tersus environmental

Tech Brief

Advancing the Science of *In Situ* Groundwater Remediation

eZVI

Emulsified Zero-Valent Iron
A Combination Technology for DNAPL Remediation

eZVI is an emulsion of powdered zero-valent iron, surfactant, vegetable oil, and water specifically designed for the remediation of source zones impacted with halogenated hydrocarbons. eZVI has the unique ability to mix with dense non-aqueous phase liquids (DNAPLs) by capitalizing on the ability of food-grade surfactants, biodegradable vegetable oil, water, and zero-valent iron to form hydrophobic emulsion droplets (micelles) that are miscible with DNAPL material *in-situ* due to matching physical chemistries. Abiotic reductive dechlorination occurs as the halogenated hydrocarbons in DNAPL diffuse through the outer oil membrane into the interior aqueous phase of the emulsion, which contains zero-valent iron. Encapsulating zero-valent iron with a hydrophobic membrane protects the nano-microscale iron from native groundwater constituents that might otherwise waste the iron's reducing capacity, and thereby reduce the mass of eZVI available to treat target contaminants and overall project costs. In addition to the **abiotic reactions** provided by the ZVI, the vegetable oil and surfactant components present in eZVI act as a long-term electron donor for **enhanced biological reductive dechlorination**.

Our Product

eZVI is an emulsion of powdered zero-valent iron, surfactant, oil, and water that reductively dehalogenates halogenated hydrocarbons (e.g., PCE, TCE, DCE, VC, TCA, CT, etc.). We offer a variety of formulations that are customized to your site-specific conditions. This Tech Brief reflects all of the ranges available.

Purpose

eZVI is a simple, safe, low-cost solution for the *in-situ* remediation of source zones impacted with halogenated hydrocarbons.

Configuration

eZVI applications are easily configured and tailored to meet site-specific conditions. Configurations include applications in grids, barriers and excavations. eZVI can be applied to the subsurface using direct-push injection, hollow-stem auger, hydraulic or pneumatic fracking, and large diameter auger (LDA) or other soil mixing technologies.

Benefits

- Effective for in situ treatment of DNAPL source zones
- Directly treats residual and phase DNAPLs
- Requires less treatment time
- Reduces treatment costs
- Produces less-toxic and more-easily degradable byproducts
- Is environmentally safe
- Field-tested by the U.S. Environmental Protection Agency (EPA) under the Superfund Innovative Technology Evaluation (SITE) program
- Typical source concentration decrease ~90+% within 3 months
- Hydrophobic, dense emulsion absorbs DNAPL, delivering contaminant to iron
- *In situ* chemical reduction of chlorinated solvents to ethene and water
- Applied using injection or soil mixing using conventional technologies
- Developed/patented by NASA

Awards

- 2007 NASA Induction into the Technology Hall of Fame
- 2006 Federal Laboratory Consortium Excellence in Technology
- Transfer
- 2005 NASA Government Invention of the Year
- 2005 NASA Commercialization Invention of the Year

Emulsified Zero-Valent Iron for *In Situ* Treatment of Source Zones
eZVI by Tersus Environmental

Offers Cost Savings

Our eZVI technology has the potential to offer significant cost savings to the groundwater remediation industry. The passive nature of eZVI eliminates the large capital and operations/maintenance costs associated with active engineered systems. eZVI offers a faster and lower cost alternative to a drawn out natural attenuation approach.

Longevity

eZVI has been shown to remain effective in the subsurface for greater than 3 years. The longevity of the emulsion is estimated to be 3 – 5 years depending on the type of source area being remediated.

Field Applications

- Dye and paint manufacturers
- Dry cleaners
- Chemical manufacturers
- Metal cleaning and degreasing facilities
- Leather-tanning facilities
- Pharmaceutical manufacturers
- Adhesive and aerosol manufacturers
- Government facilities

Product Specifications

Density: 1.05-1.10 g/mL
Hydrophobicity: Digital image verification
Micellular Structure: Micrograph digital image verification

Chemical/Physical Data

Appearance: Grey to black viscous liquid
Odor: Soybean oil (cooking oil) odor
Solubility in Water: Insoluble
Specific Gravity: 1.05-1.13 g/mL
Percent Solids By Weight: 10-17%

Packaging Options

- 275-gallon IBC containers (2,300 net lbs.)
- 3,000 - 5,000 gallon tankers

Shipping

Proper Shipping Name: Emulsified Zero-Valent Iron
Hazard Class: NA
ID Number: NA
Packing Group: None

About Us

What if we always settled for the first technology that came along?
Then we would have never gotten to where we are today.

We Develop & Market Innovative, Sustainable, Green Technologies. Tersus Environmental also provides global sales management and marketing services for inVentures Technologies' complete family of groundwater remediation products based on the worldwide-patented Gas inFusion technology, which allows for supersaturated levels of dissolved gas into liquids.

Innovative Sustainable Green Technologies
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*eZVI is marketed and sold under agreement with RemQuest, a division of *Toxicological & Environmental Associates*. eZVI is a NASA developed and patented technology, U.S. Patent No. 6,664,298.

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