

**Assessment of Heavy Metals and Polycyclic Aromatic Hydrocarbons (Pahs) in Air
Particulates on Accra-Tema Motorway in the Greater Accra Region, Ghana**

GODFRED SAFO ADU

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ABSTRACT

Particulate matter with aerodynamic diameter less than 10 μm (PM_{10}), Black Carbon (BC), Polycyclic Aromatic Hydrocarbons (PAHs) and heavy metals (Pb, Zn, Ni, Co, Cd, Cu, V, Mn, Cr, Na, Mg, As, Fe, Ca) concentration levels along the Accra - Tema motorway were assessed in this work. Using IWL sampler and Sierra Anderson (GAST) pump, airborne particulates were sampled on Teflon filters for 28 days, starting from 4th November to 1st December, 2011. Gravimetric analysis was carried out to determine the PM_{10} levels. The average concentration of PM_{10} was 86.97 $\mu\text{g}/\text{m}^3$ (54.86 - 120.64) $\mu\text{g}/\text{m}^3$. The PM_{10} mean value exceeded the WHO and Ghana EPA 24 hours PM_{10} air quality guideline values of 50 and 70 $\mu\text{g}/\text{m}^3$ respectively. The average concentration of BC was 17.82 $\mu\text{g}/\text{m}^3$ (10.63- 17.82) $\mu\text{g}/\text{m}^3$. Black Carbon (BC) contributed 21 % of the PM_{10} particulates in the ambient air. Daily variations were observed for the PM_{10} and BC levels. PM_{10} particulate levels correlated well with vehicular traffic. The PAH concentration levels were determined using Gas Chromatography. Out of the 20 PAHs quantified, 10 of them were human carcinogens and most of them were high molecular weight. The total average PAH level was found to be 809.8 ng/m^3 . Pyrene had the highest mean concentration level of 171.4 ng/m^3 . The molecular diagnostic ratio result showed that petrogenic sources were the possible major PAH pollutant sources on the highway. The levels of metal elements were determined using ICP-AES. The overall order of metal concentration was $\text{Fe} > \text{Ca} > \text{Na} > \text{Mg} > \text{Ni} > \text{Cr} > \text{V} > \text{Zn} > \text{Mn} > \text{Cu} > \text{As} > \text{Pb} > \text{Cd}$ and Co with concentrations 5.60, 4.25, 4.17, 1.34, 0.22, 0.12, 0.10, 0.09, 0.08, 0.07, 0.06, 0.02, 0.01 and 0.01 respectively. The level of Pb was lower than the EPA standard of 0.1 $\mu\text{g}/\text{m}^3$ for Ghana, showing that there is no Pb contamination in the ambient air. The Enrichment Factor (EF) results showed that Mg and Mn were non enriched while Ca, V, Pb, Co and Na were moderately enriched. These elements were from natural sources (crust and sea spray). Cr, Cu, Ni, Zn, As and Cd were enriched, indicating their origin from anthropogenic sources. The Health Risk Assessment using USEPA - Air Quality Index (AQI) shows that PM_{10} levels can

be classified as moderate, and that people with cardiopulmonary diseases, infants and the aged could be affected.

SUPERVISORS

Prof. D. Carboo

Prof. Y. Serfor-Armah

Prof. F.G. Ofofu