

## **Combinatorial optimization algorithms for source apportionment of PM2.5 on Teflon filters**

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The World Health Organization estimates 2 million early deaths per year are due to the effects of ambient air pollution. PM2.5 (fine particulate with diameter less than 2.5 microns) is of interest, as these particles can pass through to the lungs and cause chronic respiratory diseases. Such particles are also of interest due to their radiative forcings. They are thought to play a role in climate change and microclimate phenomena. These particles have variable toxicologies and radiative forcings, and the literature clearly highlights the need to distinguish between species. A non-destructive technique for source apportionment with increased specificity is desired. This is a rewarding research area, as many studies have already collected sets of filters, which remain in archive. This study seeks to develop an optical measurement method for source apportionment of PM2.5 on Teflon filters based on end-member optimization. End-member standards explored to date are: kerosene soot (for BC), environmental tobacco smoke (ETS), ammonium sulfate, and three iron oxides (goethite, hematite, and magnetite). The portion of the project treated here is the employment of an optimization algorithm for data analysis. The algorithm employs a full-field approach, avoiding issues arising from local minima. In its application, the algorithm shows that fitting data at four wavelengths (as has been previously studied) proves to be sufficient beyond two end-member standards, but these four wavelengths must be chosen carefully. In processing clinical data, the method shows preliminary success, finding statistically significant different mean ETS filter loadings in households with and without smokers. It is also found that the iron oxide end-members explored generally exist below this method's possible detection levels in U.S. urban environments.