Anthropogenic Activities and Presence of Heavy Metals in Pankshin Water Dam, Plateau State, Nigeria.

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Abstract
The overuse and misuse of agrochemicals and other human activities designed to increase productivity have resulted to higher pollution loads in water bodies. The study seeks to investigate the concentration and distribution of heavy metals such as: Mercury (Hg), Zinc (Zn), Copper (Cu) and Lead (Pb) on Pankshin water dam as a result of human activities. Water samples from four cardinal points of the dam were collected during wet and dry seasons using a niskin bottle with a depth find on an attached weigh. Water from the niskin bottle was poured into sampling bottles (glass bottles 250ml) and labeled before they were stored in cooler box at temperature below 10^0C. Samples were taken to the laboratory and prepared according to standard method (APHA, 2005). Data was subjected to statistical analysis using a one way-ANOVA and results compared with international standard. Finding revealed that there was no significant difference (P>0.05) between Pankshin water dam and the international standard (WHO).

Keywords: *Anthropogenic, water, Heavy, Metals, Concentration.*

INTROODUCTION

The term "heavy metal" refers to any metal and a metalloid element that has a relatively high density ranging from 3.5 to 7gcm^{-3} and is toxic or poisonous at low concentrations, and includes Hg, Cd, As, Cr, Tl, Zn, Ni, Cu and Pb. (Gautam, et al., 2014). They are among the most common pollutants found in water (Lavanya, et al. 2021). According to Sudarso, et al. (2021), agricultural activities alone contribute about 70% of water pollution worldwide. These anthropogenic activities include farming, application of fertilizer, pesticides and manure, animal rearing activities, improper irrigation including wet farming, recreational activities, deforestation, fishing activities, introduction of toxic chemicals through washing of clothes and vehicles and so on.

Adequate supply of safe and sanitized freshwater is an inevitable factor for human and economic development. The common sources of water that are available to local communities in Nigeria are fast been severed by a number of anthropogenic factors of which pollution remain the most dominant problem (Ayobahan, et al, 2014). To ascertain the quality of water for domestic consumption by determination of heavy metals present in Pankshin dam is of paramount importance due to the impact on human health.

Heavy metals such as Pb, Zn, Hg, Cu, Fe, and so on are elements with high atomic weight (Butu & Bichi, 2013). They are non-biodegradable and persistent environmental contaminant which may be deposited in water bodies. When heavy metals are introduced into the aquatic setting, they

redistribute throughout the water column, accumulated in sediments or consumed by aggregation (Lavanya et al., 2021).

Interest in the environmental levels of heavy metals is a global one because of the potential hazards of these metals to health of humans, animals and plants when they exist at elevated levels (Butu & Bichi, 2013). Because of the various anthropogenic activities surrounding and within Pankshin water dam, the study seeks to investigate the presence of heavy metals which are toxic to human being and animals.

METHODOLOGY

Water samples from Pankshin dam were collected at four cardinal points (North, South, West & East) during the peak of the raining season (August & September) and dry season (December & January) using a niskin bottle. Water from the niskin bottle was poured into sampling bottles (glass bottle 250ml) and the sample bottles labeled before they were stored in cooler box at a temperature below 10^0C. Samples were then taken for analysis at the soil, water and plant analytical laboratory (AWAPAL), Abubakar Tafawa Balewa University, Bauchi, Nigeria for heavy metal analysis. Heavy metals distribution and concentration were determined according to method by Lavanya, et al. (2021); Atomic Absorption Spectroscopy (AAS). The data collected was subjected to statistical analysis using a one way-ANOVA. The concentrations of resulting heavy metals were compared with the World Health Organization (WHO) standard.

RESULTTS

The result of the effect of anthropogenic activities and presence of heavy metals such as copper, zinc, iron and lead in Pankshin dam shows no significant difference ($P>0.05$) compared with the World Health Organization (WHO) standard. The result shows that the concentration of the heavy metals observed at the four cardinal points of Pankshin dam do not vary significantly ($P>0.05$). The mean value of the concentration of Cu in the four cardinal points of Pankshin dam ranges from 0.38 - 0.79 $mgkg^{-1}$ (Fig. 1). Similarly, the result of the effects of anthropogenic activities and the presence of Zn in the area of study ranged from 0.68 – 1.4 $mgkg^{-1}$ (Fig. 2). Findings on the presence of Fe in Pankshin dam as a result of anthropogenic activities recorded no significant difference ($P>0.05$) compared with the World Health Organization standard. The value of Fe observed in the four cardinal points recorded a lowest value of 0.07 $mgkg^{-1}$ while the highest value was 0.12 $mgkg^{-1}$ (Fig. 3). In the current study, the result of the effects of anthropogenic activities on the presence of Pb shows no significant difference ($P>0.05$) with that of the standard recorded by the World Health Organization. The value of Pb observed in the four cardinal points of Pankshin dam ranges from 0.1 – 0.2 $mgkg^{-1}$.

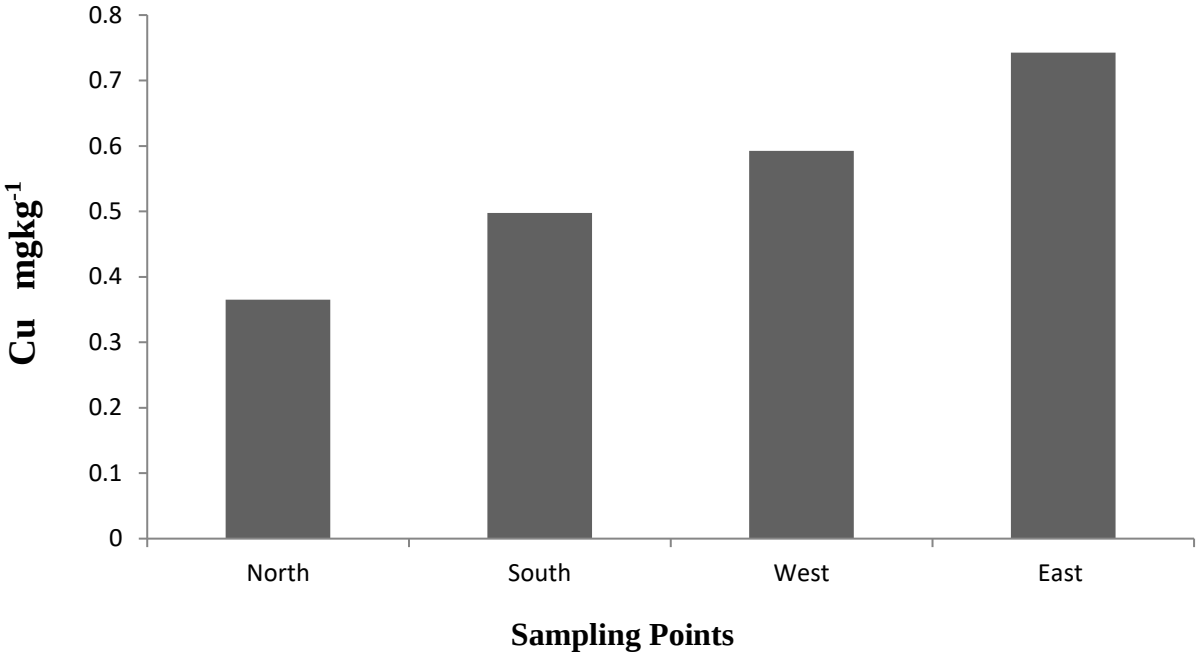

Figure 1 Values of Copper Ion Sampled in the Four Cardinal Points of Pankshin Dam.

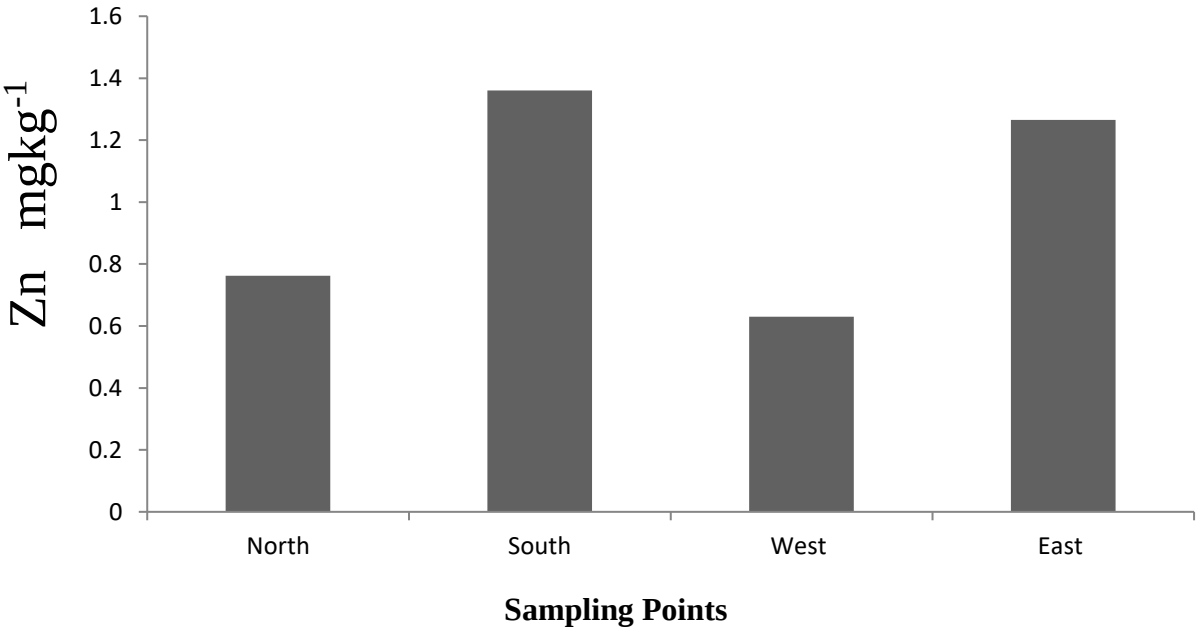

Figure2 Values of Zinc Ion Sampled in the Four Cardinal Points of Pankshin Dam.

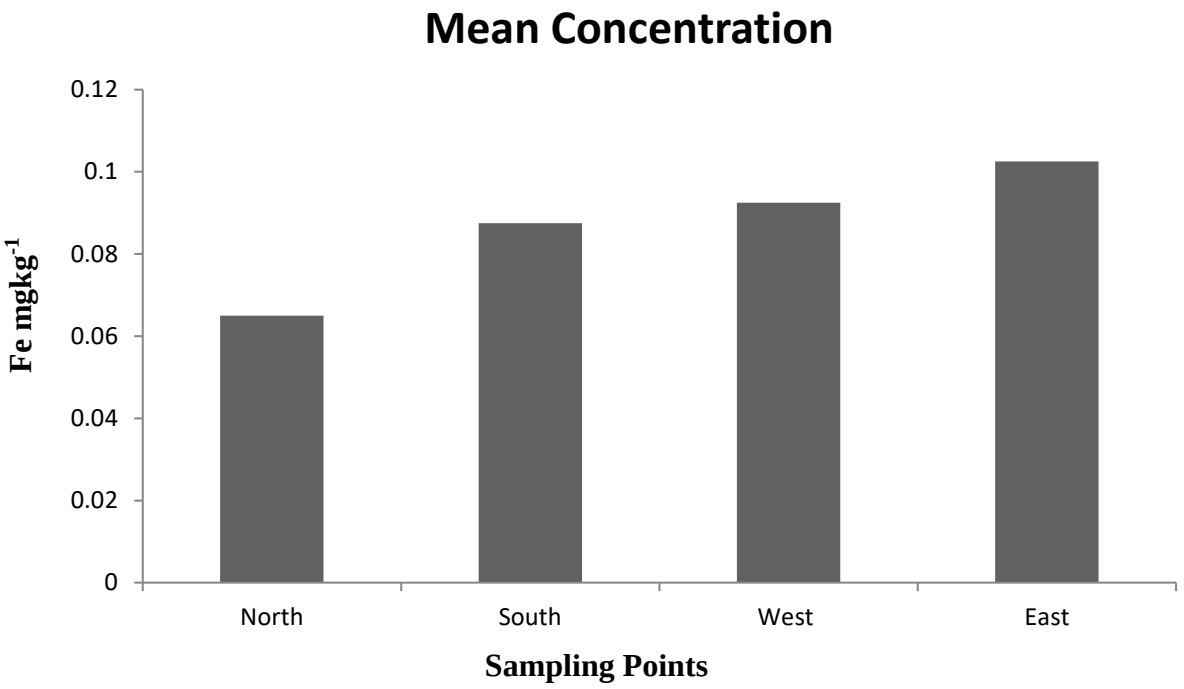

Figure 3 Values of Iron Ion Sampled in the Four Cardinal Points of Pankshin Dam.

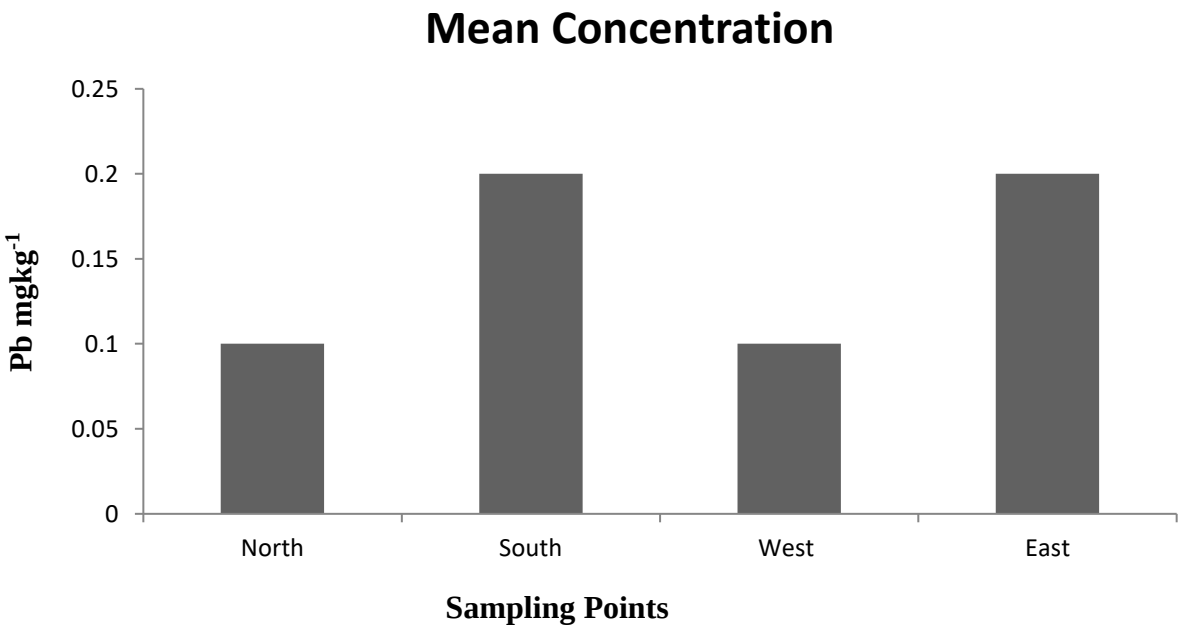

Figure 1 Values of Lead Ion Sampled in the Four Cardinal Points of Pankshin Dam.

DISCUSSION

Presence of heavy metals in excess of the safe limit in water body may result in physiological or morphological abnormalities such as slowing or stopping growth in many aquatic biotas (Luo, et al., 2011).

The value of Cu ion in the area of study shows that the mean concentration was low and within the acceptable limit specified by World Health Organization. The finding was in line with that of Mahalakshmi (2012) who reported that health risk associated with toxic metals are dependent on the concentrations of these metals in certain media and the length of exposure. The current finding on the low concentration of Cu in the area of study shows that anthropogenic activities around Pankshin dam have not increased the concentration of Cu in the water body. It is therefore worthy to say that Pankshin dam water may be free from health issues such as Liver failure as against the report by Reng, et al. (2023) who observed that contamination of water by Cu is responsible for several health issues in humans like Liver failure.

The value of Zn ion recorded in the present study was within the permissible limit of the world health organization (WHO). This finding also agrees with that of Hussain, et al (2010) who reported the recommended concentration of Zn in water as ≤2.00 $mgkg^{-1}$. Finding however, was contrary with that of Khatri and Tyagi (2015); Khan, et al. (2015); Swaroop, et al. (2021) who reported that bioaccumulation of heavy metals in water body through anthropogenic activities poses a health hazard due to their potential to transfer from polluted land and water into the food chain The permissible limit of Zinc in the current study was an indication that anthropogenic activities have not adulterated the water body, hence may not inhibit the growth rate of fish larvae and juvenile as against the report by Chinedu, et al. (2011).

Findings on the effects of anthropogenic activities and presence of heavy metals in Pankshin dam shows that the concentration of Fe ion was within acceptable limit as prescribed by the world Health Organization (Ibemenuga, 2013). The finding is contrary to report by (Witkowska, Slowik & Chillicha, 2021) who observed that contamination of water with heavy metal ions such as Cu, Zn, Fe and Pb is responsible for several health issues in humans like liver failure, kidney damage, gastric and skin cancer, mental disorders and harmful effects in the reproductive system. It is therefore worthy of mention that anthropogenic activities within and outside Pankshin dam have not impact negatively on the concentration of Fe ion in the dam hence the water might be safe for domestic use.

The effect of anthropogenic activities and the presence of Pb ion in the study area was within the acceptable limit of the World Health Organization (Enetimi, et al., 2017). This is contrary to findings by Reng et al. (2023) who observed that contamination of water by heavy metals such as Pb, Hg is responsible for several health issues in humans like liver failure. The finding is also against that of Kim and Kim (2015) who reported that increase exposure of Pb in liver cells leads to oxidative stress resulting in liver damage. Presence of heavy metals such as pb within tolerance level as discovered in Pankshin dam may not interfere with metabolic pathways or inhibit enzymatic activities in aquatic biota.

CONCLUSION

In conclusion, anthropogenic activities in and around Pankshin dam have not increased the concentration of Cu, Zn, Fe and Pb in the water beyond acceptable limit of the World Health Organization. It is however, recommended that some unhealthy practices such as irrigation farming within the shores of the dam and indiscriminate discharge of effluents should be stopped to avoid accumulation of heavy metals.

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