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Passive Diffusion Sampling for VOCs, SVOCs, Metals, Inorganics, Ions

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.

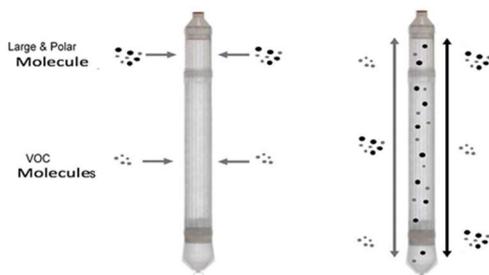
Expanding the List of Analytes Sampled By PDBs



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 (DMPDB) 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 to form a tubular sample chamber. The sampler is filled with de-ionized water and lowered into the well screen intercepting groundwater flow. When the surrounding groundwater contains molecules that are not in the sampler, a concentration gradient drives the molecules in the groundwater to diffuse through the membrane pores into the sampler. The bottom membrane, having smaller pores, allows diffusion of VOCs from the surrounding groundwater into the sampler but does not allow water molecules to pass. The upper membrane, with larger pores, allows diffusion of large or polar molecules into the sampler.



Molecules that enter the sampler through either membrane diffuse throughout the water inside of the sampler until dynamic equilibrium is reached within the sampler and with the surrounding groundwater. When the sampler is retrieved, water in the top membrane leaves the sampler through the large pores, while the lower chamber serves as a reservoir and retains the thoroughly diffused sample until discharged for analysis.

Benefits

- Reduce cost of sample acquisition by 50-80%
- Sample Volume up to 650 ml per sampler
- Depth Discrete Interval Sampling
- Also Sample for 1,4 Dioxane & PFAS
- Virtually NO Investigation Derived Waste Water (IDW)

Is the Dual Membrane PDB a Proven Sampling Method?

Yes. The Dual-Membrane PDB sampler (DMPDB) was developed by combining the functionality of passive sampling devices that were evaluated by the ITRC Passive Sampling Team in the mid 2000's and found effective for sampling a wide range of compounds. Each of the methods performed well but some were not user friendly or did not produce adequate sample volume or were too expensive to commercialize. The DMPDB enables sampling for a wide range of compounds in a simple and effective way using the passive diffusion technology developed by the U.S.G.S. Since its initial use by the USEPA, the DMPDB has undergone extensive laboratory bench testing, followed by field use, validating the DMPDB's effectiveness at producing samples that represent concentrations of contaminants in surrounding groundwater fluid.

Bench-tests were performed using the DMPDBs to sample for a variety of analytes including; VOCs, Metals, Ions, and compounds of emerging concern such as 1,4 dioxane and PFAS. A large sample chamber representing a well, was spiked with compounds of interest, DMPDB samplers were installed, and the chamber sealed. The samplers were left in place for adequate time (about 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. Next, the samplers were removed, and the contents discharged to laboratory bottles and sent to a certified lab for analysis. The resulting data from the DMPDB samples shows high correlation with the analyte concentrations from the control samples representing the water in the chamber, affirming diffusion sampling, using the Dual Membrane Passive Diffusion Sampler, produces accurate concentrations for a wide range of compounds.

In 2014 & 2015 the USEPA Region VI performed multiple, side by side field evaluations of the Dual-Membrane PDB on two sites they manage. After the evaluation the DMPDB was adopted to replace the expensive and time consuming low-flow sampling for metals and ions on those sites. Hexavalent chromium was one of the key metals of concern and the results from Dual-Membrane sampler were in line with long term trends and with the side by side low flow results.

In 2016 and 2017 the Dual-Membrane PDB was evaluated for specific VOC compounds and a range of metals by the USGS and a private consultant at a U.S. Air Force base. The USGS used the samplers in wells that were over 1,000 feet deep and the results favorably compared to bailed samples. The private consultant sampled wells that were 300 to over 500 ft deep and obtained VOC and metals data that were consistent with the data taken using submersible pumps and the low flow method. The resulting data comparisons enabled the site to remove the troublesome low-flow pumps and tedious deep-well bailing and adopt passive sampling using the Dual-Membrane Passive Diffusion Sampler.

The Dual-Membrane Passive Diffusion Sampler has also been evaluated and adopted at private commercial sites, based on successful side by side comparisons with more costly sampling methods including low-flow pumping and bailing.

How Are They Deployed?

Like PDBs, the Dual-Membrane PDB sampler is installed on a re-usable weighted suspension tether, secured to the underside of the well cap.

Want to Know More about Passive Sampling?

Since EON first commercialized the PDB in 1998, we have been the leader in passive sampling. Contact EON by email: sales@eonpro.com or phone: 800-474-2490 / 770-978-9971

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