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Physical and Chemical Morphology of Organic Compounds at PM10 by TEM-EDS and GC-SM

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Air pollution represents one of the main problems for the environment and public health in the world. This phenomenon is mostly associated with anthropogenic activities such as industrialization and the increase in vehicular traffic. In turn, air pollution is one of the most difficult problems to understand, assess, regulate and control, this is due to the large number and variety of emission sources, the dilution and/or transformation of pollutants in the atmosphere and the effects of pollutants on human health and ecosystems. [3]

Airborne particulate matter (PM) is not a single pollutant, but rather is a mixture of many chemical species. It is a complex mixture of solids and aerosols composed of small droplets of liquid, dry solid fragments, and solid cores with liquid coatings. Particles vary widely in size, shape and chemical composition, and may contain inorganic ions, metallic compounds, elemental carbon, organic compounds, and compounds from the earth's crust. Particles are defined by their diameter for air quality regulatory purposes. Those with a diameter of 10 microns or less (PM10) are inhalable into the lungs and can induce adverse health effects. [2]

Transmission Electron Microscope (TEM) is considered the most reliable equipment for studying of inorganic particles that can be found in our atmosphere, thus, in direct contact with population TEM can provide detailed information on the sizes, compositions, morphologies, structures, and mixing states of individual aerosol particles; and where, gas chromatography is an effective technique for the separation and analysis of the mixtures of organic compounds in the samples to be analized. [4]

The aim of the present study is to examine the morphology and elemental chemical composition of organic particles in PM10 samples as part of an air quality study performed by TEM-EDS and GC-MS.

The PM10 particles was collected by high-volume sampler, using a sampling flow of 1.3 m3/min. Sampling was carried for 24-h one day a week. Analysis of PM10 were performed using Transmission electron microscopy coupled with energy dispersive spectrometer, for determination of morphology and elemental composition of airborne particles. Specimens were processed by separating the collected particles from the quartz filters by means of submersing a 2 cm2 section of each filter into isopropilic alcohol within a test tube for 5 minutes. Then, an aliquot of the suspension was placed over a sample holder, and is introduced into the chamber of TEM.. For the analysis of organic compounds, an Agilent Model 6890N Gas Chromatograph coupled to Mass Spectrometry (GC-MS) was used. 50% of the filter is introduced into an extraction thimble which is placed inside the extraction tube, mounting it on the flask and the condenser tube, Dichloromethane was added to the flask through the mouth of the condenser was refluxed for 6 hours. The analysis of each compound was carried out individually by

coinciding with the database used by the software, to carry out this identification the baseline subtraction method is carried out for better identification.

In the transmission electron microscope, the image of the PM10 particle is observed, in which organic particles smaller than 1 micron adhere. (figure 1)

The image obtained from the TEM shows us a solid, irregularly shaped particle to which a variety of organic compounds are adhered, with a spherical morphology and a size of less than 0.2 microns; whose analysis in GC-Ms identify the following compounds Phenol, 3-(1,1-dimethylethyl)-4-methoxy, 2,6-bis(1,1(dimethylethyl)-4-(oxypropyl)phenol and Diisobutyl phthalate

The first two belong to the phenol group and the third is a phthalate. the compounds of the phenol group become remarkably important due to their toxicity and persistence. Its presence in the environment is a consequence of both natural actions and anthropogenic contributions, mainly of an agricultural and industrial nature. The release of phthalates into the natural environment can occur during their production or during the manufacturing of plastic materials. Many building materials contain significant amounts of phthalates, and inhalation of these compounds may be one of the main sources of exposure in humans.

Therefore, the existing synergy between the size of the particles, PM10 and organic, facilitate their entry into the respiratory system; and increase its damage to the health of the population.

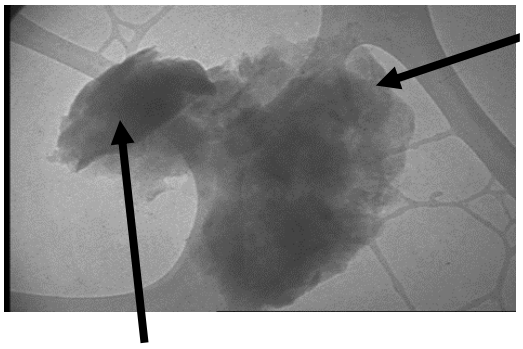

Figure 1. Particulate matter by TEM

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