Improving Indoor Air Quality through Botanical Air Filtration in Energy Efficient Residences

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Dan Newkirk is a Graduate Research Assistant at Purdue University working in the Applied Energy Lab. He received his Bachelors of Science in Mechanical Engineering from Iowa State University in 2012 and has since held internships with the Iowa DNR and Purdue's facilities department doing energy engineering. Funded by the EPA and an ASHRAE Innovative Research Grant, at the end of the month his research will be on display in Washington, D.C. as part of the EPA P3 sustainable design competition. Dan has accepted a position in Champaign, IL with Alpha Controls and Services where he will be working full time as an Energy Solutions Engineer beginning in June.

Abstract

According to the U.S. EPA, Americans spend 90 percent of their time indoors where indoor air is two to five times more polluted than outdoor air. Toxins in the built environment have been found to cause adverse physical and mental health effects on occupants and are estimated to cost the U.S. 125 billion dollar annually in lost productivity. As society attempts to reduce its energy consumption and avoid changes in the climate, energy efficient residences will become increasingly popular. Unfortunately these residences are sealed to reduce air leakage, which also decreases their natural ventilation. This can lead to problems in indoor air quality, and the typical solution of mechanically ventilating the residence is often energy intensive. Instead, it is proposed to "close the loop" on the system and filter the air naturally through the process of botanical air filtration. The purpose of this study was to evaluate the impact of a botanical air filter on an energy efficient residence. The botanical air filter was designed and placed in an environmental chamber where temperature, relative humidity and toxin levels were monitored. A known amount of contaminant was introduced in to the chamber, with its decay monitored both with and without the filter. It was found that botanical air filters can have a positive impact on indoor air quality and also reduce energy use in energy efficient residences.