

Terra Systems Core Competencies

U.S. and Japanese Manufacturing

Terra Systems owns and operates a manufacturing plant in Claymont, Delaware right on the I-95N/S and near the I-76W corridor and also manufactures for the Japanese market in Nagoya, Japan.

Maintaining control over manufacturing is a key differentiator between Terra Systems and other U.S. suppliers of EVO and provides the following customer benefits:

1. Provides reproducible product from batch to batch.
2. The mixing of nutrients, Vitamin B₁₂ and any buffer is carried out in a controlled environment.
3. The right piece of equipment is used to produce each product.
4. Droplet size and droplet size distribution are strictly controlled.
5. QA/QC is monitored on each batch.
6. New products can be designed in the lab and manufactured in "pilot" amounts next door in the plant.

Manufacturing vs. Field Emulsion

In the early days of in-situ bioremediation when Terra Systems first patented the technology, it was common to bring the water, emulsifiers, oil, and other ingredients to the site and using trash or other pumps to mix the ingredients together to form an emulsion. It soon became apparent that poor emulsion consistency and a broad range of droplet sizes resulted in inadequate and uneven distribution when injected.

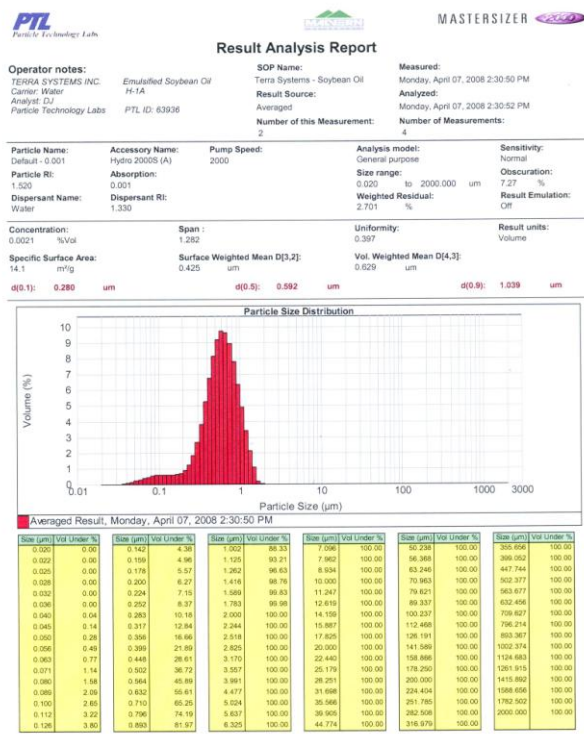
For example, we recently obtained a sample of a competitor's commercially available product that claims to be 100% substrate to which water is added in the field to form the emulsion.

We took a sample of the emulsion after the client added about 20 gallons of the product to 4,000 gallons of water and mixed with a trash pump for about 30 minutes.

- The droplet size averaged 2.4 to 2.5 microns with droplets as large as 9.7 to 9.9 um.
- 19 to 22% of the droplets were less than 1 um
- 47 to 51% were less than 2 um
- 90 to 92% less than 5 um.

From the independent PTL report below, Terra Systems droplet size for our small droplet 60% SRS[®]-SD is.

- 10% were less than 0.28 μm
- 50% were less than 0.57 μm
- 90% were less than 1.93 μm



MasterSizer 2000 Ver. 5.1
 Report Number: 34208-113
 File Name: 10088
 Report Number: 21
 DR Apr 2008 9:21:40 AM

Don't be "penny wise and pound foolish".

Consider:

- The labor and equipment time and cost of mixing in the field.
- That you will need to mix the nutrients and Vitamin B₁₂ longer to achieve consistency.
- The cost of inadequate distribution due to droplet size and emulsion inconsistency.
- The lack of QA/QC

To discuss a challenging site call or email Michael Free at mfree@terrasystems.net or 484-889-2214.