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Moss as Indicator of Heavy Metals Pollution in Kano Municipality-Kano Nigeria

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ABSTRACT

Metals accumulation was determined in moss specie funaria *hygrometrica* collected from industrial and neighbouring residential areas of Kano municipality, using atomic absorption spectrometry with air acetylene flame. The areas under study have been modified by increasing industrial activities and extension of road network. The mean concentration of these elements in the areas, ranged between 0.39- 3.06 μgg^{-1} for cadmium, 0.64-4.97 μgg^{-1} for manganese and 7.36-38.51 μgg^{-1} for zinc. The varying concentration of these metals may be due to their prevailing levels in the areas under study.

Keywords: accumulation, *funaria*, heavy metals, moss, spectrophotometer

INTRODUCTION

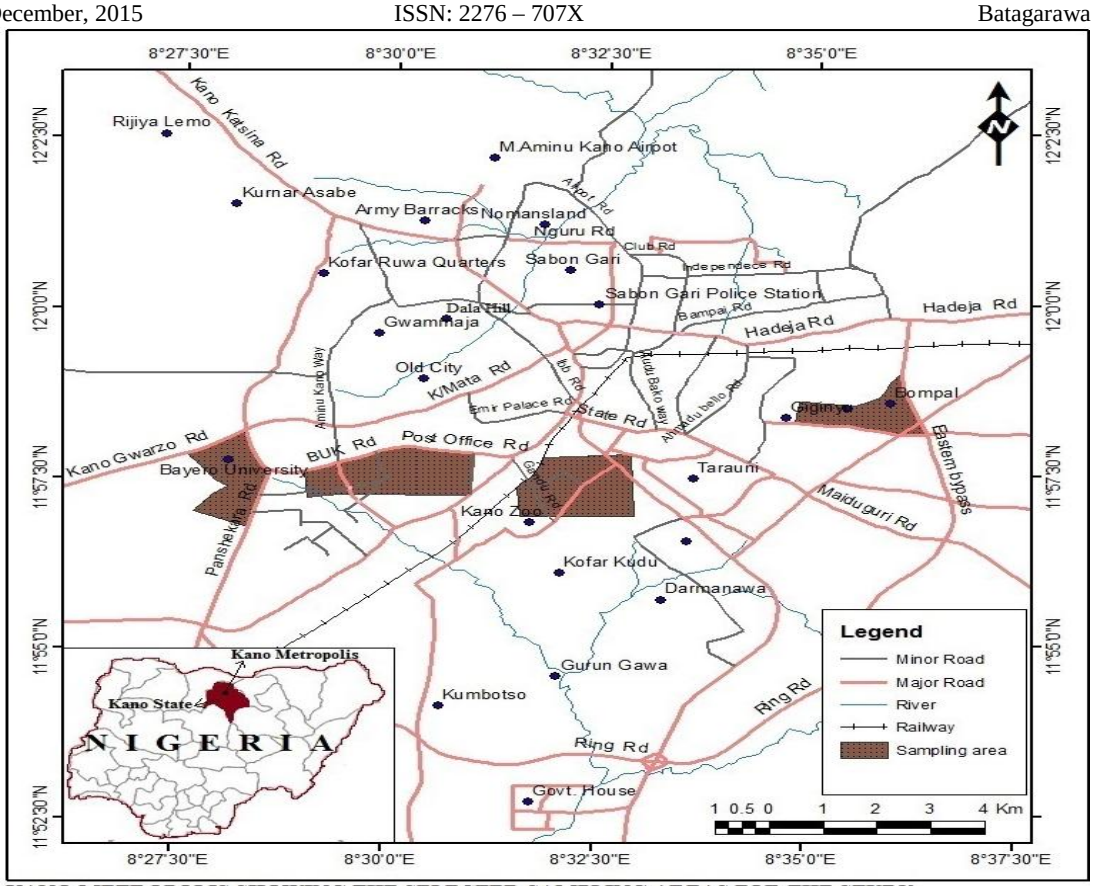
Environmental pollution is one of the main causes of deteriorating living conditions for the inhabitants of densely populated and residential areas in Kano Nigeria. Several ecological effects such as odour from tennaries, heat downstream of some factories and problems of untreated wastes disposal take place in the areas. Determination of trace metal concentration in plants is among the methods of monitoring pollution in the environment. Many studies have shown that, various plants have been used as bioindicators in pollution monitoring. For example, lichens (Herzig *et al*., 1989, Blasco *et al*., 2006, Garty, 1993) coniferous trees (Grozinska, 1984; Huttmen *et al*., 1985; Nourteva, *et al*., 1986, Ayodele and Ahmed 1996). Moss plant has been widely used by many researchers to biomonitor heavy metals pollution in several areas. Fernández, (2000) used moss analysis to study heavy metal deposition in Galicia town of Spain. Steinnes, (1995) studied atmospheric deposition of heavy metals and other trace constituents using naturally occurring moss plant.

The moss specie, funaria *hygrometrica* meets many requirements of a bioindicator plant (Innes and Haron, 2000). The specie is widely distributed, easily identified (Watson, 1986) and has already been used in bio-indicator studies, for example, (Richardson, 1981; Dutta, 1979; Thomas *et al*., 1986; Moevet *et al*., 1986; Ayodele and Batagarawa, 2004)

MATERIALS AND METHOD

Study area

Kano city is located in the south eastern part of Kano state Nigeria in the sudan eco-climatic zone within the longitude of 8° 18'-8° 36' E and latitude 11°16'-11°29'N. The climate of the region is the Sudan Savannah type with an annual rainfall of 900mm, moderate humidity and temperature variation of between 28°-36° C (Olofin, 1979). Fig. 1 below shows the map of Kano metropolis and the sampling sites.



KANO METROPOLIS SHOWING THE SELECTED SAMPLING AREAS FOR THE STUDY.
Source:-NASA/NOAA Spot Image 2000

Fig. 1 Map of Kano Metropolis showing the selected sampling sites

Sampling and Sample treatment

This paper reports the level of Cadmium (Cd), Manganese (Mn) and Zinc (Zn) in moss specie, funaria *hygrometrica*. The samples were obtained from five designated areas namely; Bompai, Sharada, Zoo road, Bayero University Campus and Kano Municipality. Both Sharada and Bompai are parts of Industrial areas of Kano city, while Zoo road, Bayero University Campus and Kano Municipality are considered as residential areas of the City. Twenty samples were collected from each of these sampling areas. Thus, a total of one hundred samples were collected from the five designated areas, and brought to the laboratory for analysis. The metals were determined based on their concentrations in the areas.

The samples were collected on wall buildings, hard ground and back of trees, from the designated areas using a hand shovel. Each collected sample was transferred to a clean polythene bag and was labelled with date and site of collection. The Collections were made between July and September, 1999. At the laboratory, the samples were washed with plenty of water and finally rinsed with distilled water. After drying for 12 hours in an oven, at 100 °C, the plant material was ground to powder, using pestle and mortar. 1.00 g of each sample was weighed into a digester (Mulex A 20) containing 10 cm^3 of a mixture of concentrated HNO_3 and $HClO_4$ in the ratio of 4:1. The sample was digested for 2 hours. The resulting solution was evaporated and re dissolved in 5.00 cm^3 of 0.1M HNO_3 solution. The metal concentrations were determined by Atomic Absorption Spectrophotometer (Buck Scientific Model, 210 VGP) which was equipped with a continuum source background correction. Results are given in $\mu g g^{-1}$ dry mass.

Results and discussion

Table 1 shows the mean concentrations of Cadmium (Cd), Manganese (Mn) and Zinc (Zn) in the study areas. The results showed variation in the concentration of the metals at different sampling sites. This indicated that, the dissolved form of the metals is differently available to the plant. The mean concentration of the metals studied are in the order; Zn > Mn > Cd. Similar pattern of results have also been reported by Burton and Petersson, (1979) using *sepania undulate*, and Fisher and Gestotner, (1997) using *sphagnum papillosum* specie of moss plant. The high concentration of cadmium and zinc metals at Sharada could be attributed to industrial activities around the area.

Table 1 Mean Cd, Mn and Zn concentrations in the study areas

Location / metals	Cadmium(μgg^{-1})	Manganese(μgg^{-1})	Zinc (μgg^{-1})
Sharada	3.06 ± 2.02	2.58 ± 1.22	38.51 ± 23.30
Bompai	0.62 ± 0.18	1.79 ± 1.30	13.33 ± 7.25
Bayero Univ. Campus	0.42 ± 0.28	4.71 ± 3.04	8.66 ± 0.36
Kano municipal	1.06 ± 0.83	4.97 ± 2.49	8.01 ± 7.54
Zoo road	0.39 ± 0.11	0.64 ± 0.34	7.36 ± 1.46

Metal concentration in plants may be associated with Industrial wastes, Soil constituents and atmospheric deposition (Beavington and Clause 1979, Ayodele and Gaya, 1994). Moss plants have widely been used to monitor atmospheric deposition of heavy metals and other trace constituents as reported by Steinnes (1995), Herpin *et al*. (1996) and Fernández *et al*. (2000).

Fig. 2 shows the distribution of the metals in the various study areas. Many factors may be responsible for high uptake of metals in moss plant; of particular significance is the absence of cuticle cell wall in the plant. This allows for easy absorption and retention of the metal ions on the leaves (*Martinez, et al, 1971*) the nature of the plant leaves also contribute significantly for an effective trapping of dry particulate matter on their surface (Ruhling and Tyler, 1970).

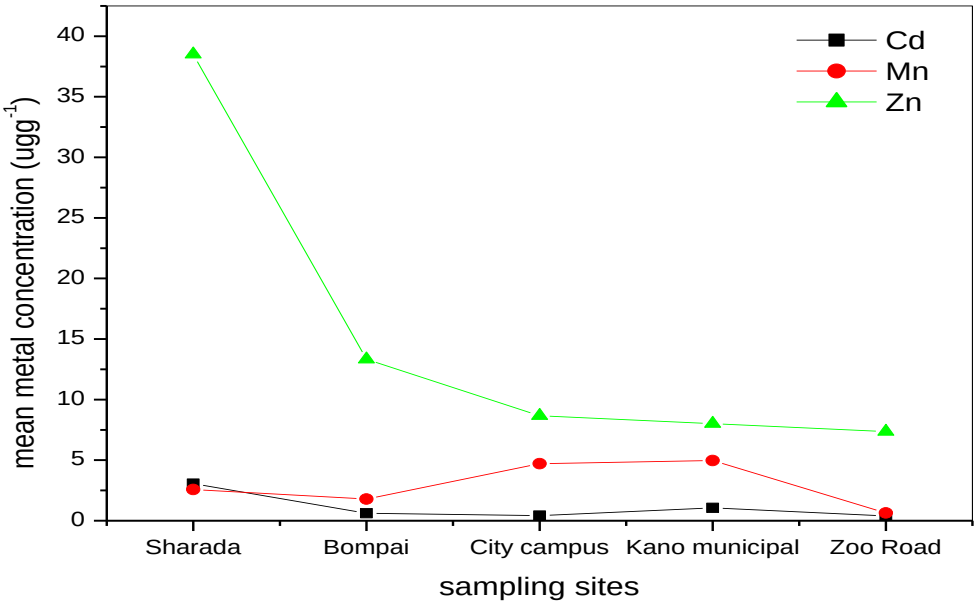


Fig. 2 The distribution pattern of the heavy metals in the various sampling sites

CONCLUSION

The study above indicated that, moss specie *funaria hygrometrica* can be an effective bio-indicator of heavy metals pollution. The significant level of Mn reported in the industrial areas of sharada and Bompai is a reflection of the activities being carried out there. Similarly, the mean low level of Cd also indicated the metals relative abundance in the Earth crust, which is generally low.

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