Comparative Analysis of the Mitigation and Emission Rates of Volatile Organic Compounds (VOCs) of Various Ornamental Plants Using a Monitored Environment

Joseph, Patricia (School: Engineering and Science University Magnet School)

Poor ventilation and sub-par construction methods cause the proliferation of indoor air pollution, especially in lower-income nations. Specifically, volatile organic compounds (VOCs) pose a great threat to human health as long-term exposure and inhalation cause cardiovascular and respiratory diseases. VOCs react with nitrogen oxides (NOx) and carbon monoxide (CO) to form ozone, notable greenhouse gas and the main component of smog. Ornamental houseplants have great potential as an economic solution for reducing pollutants; however, such properties prove to be nuanced as plants also emit VOCs naturally. This project aims to conduct a macro-analysis by considering both the mitigation and emission rates of three species: the Peace Lily, D. Marginata, and S. Trifasciata. It was hypothesized that the S. wallisii would emit more VOCs during the emission phase, whereas the S. trifasciata would have greater mitigatory effects due to its large surface area per leaf ratio. An Arduino-programmed SGP30 sensor and self-made carbon filter was used to accurately measure the total VOC. An aerosol paint with high concentrations of acetone, xylene, and ethylbenzene was sprayed during the mitigation phase spiking levels to 60,000 ppb consistently. During emissions, the S. trifasciata produced the most VOCs as peaks reached ± 250 ppb, while the S. wallisii emitted < 100 ppb and the D. marginata emitted < 40 ppb with cyclical rates. The S. trifasciata had the highest mitigation rates and reduced 60,000 ppb in 16 ft^3 to acceptable levels in approximately 28 minutes, accepting the aforementioned hypothesis.