

## Natural and Anthropogenic contributions to PM<sub>10</sub> in the L'Alacantí region in the South-East of Spain.

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This work is an estimation of the main sources contributing to PM<sub>10</sub> in L'Alacantí region, covering a long period (2004 to 2006) and a dataset of 173 samples. The region of L'Alacantí has, at national level, an important production of cement and ceramic, due in part to the presence of important reservoirs of clays, gypsum, and calcareous rocks also derived and related activities: quarries, grinding, transport, construction are present. These activities together with the condition of being an arid area (rain < 300 mm/yr) play an important role on atmospheric particulate matter intrusions.

The sampling has been done at the University of Alicante, which is situated in between the growing residential areas of two main cities in the L'Alacantí region, Alicante and San Vicente. The area is opened to the Mediterranean Sea (East) and surrounded by mountains in the other directions (from S to N) forming a basin. Mild climatology, long periods without complete renovation of air mass, favours the accumulation of local emissions and the development of episodes of regional contamination.

The analysis of NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>-2</sup>, and Cl<sup>-</sup> were made by ionic chromatography on water extracts of a quarter of the fibre quartz filters. NH<sub>4</sub><sup>+</sup> was analysed in water extracts by indophenol method. For the metal analysis half of the filter was digested using an acidic oxidant digestion (HNO<sub>3</sub> (65%) + H<sub>2</sub>O<sub>2</sub> (30%)) on a microwave oven reaching high temperature (170°C) and analysed by ICP-Mass spectrometry. C was determined directly on the filters by a LECO CN analyser. SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> were calculated according to the equations described in Querol et al. (2002).

In the factor analysis performed on the dataset five factors (with factor loadings =>0.5) were found. The first factor has as main tracers SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Mn, Fe, Mg, Sr, Ca, Ba and Zn. This suggests a mineral origin of the atmospheric particles, probably originated from natural sources (regional-scale re-suspension and African Outbreaks). The second factor represents a traffic source (traced by Mo, Sb, Cu, Pb, Cr). Cu is a known tracer of break-wear and carbonaceous particles are tracers of exhaust emissions (mostly diesel). The tracers of the third factor are V, Ni, Tl and K. V, Ni are generally known as tracers for oil combustion emissions and Tl and K are tracers for cement compounds. Hereby this factor suggests cement plant emissions as the underlying PM source. In factor 4, SO<sub>4</sub><sup>-2</sup>, NH<sub>4</sub><sup>+</sup> and NO<sub>3</sub><sup>-</sup>

suggests that this source was associated with secondary aerosols and regional or long-range air mass transport, given the prolonged atmospheric residence time of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>. Furthermore, secondary aerosols may also originate from local NO<sub>x</sub> and SO<sub>2</sub> from industry or traffic on a city scale (regional-scale). Finally, the last factor may be easily identified as sea salt with Cl<sup>-</sup> and Na<sup>+</sup> as main tracers.

Quantification of the contributions to PM<sub>10</sub> of the sources described above was carried out by means of MLRA. A good correspondence was achieved between the modelled and the gravimetric PM<sub>10</sub> results with R<sup>2</sup> value >0.85. Mineral source constitutes the major source of PM<sub>10</sub> with a 41.5% (18.63 µg/m<sup>3</sup>) of the PM<sub>10</sub> mass. Industrial combustion contribution represents the second highest PM<sub>10</sub> fraction with a percentage of 14.79% (6.64 µg/m<sup>3</sup>). The traffic source accounted for 12% of the PM<sub>10</sub> mass with 5.38 µg/m<sup>3</sup>. The secondary aerosol source constitutes only 4.41 % (~2 µg/m<sup>3</sup>) of the mass due to the selection of the days explained above. Finally, sea-salt accounted for 2.71% the mass (~1.22 µg/m<sup>3</sup>) (Figure 1).

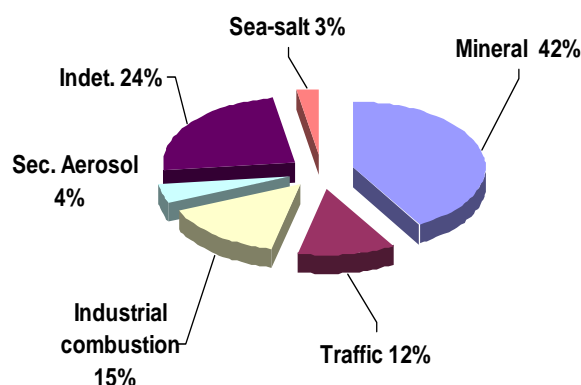


Figure 1. Quantification of the contributions to PM<sub>10</sub> of the sources by means of MLRA.

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Querol, X., Alastuey, A., De la Rosa, J., Sánchez de la Campa, A., Plana, F., Ruiz, C. (2002). Source apportionment analysis of atmospheric particulates in an industrialised urban site in southwestern Spain. *Atmospheric Environment* 36, 3113-3125.