

High Resolution Mass Spectrometry of Seasonal Aerosol Samples From an Urban Location in the Italian Po Valley

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The Po Valley in Northern Italy represents one of the most polluted environments in Europe, with PM_{2.5} and ozone concentrations regularly exceeding 100 μ g/m³ and 50ppb respectively. Particularly during winter, prolonged inversion conditions together with biomass burning and anthropogenic emissions regularly lead to severe air pollution events.

Over the course of several months in 2013-14, we carried out a sampling program at a city-centre site in Padova, Italy, collecting 24-hour high-volume aerosol filter samples, 18 in winter (mid December - mid March) and 20 in summer (late May - late July). Utilising high-resolution Orbitrap mass spectrometry techniques, we have characterised these sample sets to examine the long-term variation in aerosol composition over the sampling campaign and to determine the effect of anthropogenic gaseous pollutants such as NO_x and SO₂ on the composition of organic particle components.

The results showed that between ca. 450-700 ions were measured in each sample in both the summer and winter sample sets, however the majority (90%) of ions in the winter samples were below 300m/z and below 380m/z in the summer samples. A much higher percentage of CHO-only ions were found in winter (ca. 27%) compared to the summer samples (ca. 6%), indicating a higher degree of photochemical reactions taking place involving pollutants such as NO_x and SO₂ in summer.

Our results represent the first long term data set of high-resolution measurements of aerosol composition and demonstrate that this technique is an important tool in evaluating the composition of aerosol particles in complex polluted urban areas.