SRS®-Z_{VI} Small Droplet Emulsified Vegetable Oil (EVO) Substrate Combined With Zero Valent Iron (ZVI) for DNAPL and Biobarrier Applications
United States Patent# RE40,448

What Is SRS®-Z_{VI}? 

Terra Systems SRS®-Z_{VI} uses our state of the art manufacturing facility to produce a unique oil/iron product that combines patented emulsified vegetable oil substrate technology (SRS®) with zero valent iron (ZVI), which results in a product that provides better flow characteristics and higher carbon and hydrogen yield than other commercially available ZVI and organic products.

Why Combine Emulsified Vegetable Oil Substrate and Zero Valent Iron? 

- Terra Systems patented, nutrient enriched, proven slow release SRS® family of emulsified vegetable oil substrate is used extensively by the Air Force, DOD, Navy, EPA, drycleaners and private firms to remediate chlorinated solvent sites.
- SRS®-Z_{VI} is formulated under NASA’s EZVI patent.
- Zero Valent Iron can promote the abiotic dechlorination of solvents including tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane).
- SRS®-Z_{VI} contains approximately 31.3 percent carbon.
- Terra Systems core competence in manufacturing produces a stable combined product that provides good flow characteristics, which makes it easier to inject and distribute in the aquifer.
- SRS®-Z_{VI} arrives at the project site injection ready and does not require on-site mixing.

What Are the Best Applications SRS®-Z_{VI}? 

- High concentrations of chlorinated solvents
- Biobaroriers to prevent migration across property boundaries
- Freon 113

Why Terra Systems, Inc.?

- Terra Systems holds United States Patent# RE40,448 for the use of emulsified vegetable oil for remediation of chlorinated solvents and is a licensee of NASA for EZVI.
• Terra Systems owns and operates a US based manufacturing plant with an in-house quality control laboratory for strict quality assurance and our products are manufactured using Terra Systems full time employees, not toll producers.

• Terra Systems has been in continuous operation for 21 years supplying aerobic and anaerobic remediation solutions to environmental consultants.

• The soy bean oil provided is grown in the United States and provides a slow release biodegradable carbon source, which promotes long-term biological activity.

**SRS®- ZV1 Oil/Iron Substrate Specifications**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percent by Weight/Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Grade U.S. Grown Soybean Oil</td>
<td>36%</td>
<td>Terra Systems operates its own state-of-the-art manufacturing facility for SRS®-SD production and can custom blend substrate packages as site conditions require.</td>
</tr>
<tr>
<td>Zero Valent Iron</td>
<td>40%</td>
<td>Micro-scale zero valent iron (nano/micro scale iron available at a higher cost)</td>
</tr>
<tr>
<td>Proprietary Food Grade Additives/Preservatives/Proprietary Nutrients, Vitamin B12, Soluble Substrate and Emulsifiers</td>
<td>6%</td>
<td>Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus. Organic and inorganic nutrients have been shown to support the growth of the anaerobic microbial population.</td>
</tr>
<tr>
<td>pH</td>
<td>6.5 – 7.5</td>
<td>Neutral pH</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>12 pounds/gallon</td>
<td>Denser than water</td>
</tr>
<tr>
<td>Viscosity</td>
<td>3,306 centipoises</td>
<td>Non-Newtonian fluid with 3,300 centipoise plateau with constant speed spindle and 2,300 centipoise with increasing speed spindle</td>
</tr>
<tr>
<td>Organic Carbon</td>
<td>31.3%</td>
<td>Theoretical carbon yield</td>
</tr>
</tbody>
</table>

**Packaging:** Terra Systems patented SRS®- ZV1 is shipped in 275-gallon IBC totes.

**Delivered Injection Ready:** Terra Systems patented SRS®- ZV1 is shipped ready-to-inject.

**Injection Method:** Direct Push. SRS®- ZV1 is not recommended for injection into screened wells.

**Shelf-Life:** SRS®- ZV1 is designed to be injected within 2-weeks of being received.
Photo of SRS® - Zv1 Sample: