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Sample Pro® Polyethylene and Teflon® Bladder Purity and Sorption Testing

Introduction

Polyethylene and polytetrafluoroethylene (PTFE, also known by the brand name Teflon®) are plastics that are commonly used to make both tubing and pump components in groundwater sampling equipment. Polyethylene comes in various formulations designated as LDPE (low-density polyethylene), MDPE (medium-density polyethylene) and HDPE. These general designations refer to the relative density of the material and the length of the polymer chains in the material. Chemically, they are essentially the same. At QED, we select different formulations based on the function of the material. For example, the disposable bladders on our portable Sample Pro® bladder pumps are LDPE, which is more flexible than MDPE and HDPE, while our tubing is typically MDPE to provide greater tensile strength for supporting the weight of the pump and tubing and the water within them. In the environmental industry, HDPE is most commonly used for items that require limited to no flexural movement, such as plastic piping systems and landfill liners.

QED performed a series of tests on our disposable LDPE bladders to determine their suitability for sampling organic compounds in addition to testing for performance (flex life, burst strength, etc.). We performed soak tests in known clean water to determine if any organic compounds would leach from the new bladders, and a series of sampling comparisons in spiked solutions using both LDPE and Teflon bladders to determine the potential for sorption as measured against control samples.

Description of testing methods

For the leaching test, a production run of Sample Pro LDPE pump bladders was randomly sampled, and the bladders were immersed in deionized water for 24 hours using just sufficient water to fully immerse the bladders. After the 24-hour soak period, the water was sampled and analyzed for SVOCs using EPA Method 625 and VOCs using EPA SW-846 Method 8260 for a total of 104 analytes. No measurable organics were found, as defined by the stated detection limits for each parameter.

Sorption of VOCs and SVOCs was tested by placing two bladder pumps in a 200-gallon tank of water spiked with TCE and benzene. One of the pumps had a Teflon bladder and the other used a LDPE bladder. Both pumps were operated simultaneously at 200 ml/minute for 20 minutes, with samples taken after two pumps cycles (0 time) and 1, 5, 10 and 20 minutes. Control samples were taken at the beginning of the testing (time zero) and at the end of the testing (after 20 minutes) from sample ports in the side of the tank. Table 1 below shows the data from these samples, and Figures 1 and 2 below show plots of these data points. The results show no significant difference between the control samples and those from either the LDPE or PTFE bladders, and no trend of lower concentration levels for the LDPE bladder than for the Teflon (PTFE) bladder due to sorption. In fact, the LDPE bladder in some sample sets appears to show slightly higher concentrations than the PTFE bladder, but these differences are not consistent and are judged to lie within the range of experimental and analytical error.

Table 1 – Sample Pro LDPE Bladder Sorption Testing

Benzene Test	Time 0	1 minute	5 minutes	10 minutes	20 minutes
PTFE bladder	380	470	470	520	500
LDPE bladder	450	500	430	380	460
Control	470, 480				430, 450
TCE Test					
PTFE bladder	130	170	170	180	170
LDPE bladder	160	170	160	140	170
Control	170,170				150,160

Summary

Production lot testing of Sample Pro disposable LDPE pump bladders was conducted to determine whether they sorbed TCE or benzene from spiked solutions or released any volatile or semi-volatile organic compounds into water. Based on this testing, we found that the LDPE bladders did not leach any measurable levels of semi-volatile or volatile organic compounds tested, and there was no discernable difference in sorption levels between the LDPE and Teflon bladders. Test results show no pattern of TCE or benzene sorption from the spiked solutions and no measurable levels of 104 organic compounds tested based on a 24-hour extraction period. Our conclusion is that the Sample Pro LDPE bladders are highly unlikely to either remove or contribute measurable levels of organics contaminants in ground water samples under typical sampling conditions.

Figure 1 – Test Results of Bladder Test for Sorption – Benzene

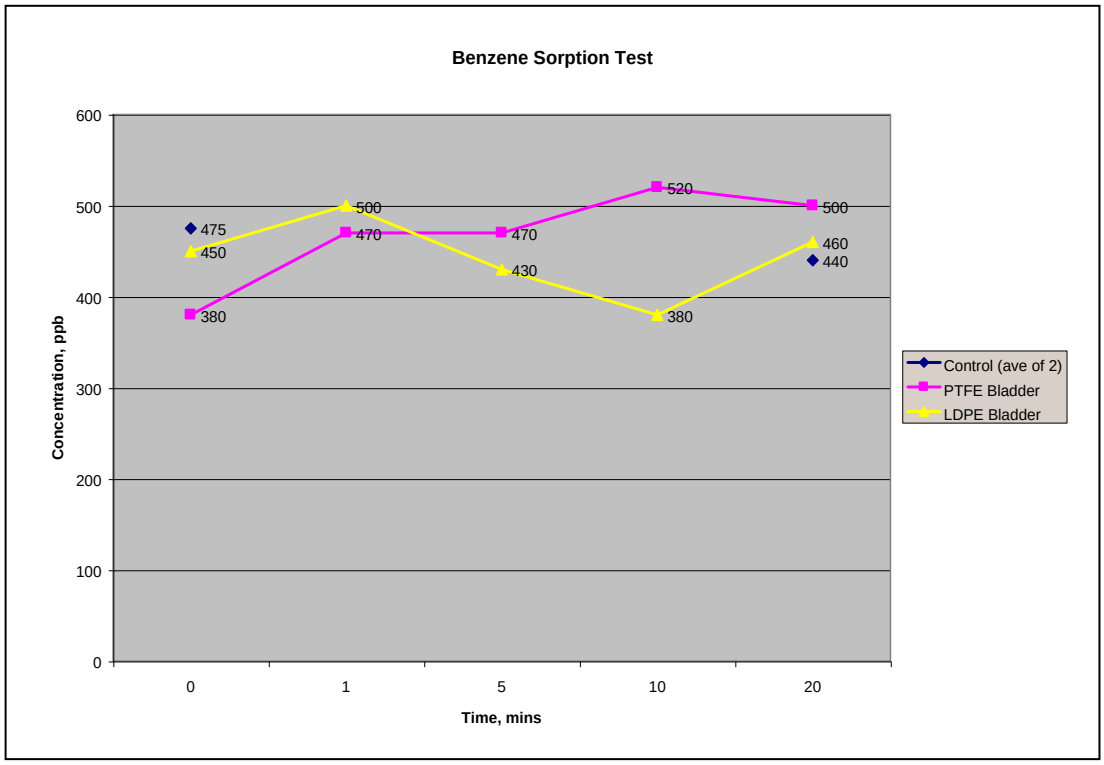

Figure 2 – Test results of Bladder Testing for Sorption – TCE