

Development of Air Filtration Systems for 3D Printers

Diatomix’s patented air filtration media (AFM) is designed to adsorb and degrade VOCs into harmless byproducts such as carbon dioxide and water. 3D printers are an exciting and fast-growing technology that is becoming more present in workplaces, schools, and homes, often operating in unventilated areas. This document is designed to explain the need for air filtration with this technology and the advantages of using Diatomix AFM over other VOC mitigating alternatives.

3D printing with ABS or PLA filaments releases unhealthy amounts of styrene, aldehydes, and other harmful VOCs into the air. Diatomix AFM is specifically designed to adsorb these VOCs quickly and then destroy them using 405 nm LED light, keeping the filter from saturating over time.

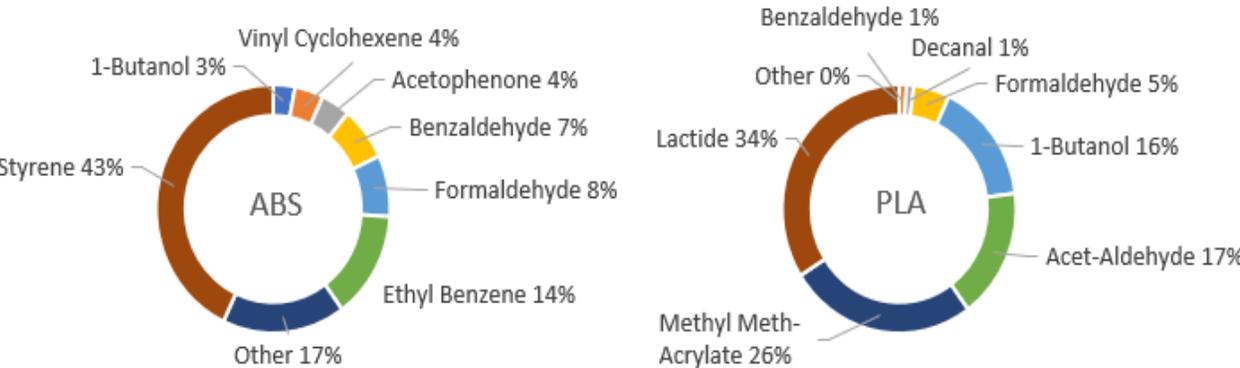


Figure 1 Composition of gaseous emissions from 3D printing with ABS and PLA filaments. Values courtesy of USEPA web. “Characterization of Particle and Chemical Emissions from 3D Printers.”

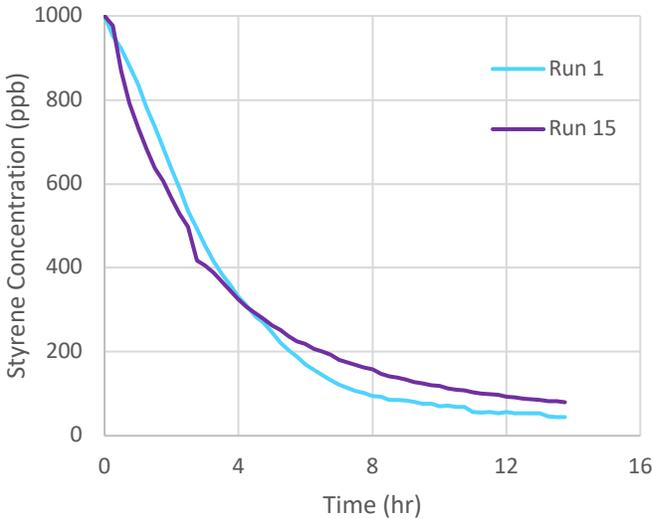


Figure 2 Repeat 1000 ppb styrene removal testing with Diatomix AFM prototype.

The popular benchmark testing toy, 3DBenchy requires 1.5 hours printing time and 10.9 g of ABS filament equating to approximately 327 µg styrene emission. Diatomix prototype filter can remove styrene at a rate of 4 mg per hour, that’s over 18 times faster than the rate of off gassing during the 3DBenchy print!

Diatomix has tested 15 repeat injections of 1000 ppb styrene (that’s over 1500 3DBenchys’ worth) against our prototype AFM filter in a 250 ft³ glass testing chamber as a representation of 3D printing emissions with extensive use. After 15 runs, the AFM system still destroys styrene at a comparable rate.

Diatomix printed 3DBenchy with a Prusa Mini+ 3D printer using ABS filament with and without a Diatomix prototype AFM filter in our 250 ft³ glass testing chamber. TVOC levels reached 150 ppb without the prototype and only 60 ppb with the prototype. In addition, the air in the chamber nearly returns to normal after just 2.5 hours once the print finished with the prototype filter while after 17 hours without the filter, levels are still above 60%. This clearly shows the benefits to using this technology for the 3D printer market.

Other photocatalytic filters rely on recirculation through a system, meaning harmful byproducts can be released into the air you breathe before reentering that system. Activated carbon systems rely solely on adsorption to clean air, this allows for filters to become saturated quickly, in addition, VOCs can release back into the air when ambient concentrations are low. Diatomix AFM adsorbs as it destroys, allowing the system to completely degrade VOCs before they can be reintroduced into the air.

Diatomix can produce prototype air filters to treat 3D printer off-gassing in a variety of form factors. We are looking for a partner to help us design and test air filters for home 3D printer enthusiasts. Our ideal partner would be able to test multiple configurations of the air filter system to optimize a solution and offer this solution along with 3D printers to consumers.

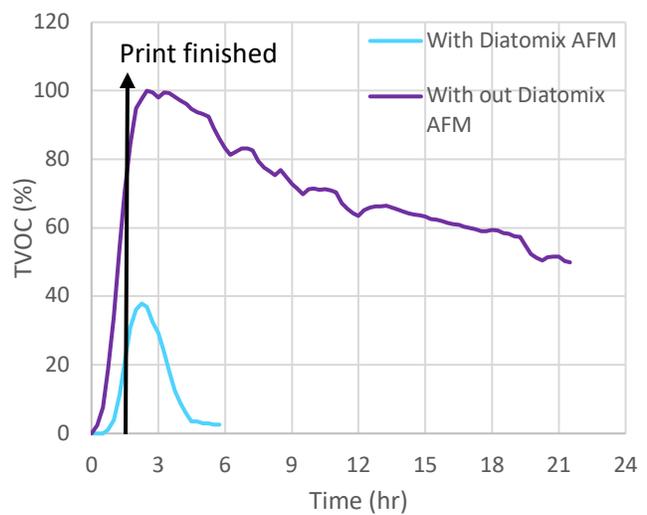


Figure 3 TVOC of a 3DBenchy print with and without Diatomix prototype AFM filter