

mi BIO-TRAP® *Catch Remediation in the Act... Trap It!*

ADVANCED DIAGNOSTIC SAMPLERS

What are Bio-Trap® Samplers?

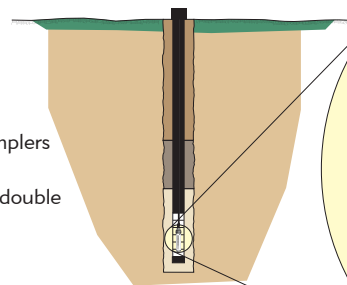
Bio-Trap® Samplers are passive sampling tools that collect microbes over time for the purpose of better understanding biodegradation potential. The key to the Bio-Trap® approach is a unique sampling matrix, Bio-Sep® beads. The beads are 2–3 mm in diameter and are engineered from a composite of Nomex® and powdered activated carbon (PAC). When a Bio-Trap® Sampler is deployed in a monitoring well, the Bio-Sep® beads adsorb contaminants and nutrients present in the aquifer essentially becoming an *in situ* microcosm with an incredibly large surface area (~600 m²/g) which is colonized by subsurface microorganisms. Once recovered from a monitoring well (30-60 days after deployment), DNA, RNA, or PLFA can be extracted from the beads for CENSUS® or PLFA assays to evaluate the microbial community.



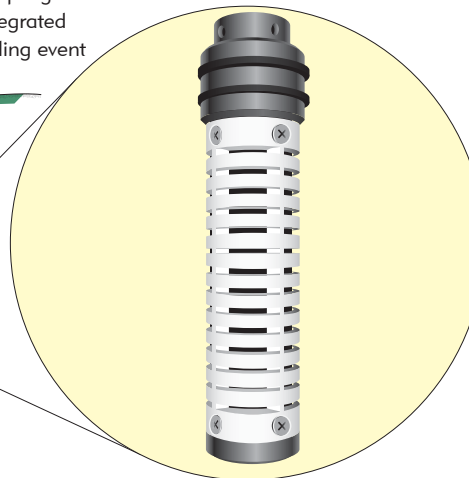
A modern approach to microbial sampling

Bio-Trap samplers utilize a passive sampling approach allowing the results to be integrated over time rather than from a single sampling event

Multiple Bio-Trap samplers can be isolated from one another using a double seal cap assembly

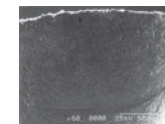


Samplers are suspended in the screened interval for typically 30 days.
*study length can vary depending on objectives

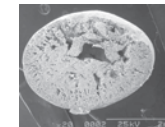


Sampling Matrix: Bio-Sep® Beads

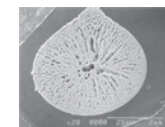
A key to this sampling approach is the use of Bio-Sep® beads as the sampling matrix. The unique properties of these beads allow them to mimic environmental conditions very well.



Exterior of Bio-Sep bead



Interior of Bio-Sep bead



Lactate amended Bio-Sep® bead

Bio-Sep® beads provide a large surface area within the bead for microbial attachment. Most microbes prefer to be attached to a surface rather than be free floating.

Fishin' for microbes! "Baited" Bio-Trap® samplers can be used to evaluate the microbial response to a wide range of amendments (electron donors and acceptors, etc.).

*see reverse for more details

Samplers can be analyzed using a wide variety of analyses including:

Molecular Biological Tools

- CENSUS® (qPCR)
- PLFA
- DGGE
- SIP

Chemical Analysis

Geochemical Parameters
And more!

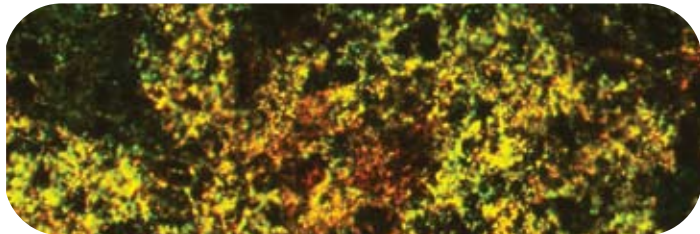
What types of samplers are available?

Bio-Trap samplers are available in a wide variety of configurations that can be tailored to answer your site-specific questions.

Standard: Basic Bio-Trap® Samplers in the simplest terms are a replacement for collecting groundwater samples using a conventional approach. Most microbes prefer to be attached to a surface rather than free floating and this passive sampler provides a large surface area for the microbes to colonize. Results generated using this approach have been shown to minimize the variability associated with traditional sampling approaches. Bio-Traps biofilms have also been shown to directly reflect spatial and temporal changes in aquifer microbial community structure plume which could not be determined from groundwater analysis. Standard Bio-Trap® Samplers are primarily used during site characterization and routine monitoring activities to:

- Quantify specific microbes or contaminant degrading bacteria (e.g. *Dehalococcoides*)
- Evaluate monitored natural attenuation (MNA)
- Compare microbial populations from different sampling points
- Monitor shifts within microbial communities following biostimulation

Standard Bio-Trap® Samplers are designed for microbial analyses using a variety of molecular biological tools but can also be configured for some chemical and geochemical analyses.



Baited: As the name suggests, Bio-Trap® Samplers can be “baited” with various amendments or compounds to answer site-specific questions. In the past, project managers have been forced to turn to laboratory microcosms or small-scale pilot studies to evaluate bioremediation as a treatment alternative. While microcosm experiments with native site materials can show biodegradation in the laboratory, duplication of *in-situ* conditions is difficult and the results may not extrapolate to the field. Pilot studies are performed on site but are often prohibitively expensive as an investigative tool. Baited Bio-Trap® Samplers are designed to create discrete *in situ* microcosms that can be used to:

- Evaluate monitored natural attenuation versus enhanced bioremediation
- Compare effectiveness of different amendments (e.g. HRC®, EOS®, sodium lactate, molasses, etc.) designed to stimulate bioremediation
- Prove that biodegradation is occurring (¹³C-labeled compounds - Stable Isotope Probing)
- Estimate relative rates of degradation for a specific contaminant (i.e. MTBE, TBA etc.)
- Address specific questions such as:
 - Is benzene being degraded at my site?
 - Will sulfate amendments stimulate bioremediation?
 - Will sodium lactate increase the concentration of known dechlorinating bacteria?

Baited Bio-Trap® Samplers can be amended with a number of compounds including:

- Sodium acetate
- Sodium lactate
- Potassium lactate
- HRC®
- Molasses
- Vegetable oil
- EOS®
- Sodium phosphate
- Sulfate
- Nitrate
- Ammonium chloride
- Elemental sulfur
- Calcium carbonate
- Iron (III)
- ¹³C-labeled contaminants
 - Benzene
 - Toluene
 - Xylene
 - MTBE
 - TBA
 - Chlorobenzene
 - TCE
 - DCE
 - VC
- Fluorinated surrogates for tracing chlorinated compounds
 - TCE
 - DCE
- And more!