Seasonal variation of urban aerosols in a sub-Saharan city: case study of Nairobi, Kenya

S.M. Gaita[1], J. Boman[1], J.B.C. Pettersson[1], M.J. Gatari[2] and S. Janhäll[3]

[1]Department of Chemistry and Molecular Biology, University of Gothenburg, SE-412 96, Göteborg, Sweden
[2]Institute of Nuclear Science and Technology, University of Nairobi, P. O. Box 30197-00100, Nairobi, Kenya
[3]Swedish National Road and Transport Research Institute – VTI, P.O. Box 8072, SE-402 78, Göteborg, Sweden

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Presenting author´s email: samuel.gaita@chem.gu.se

Seasonal variation of urban aerosols is poorly understood in sub-Saharan Africa due to lack of long-term measurement data. Available scientific information is usually based on short term measurement campaigns (e.g. Gatari and Boman, 2003; Kinney *et al.*, 2010). This predicament is further compounded by the fact that sub-Saharan cities are characterised by lack of long-term air pollution monitoring strategies and concrete policies on air quality and climate change, (UN, 2013).

In the view of the above, measurements of airborne fine particles (equivalent aerodynamic diameter < 2.5 µm, $PM_{2.5}$) were carried out from April, 2008 to May, 2010. The main objective was to get a better understanding of physical and chemical properties of Nairobi aerosol based on long-term measurement data. Observations would then be linked to perceived aerosol sources (local and regional) especially anthropogenic activities within the metropolitan area and their effects on urban air quality and local micro-climate.

Sampling was carried out at two sites within Nairobi metropolitan area. One site was at University of Nairobi main campus (UoN) and the other at the United Nation Environmental Programme (UNEP) headquarters, 5 km to the north of UoN site.

$PM_{2.5}$ samples were collected on pre-weighed polycarbonate filters using cyclone samplers for 24 h, per sample, at a flow rate of 3 L/min, except on weekend when samples were collected for 48 h. At the UoN site, a cyclone sampler was placed 17 m above the ground (agd), on the rooftop of Engineering building. This site being close to the central business district was a good representation of an urban background setting. At the UNEP site, a cyclone sampler placed on the rooftop of Urban Environment Unit offices, 10 m agd.

Particulate mass were determined using a Mettler Toledo TM5 microbalance, BC concentration using a black smoke detector (FH62 1-N) whereas elemental concentrations were analysed using an Energy Dispersive X-ray Fluorescence (EDXRF) spectrometer.

Results presented here are from the UoN site. Observed trend in $PM_{2.5}$ mass concentration (Figure 1), followed the normal rainfall pattern experienced in Kenya. Two troughs were observed and they coincided with two rainy seasons (long rains; March to May, Julian days 75 to 135: short rains; October to early December, Julian days 268 to 329). Importantly, higher concentrations were observed in 2009 due to draught that was being experienced in the country. WHO 24 h guideline limit of 25 µg/m^3 for $PM_{2.5}$ was frequently exceeded in 2009. This highlights the influence of natural phenomenon to air pollution monitoring. Results from elemental concentrations analysis and Positive Matrix Factorisation will be presented on the poster.

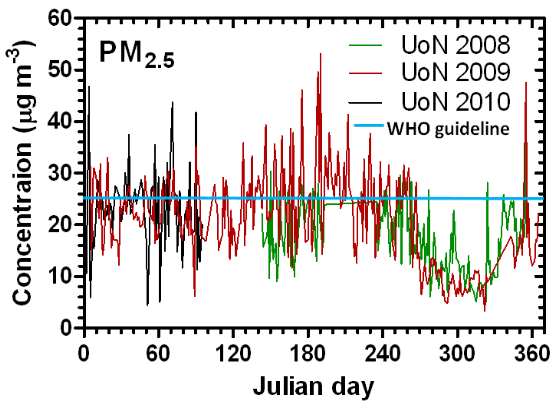

Figure 1: Seasonal variation of $PM_{2.5}$ sampled in Nairobi, Kenya.

In conclusion, it is worth noting that seasonal variation is evident in Nairobi city despite the unpredictability of the weather as experienced in 2009 when rainfall pattern became erratic. This observed variation can be exploited for modelling purposes as a way of planning for mitigation strategies to counteract the effects of aerosols on human health and local climate.

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