Terpene Adsorption Analysis in Tedlar® Air Sampling Bags

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Tedlar® air sampling bags, which are composed of a polyvinyl fluoride polymer, are the EPA recommended bags used in several whole-air sampling and analytical methods for determining the presence of volatiles. Recent studies suggest that compounds which exhibit hydrogen bonding, as well as those that have a low vapor pressure, will tend to adsorb to the Tedlar® bags at a high rate. Furthermore, alkenes seem to display significant adsorption rates. For example, terpenes are a type of volatile organic compound (VOC) which contain the alkene functional group, and are found in oils produced by plants and some insects. In the current experiment, the adsorption rates of three specific terpenes introduced into Tedlar® bags were analyzed. The terpenes in question are alloaromadendrene (MF: $C_{15}H_{24}$, MW: 204.36 g/mol, VP: 0.023 mm/Hg @ 25.00°C), caryophyllene (MF: $C_{15}H_{24}$, MW: 204.36 g/mol, VP: 0.013 mm/Hg @ 25.00°C), and limonene (MF: $C_{10}H_{16,}$ MW: 136.24 g/mol, VP: 1.980 mm/Hg @ 25.00°C), which are cyclic and contain multiple alkenes. After the introduction of the three compounds into each of five Tedlar® bags, an air sample of each bag was collected and analyzed daily using gas chromatography-mass spectroscopy (GC-MS). The results show that after a period of equilibration, caryophyllene and alloraromadendrene showed a steady decrease in presence by the fourth day, whereas limonene, a smaller molecule, seemed to increase in the bag, suggesting that larger molecules, such as caryophyllene and alloaromadendrene, which also contain lower vapor pressures, are adsorbing at a faster rate than that of the smaller limonene. These findings give insight as to how certain experiments may be influenced by equipment used, and provides information on how to accommodate for these sources of potential error. Further research

regarding the experiment will include a desorption study, which may aid in identifying the affinity of certain compounds to the Tedlar® bag, and provide information on the feasibility of reusing bags for terpene analysis.