Characterization of Carbonaceous Materials in PM2.5 and PM10 size Fractions during 2006 wet season campaign in Morogoro, Tanzania

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Introduction

Carbonaceous materials account for a large fraction of atmospheric aerosols. They consist of elemental carbon and a complex mixture of numerous organic compounds. While elemental carbon is derived only from combustion processes, organic carbon is produced by both primary and secondary sources. Anthropogenic activities are the major sources for elemental carbon whereas organic carbon, in addition, has significant natural biogenic source. Carbonaceous aerosols have significant effects on global and regional climates, and adverse effects on human health and local environments [1]. A few investigations have been reported in Africa and particularly in Tanzania [2,3]. The purpose of this study was to determine the mass concentrations of the PM and the carbonaceous aerosol components for the PM2.5 and PM10 size fractions.

Results and discussion

The mean concentrations (and concentration ranges) for the PM10 and PM2.5 mass and the carbonaceous species for the 2006 wet season campaign at Morogoro are given in Table 2. When comparing our results with the few available other data sets for rural sites in East and Southern Africa, the levels of the PM10 mass and carbonaceous species in Morogoro are in line or slightly higher than those in reported at the remote site of Rukomechi in northern Zimbabwe [4], and the rural site of Meru in Kenya [5].

Table 2: Mean concentrations and ranges (μg/m^3) in PM10 and PM2.5 at Morogoro.

Size fraction	PM10		PM2.5		PM2.5/PM10	
	Mean	Min-Max	Mean	Min-Max	Mean	Min-Max
PM mass	14	10–28	7.3	1.1-21	0.46	0.17-0.87
TC	5	3.5-7.2	3.2	1.9-7.4	0.61	0.48-0.84
OC	4.5	3.2-6.4	2.8	1.6-6.3	0.59	0.44-0.85
EC	0.52	0.26–0.90	0.45	0.23-1.1	0.85	0.66-1.06
WSOC	1.4	0.86–2.4	1.25	0.66-2.2	0.88	0.53-1.20

The mean mass ratios among the carbonaceous components and the OC/PM and TC/PM mass ratios of the PM10 and PM2.5 samples are shown in Fig. 1. On average, front filter TC accounted for 33% of the PM10 and larger fraction of the OC was water-soluble. The mean EC/TC percentage ratio was 10% which indicate that the carbonaceous aerosol originates mainly from biogenic aerosols and/or biomass burning [6]. For the PM2.5 size fraction, the OC/PM and the WSOC/OC percentage ratios were, on average, 33% and 34%, respectively. The mean EC/TC percentage in PM2.5 was 14%, while the mean percentage of TC was 44%.

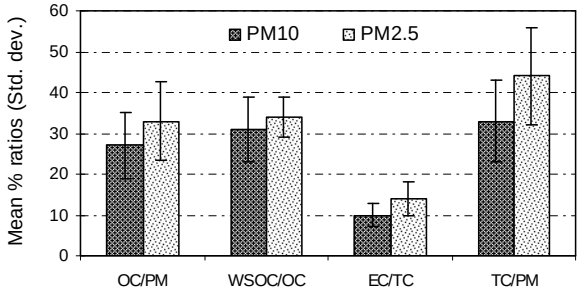

Fig. 1: The mean percentage mass ratios (and associated standard deviations) for the carbonaceous aerosol components of the PM10 and PM2.5 samples from Morogoro.

Conclusion

In this study, the percentage attribution of the mean gravimetric PM10 mass concentration to crustal aerosol components was 32%. A simple source apportionment approach was used and shows on average, 93% of the PM10 OC was attributed to biofuel and 7% to charcoal burning. However, it is suggested that a contribution to the OC at Morogoro could also come from other natural biogenic matter, and/or biomass burning aerosols.

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