



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Chung Jui Yu	Project Number 31351
Project Title Mapping the Time-Averaged Distribution of Combustion-Derived Air Pollutants in the San Francisco Bay Area	
Objectives/Goals Urban air pollution is an ongoing and complicated problem for both residents and policy makers. One particular class of organic air pollutants known as polycyclic aromatic hydrocarbons (PAHs) and their derivatives are well-studied carcinogens that have been associated with numerous health problems. The purpose of this study was to: 1) provide insight to the interaction of PAHs with tree leaves; 2) develop a method to quantitatively measure the concentration of PAHs in widely distributed tree leaves in the Bay Area; 3) generate maps of the pollutant distribution and compare my results with those done in past studies. Abstract Urban air pollution is an ongoing and complicated problem for both residents and policy makers. One particular class of organic air pollutants known as polycyclic aromatic hydrocarbons (PAHs) and their derivatives are well-studied carcinogens that have been associated with numerous health problems. The purpose of this study was to: 1) provide insight to the interaction of PAHs with tree leaves; 2) develop a method to quantitatively measure the concentration of PAHs in widely distributed tree leaves in the Bay Area; 3) generate maps of the pollutant distribution and compare my results with those done in past studies. Methods/Materials Shade leaves of Quercus agrifolia and Sequoia sempervirens were sampled throughout the Bay Area. PAHs and other plant material extracted using dichloromethane (DCM) and concentrated using the rotary evaporator. Short column silica gel chromatography was employed to isolate the PAHs from the plant material, and samples were analyzed using the gas-chromatography mass spectrometry (GCMS) for quantitative analysis. The program ARCGIS was used to generate the maps of my data. Results From my microcosm, there is a relationship between the initial accumulation rate and the vapor air concentration of the PAHs in the various substrates, which provides a foundation towards the understanding of PAH accumulation based on its vapor pressure in the atmosphere. Comparing redwood and oak PAH concentrations, differing accumulation patterns suggest species specific factors that influence the uptake of PAHs. A study done on PAH concentrations of redwood and oak in the same locality reveal the numerous factors influencing accumulation of PAHs and a relationship is generated to eliminate these factors. This relationship was used to convert oak concentrations into redwood equivalents and was integrated into redwood maps of the Bay Area. The magnitude of the signals corresponds to their proximity to pollutant sources. Differing distributions of the PAHs can be observed. Conclusions/Discussion Tree leaves demonstrate the capability to monitor PAHs in the atmosphere and map the heterogeneity of the PAH distributions over a given area. Further research towards the development of equilibrium models can provide a more accurate representation of regional air pollutant concentrations. This study provides the foundation for the application of leaves as inexpensive high-resolution air pollutant monitors.	
Summary Statement A study on the interaction of PAHs with leaf wax and the potential for leaves to monitor the distribution of air pollutants in the Bay Area.	
Help Received Used lab equipment at Stanford University under the supervision of Dr. David A. Zinniker and Professor Michael J. Moldowan.	