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Passive Diffusion Sampling for PFAS

Passive Diffusion Bag Samplers (PDBs) have been used worldwide to collect groundwater samples for Volatile Organic Compounds (VOCs) in groundwater since 1998. Lab and field case studies demonstrate that PDBs produce accurate sample concentrations and provide cost savings of 50 to 80% compared to low-flow and volume purge. PDBs also allow for discrete interval sampling and a reduced carbon footprint compared to pumping and bailing.

Expanding the List of Analytes Sampled by PDBs



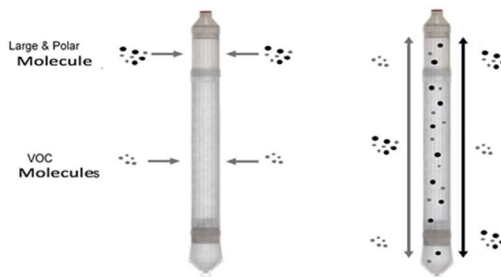
Until now, the reliable and economical use of passive diffusion sampling has been limited to non-polar VOCs because large or polar molecules and ions cannot pass through the polyethylene membrane into the sampler. EON's Dual-Membrane Passive Diffusion sampler operates under *the same principles as the well established PDB sampling*, using two semi-permeable membranes in a single sampler, to capture an expanded list of compounds.



What is the Principle?

Two separate semi-permeable membranes are aligned in series around a perforated tube and sealed to form a sample chamber. The sampler is filled with de-ionized water before use and lowered into the saturated well screen to intercept groundwater flow. When the surrounding groundwater contains molecules that are not in the sampler and that can pass through one of the membranes, a concentration gradient exists between the fluid inside the sampler and outside. The gradient drives the molecules in the groundwater to diffuse into the de-ionized water in the sampler until equilibration is reached. If the gradient is reversed, the molecules diffuse out of the sampler to maintain a constant dynamic equilibrium.

Why Two Membranes?



The upper membrane has large pores and is hydrophilic, facilitating diffusion of large and polar molecules into the sampler. The bottom membrane has smaller pores and is hydrophobic, allowing diffusion of non-polar VOCs from the surrounding groundwater into the sampler while retaining water for sampling. Molecules that enter the sampler through either membrane diffuse throughout the water inside the sampler until dynamic equilibrium is reached within the sampler and with the surrounding groundwater.

Benefits

- **Sample for PFAS to Single-Digit ng/L (ppt)**
- **Reduce Cost of Sample Acquisition by 50-80%**
- **Virtually No Investigation Derived Waste**
- **Depth Discrete Interval Sampling**
- **Sample Volume up to 650 ml per Sampler**

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Accurate PFAS Results?

The DMPDB uses the same principles as the highly effective PDB in use for VOCs for over 20 years, with the addition of a second membrane that facilitates the diffusion of PFAS into the sampler. Bench-tests of the DMPDB for sampling PFAS were performed using a large sample chamber spiked with long, medium, and short-chain PFAS. The DMPDB samplers were installed and left in place for varying times of about two to three weeks to allow for the diffusion process to come to equilibration. Control samples were then taken from the fluid in the chamber surrounding the samplers, the samplers were then removed, and the contents discharged to laboratory bottles. A second control sample of the chamber water was taken after the samplers were removed to verify repeatability. All samples were sent to an experienced and certified lab for PFAS analysis using Method 537. The resulting data shows a high correlation in PFAS concentrations between samples from the DMPDB and those from the control samples, even at single-digit ng/L concentrations.

Are DMPDBs PFAS-Free?

The Dual Membrane Passive Diffusion Sampler DMPDB and installation accessories are manufactured from materials that do not contain PFAS and have been listed as acceptable materials (HDPE, polypropylene and stainless steel, for example) for PFAS sampling. Rinsate testing has been performed on the DMPDB samplers validating the PFAS-free expectations. Additionally, because passive diffusion samplers are immersed in the aquifer water for an extended time, PFAS concentrations in the groundwater equilibrate with the DMPDB materials before the sampler is removed, virtually eliminating the potential for bias caused by incidental contact between the sampler and PFAS containing materials or by adsorption of PFAS from the groundwater to the sampler materials.

How Are They Deployed?

Like standard PDBs, the Dual-Membrane PDB sampler is lowered into the saturated screen on a re-usable weighted suspension tether, secured to the underside of the well cap. The DMPDBs are left in place for a minimum of three weeks. To save mobilization costs they may be left in place for an extended period and recovered at the next sampling event. Simply remove the samplers, discharge them to laboratory sample bottles and replace them with new DMPDBs for the next sampling event. Whenever the samplers are removed, they will represent the well concentrations of the surrounding water during previous few days.

DMPDB Use and History?

The Dual-Membrane Passive Diffusion Sampler has been field tested for sampling VOCs, metals, inorganics and other compounds in side by side comparisons with low-flow pumping and bailing, and has been in use at Federal EPA, DoD, USGS, and private sites since 2014. DMPDBs have been used for sampling PFAS since 2016.

Want to Know More about Passive Sampling?

Since first commercializing the standard PDB in 1998, EON has been the leader in passive groundwater sampling devices, having a full suite of passive and active options with full technical support. EON Products is an active Affiliate Member of the Interstate Technology Regulatory commission (ITRC) PFAS team and the 1,4 Dioxane team. We are committed to bringing the latest information and technology to our groundwater sampling clients.

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