMA-San Diego, March 04

Milestones: Awards, Evaluations, Publications, Distribution

- ➔ AWARD - Top 100 Inventions of the Year 2000, R&D magazine, 39th annual awards
- ➔ AWARD - Outstanding Technology in Industrial Cleaning, Clean Tech Magazine, 05/01
- ➔ "Lava, ETS Bio Deruster & Soft Touch, Rust Buster" by Jim Richardson, Auto Restorer, 7/2002 p3
- ➔ "Better Rodding Through Chemistry" by Ron Ceridono, Street Rodder, 09/02
- ➔ "Restoration Primer" by Matt Joseph, Skinned Knuckles, 11/02 p 3-10
- ➔ "Combating Corrosion" by Shawn McGlothlin & Michael Jago, Clean Tech, 05/03 p 14-19
- ➔ "A Rusted Development" by Matt Hardesty, Muscle Car Enthusiast, 10/03 p 64-67
- ➔ Wal*Mart Stores, 03/03
- ➔ Snap-on Tools Dealer & Industrial Division, 04/03
- ➔ Military National Stock Number (NSN) Listing – 04/03
- ➔ Army Air Force Exchange (AAFES) Stores, 02/04
- ➔ ETS Bio deruster is nominated for the SMALL BUSINESS AWARD category.
- ➔ ETS Bioderuster is nominated under category 3 – Safer Chemical.



Abstract:

The submitted chemistry is an industrial replacement for corrosion removal and control in iron preparation. Current chemical and mechanical methods are major contributors to hazardous disposal, emissions, and human health issues. Their low purchase price is only a small portion of their true cost. These hazardous materials are toxic, corrosive, and can create explosive gasses. Waste from both the chemical and mechanical methods may contain heavy metals, paint, grease, oil, and various organic materials. ETS Bio- Deruster is a non-toxic, non-hazardous, non-flammable chemical with a targeted process of removing rust (iron oxide). ETS Bio-Deruster removes the iron oxide into solution by a proprietary process called selective chelation. As the normal operational pH is 6 - 7, the solution is never hazardous to handle, store, or dispose of in neat form. PPE is not required with ETS Bio Deruster, making it an excellent industrial and consumer product. There are no transportation restrictions, air or ground, for ETS Bio-Deruster. Waste generated by ETS Bio Deruster is typically non-hazardous and has potential use as lawn and garde fertilizer.



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EXECUTIVE SUMMARY

ETS-Bio Deruster is a patent pending non-hazardous rust remover that employs a unique selective chelating agent to remove rust (iron oxide) corrosion. ETS-Bio-Deruster has been thoroughly tested against current methods of rust removal and proves to greatly enhance the safety in the workplace, reduce and replace the use of hazardous/inherently dangerous materials (such as acids, caustics, converters, electrical, and mechanical methods), thereby reducing both hazardous emissions and disposal.

CORROSION COSTS

U.S. economic loss to corrosion costs \$276 billion dollars annually, \$20 billion in the Department of Defense (DoD) alone¹. Current methods of rust removal subject personnel, equipment, and the environment to toxic and hazardous materials, emissions, conditions, and waste. How big is the scope? As an example, the steel pickling industry utilized an estimated 245 million gallons of Hydrochloric Acid alone in 1991 and emits approximately 8920 Mg/yr of HCl₂.

COMPARISON OF METHODS

Current methods of corrosion or rust removal include acids, caustics, converters, electrolysis, and mechanical. These methods are key contributors to hazardous disposal, emissions, and human health issues. By nature these processes are toxic, flammable, eye and skin irritants, inhalation hazards, VOC's/HAP's sources, corrosive, and may contain heavy metals. These and other factors, such as DOT restrictions, surface compatibility, surface protection, and cost are documented against ETS Bio Deruster .

HUMAN HEALTH & ENVIRONMENTAL BENEFITS

ETS-Bio Deruster is non-toxic, non-flammable, not an eye irritant, not a skin irritant, does not contain VOC's or HAP's, non-corrosive, and does not create flammable gasses. The operating range is pH 6 to 7 and is not hazardous to store, use, or dispose. There are no requirements for PPE or Environmental controls. ETS-Bio-Deruster has no transportation restrictions and, in most cases, only the chelated iron content will dictate disposal method. Spent solution may have a benefit as a fertilizer as iron must be in chelated form for plant root uptake.

CHEMISTRY

Chelation is the binding of metals by an organic compound by the sharing of electron pairs. ETS-Bio-Deruster employs a proprietary selective-chelating agent. The molecule latches on to free Fe II on the surface of the metal. The chelated iron is then converted to ferric sulfate by a non-toxic sulfur compound. It also allows the chelating agent to remove more iron from the iron oxide. The molecule does not have sufficient strength to break iron-to-iron or in un-rusted steel; hence it is self-limiting and non-corrosive. The solution is no longer viable after removing approximately 1/2 lb of iron oxide per gallon of solution. Bio-Deruster is NOT based on the action of EDTA, citric acid, glycolic acid, or their sodium salts. How the technology meets the scope: Bio-Deruster, a patent pending non-hazardous rust remover, employs a unique selective chelating agent to remove rust (iron oxide) corrosion. ETS Bio-Deruster has been thoroughly tested against current methods of rust removal and proven to:



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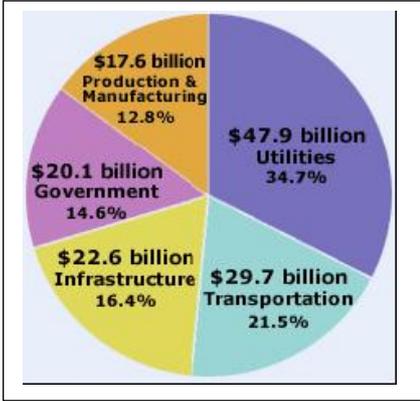
How the technology meets the scope:

ETS Bio-Deruster, a patent pending non-hazardous rust remover, employs a unique selective chelating agent to remove rust (iron oxide) corrosion. ETS Bio-Deruster has been thoroughly tested against current methods of rust removal and proven to:

- A. greatly enhance the safety in the workplace
- B. reduce and replace the use of hazardous/inherently dangerous materials (such as acids, caustics, converters, electrical, and mechanical methods)
- C. thereby reducing both hazardous emissions and disposal
- D. Resulting in increased productivity.

ETS-Bio-Deruster is the only chemistry in the world employing selective chelation for rust removal. ETS-Bio-Deruster is sewerable in neat form and works at a pH ranging from 6 as delivered to 7 as a spent solution. ETS-Bio Deruster is 100% replacement for acid and caustic rust removal applications, yet is non-hazardous, non-corrosive, non-flammable, and poses no environmental or health hazards. ETS-Bio-Deruster is a clear to yellow liquid best suited for dip tank applications. This unique green chemistry can also be adapted to large projects to supplement or replace abrasive and conversion easily as long as it is kept as a free liquid. Innovative customers have proven the principal by utilizing simple re-circulation pumps and capturing run-off for continual re-use. It works at room temperature with no special equipment. In its simplest application, a plastic pail will suffice as an impromptu dip tank application. Rust removal is accomplished with no operator input once the piece is fully immersed. The operator does not even need to dismantle most pieces/parts before soaking. ETS-Bio-Deruster does not harm aluminum, brass, copper, vinyl, plastic, wiring, rubber, chrome, or non-oxide paint. Light rust is removed in as little as 5 to 30 minutes. Medium Rust up to 6 hours, and heavy rust takes up to 24hours. The chemistry is corrosion inhibiting for up to 2 weeks or it can be rinsed off for immediate painting. Applications from engine rebuild facilities report 1 gallon of ETS-Bio-Deruster de-rusts an average of 300 pounds of steel at a cost of 4 to 6 cents per pound. A pipe stem re-manufacturer has reported 600 lbs. per gallon as a running average or about 2-3 cents per pound. The severity of the rust and the surface area to be treated will proportionately affect the pounds per gallon figure. ETSBio- Deruster has no transportation restrictions and, in most cases, only the chelated iron content will dictate disposal method.

U.S. economic loss to corrosion costs \$276 billion dollars annually, \$20 billion in the Department of Defense (DoD) alone .Figure 1 (right) shows the actual cost of corrosion, broken down by industry4. Current methods of corrosion or rust removal include acids, caustics, converters, electrolysis, and mechanical. These methods subject personnel, equipment, and the environment to toxic and hazardous materials, emissions, conditions, and waste.



How big is the scope?

As an example, the steel pickling industry utilized an estimated 245 million gallons of Hydrochloric Acid alone in 1991 and emits approximately 8920 Mg/yr of HCl. This number does not include other acids, caustics, chemistries or methods and is a good indicator to why the US Army has a goal of reducing the use of caustic/acid by 50%. ETS-Bio Deruster has been implemented in general industrial and strategic Depot Level DoD installations such as Anniston Army Depot and the US Navy Southwest Regional Maintenance Center (formally SIMASD).The following table outlines the current methods of rust removal employed by the industrial and military sectors exposing their typical health and environmental factors, operational issues, cost, and application.



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