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Particulate matter pollution in Bogotá: research opportunities and needs

Although particulate matter is perhaps the most relevant of air pollutants regarding public health, and the pollutant with the highest number of annual air-quality-standard exceedance days in Bogota, the state of research on particulate matter is still incipient. Researchers from four universities have identified research opportunities and started research work on particulate matter from several points of view, including particulate matter concentration measurement, chemical characterisation, association to morbidity, personal exposure, among others. One of the most interesting aspects of this research work is related to changes in transportation that have been taking place in the city since 2000. From a poorly organised “conventional” bus transportation system, Bogota is moving towards a Rapid Bus Transit (RBT) system called *Transmilenio*, consisting of exclusive bus lanes, high quality vehicles and passenger amenities, among other features. The buses used in this system are equipped with Euro-II and Euro-III engines and Diesel Oxidation Catalysts (DOC). However, the high-sulphur diesel (1100 ppm S) used in Bogota is not the most appropriate fuel for these engines, and high particulate matter emissions still occur as a result.

In the first stage of the project, roadside measurements of particulate matter concentration and size distribution were made at three sampling sites: one for each type of transportation system, and a “clean air” site. A three-stage cascade impactor was used. The results showed a 2:1 ratio between PM₁₀ at the conventional transport site and PM₁₀ at the RBT site. A similar result was found for PM_{2.5}.

A second stage of the project is a two-year study that started in March 2006. The study is a natural experiment that will find relationships between the change in transportation system, air pollutant concentrations and health indicators in children attending schools built by the roads chosen for the study. Particulate matter concentrations and health indicators will be determined before, during and after the road transformation from a conventional to an RBT road.

For this stage of the project, two portable laser photometers (Dusttrak, TSI – One for PM_{2.5} and one for PM₁₀), one portable dual-beam aethalometer (Magee Scientific) have been acquired. Five Harvard impactors and one high-volume PM₁₀ sampler will also be used to measure PM concentrations.

A third stage of the project consists of the complete PM chemical characterisation and the application of source contribution models. In a preliminary stage, the concentrations of nitrates, sulphates, 6 metals, and several hydrocarbon species have been determined. However, a complete chemical characterisation of a single PM sample has not been achieved. PM measurements, chemical characterisation and the application of source contribution models in Bogota still needs to be very much improved, and the participation of international research groups as our partners in this project, is strongly encouraged.

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