Preliminary results on the characterisation of organic aerosols in urban schools by Aerosol Mass Spectrometry

L. Crilley, G. A. Ayoko, E.R. Jayaratne, L. Morawska

International Laboratory for Air Quality and Health, Queensland University of Technology, Brisbane, QLD, 4001, Australia
Keywords: Vehicle emissions, Schools, Organic aerosols
Presenting author email: leigh.crilley@qut.edu.au

Vehicle emissions have been linked to detrimental health effects with children thought to be more susceptible (See e.g., Ryan et al 2005). In an urban environment a major source of organic aerosols (OA) are vehicle emissions. The ambient concentration of OA is dynamic in nature and the use of an aerosol mass spectrometer can achieve the necessary temporal resolution to capture the daily variation of OA (Jimenez et al 2009). Currently there is a limited understanding of effects of long term exposure to traffic emissions on children's health. In the present study, we used an aerosol mass spectrometer to monitor OA and determine children's potential exposure at school to traffic emissions.In this paper, we present the preliminary results of this investigation. The study is a part of a larger project aimed at gaining a holistic picture of the exposure of children to traffic related pollutants, known as UPTECH (www.ilaqh.qut.edu.au/Misc/UPTECH%20Home.htm).

A compact time-of-flight aerosol mass spectrometer (AMS) was operated at four schools in different suburbs in Brisbane, Australia (S01, S04, S11 and S12). The AMS was housed within a classroom and the outdoor air was sampled using a minimum length of tubing. Sampling was carried out for 2 weeks at S01, S11 and S12 and for 3 weeks at S04. Sampling interval was 5 minutes alternating equally between PTOF and MS modes. The AMS was calibrated for ion efficiency (IE) and particle size at the beginning of the sampling and the IE calibrations also done in the middle and at the end of sampling. AMS data analysis was conducted using the standard software (Squirrel v1.51 in IGOR Pro v6.22).

The average diurnal variation of the total organic concentration for each school was determined. In general during school hours (9am – 3pm) the concentrations were lower compared to the rest of the day at all four schools. Peaks in the concentration of OA were observed in the morning around 6-8am and in the evening around 8pm at each school with varying intensities.

The diurnal variation observed at S04 (Figure 1) and S11 showed a large peak in morning and a smaller peak in the evening. The morning peak would suggest a traffic influence as it coincides with peak morning traffic. The average mass spectrum at this time for both schools more resembled the hydrocarbon-like organic aerosol (HOA) as described in Ng et al (2010). However, the m/z 44 was found to have a mass similar to that for m/z 41 and 43, which meant that the aerosols were partially oxidised and so were not fresh traffic emissions. Notably, there was no peak observed at around 5-6pm as would be expected due to peak evening traffic. Instead the evening peak was observed later and with different oxidation levels. At S04 it had a similar spectrum to the morning peak, which further suggests that this was due to slightly aged traffic emissions. At S11 the spectra was more like low-volatility oxygenated organic aerosols (LV-OOA) (Ng et al. 2010) meaning that this peak can be attributed to an increase in aged and highly oxidised OA concentration.

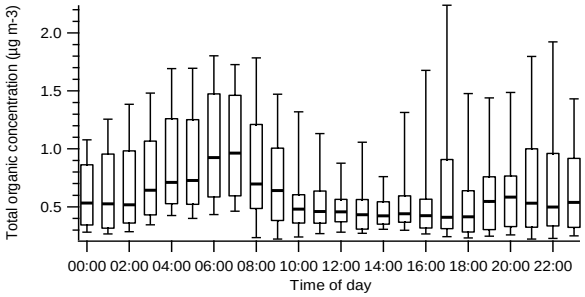

Figure 1: Average diurnal variation of total organic concentrations for S04.

In S12 the dominant peak was in the evening and these OA were LV-OOA in nature and so were highly aged and oxidised. The presence of m/z 60 and 73, which are attributed to levoglucosan, a marker for biomass burning (Ng et al 2011) means that the origin was biomass burning. At S01, there was little variation observed apart from a very large peak that was observed at 7am and we suspect that this was due to the use of fuel powered gardening equipment, possibly a leaf blower at the school.

At each school the lowest concentrations of OA were observed during school hours with peaks associated with traffic occurring outside school hours, which would indicate that, at these schools, children had limited direct exposure to traffic emissions during the sampling period.

The authors would like to acknowledge all the members of the UPTECH team, especially Dr Mandana Mazaheri. This work was supported by the Australian Research Council, Department of Transport and Main Roads (DTMR) and Department of Education, Training and the Arts (DETA) through Linkage Grant LP0990134.

Jimenez, J.L., et al., (2009) *Science*, 326, 1525-1529.

Ng, N.L., et al., (2010) *Atmos. Chem. Phys.*, 10, 4625-4641.

Ng, N.L., et al., (2011) *Environ. Sci. Technol.*, 45, 910-916.

Ryan, P.H., et al., (2005) *J Allergy Clin Immunol*, 116, 279-284.