International Journal of Development and Sustainability
Online ISSN: 2168-8662 – www.isdsnet.com/ijds
Volume 2 Number 2 (2013): Pages 814-824
ISDS Article ID: IJDS13010702

Special Issue: Development and Sustainability in Africa – Part 2

Sources and levels of concentration of metal pollutants in Kubanni dam, Zaria, Nigeria

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Abstract

The paper looked at the sources and levels of concentration of metal pollutants in Kubanni dam, Zaria, Nigeria. The main sources of data for the study were sediment from four different sections of the long profile of the dam. The samples were prepared in the laboratory according to standard methods and the instrumental Neutron Activation Analysis (INAA) technique was adopted in the analysis using Nigeria Research Reactor – 1 (NIRR – 1). The results of the analysis showed that 29 metal pollutants; Mg, Al, Ca, Ti, V, Mn, Dy, Na, K, As, La, Sm, Yb, U, Br, Sc, Cr, Fe, Co, Rb, Zn, Cs, Ba, Eu, Lu, Hf, Ta, Sb and Th currently exist in Kubanni dam in various levels of concentrations. The results showed that most of the metal pollutants in the dam are routed to anthropogenic activities within the dam catchment area while few are routed to geologic formation. The results further revealed that metal pollutants that their sources are traceable to refuse dumps, farmlands, public drains and effluents showed higher levels of concentration in the dam than the ones that are gradually released from the soil regolith system.

Keywords: Anthropogenic activities, Catchment area, Chemical elements, Kubanni dam, Levels of concentration, Metal pollutants, Regolith system, Sources

Cite this paper as: Butu, A.W. and Ati, O.F. (2013), "Sources and levels of concentration of metal pollutants in Kubanni dam, Zaria, Nigeria", *International Journal of Development and Sustainability,* Vol. 2 No. 2, pp. 814-824.

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1. Introduction

Environmental pollution is a major problem in modern society. The contamination of inland water ways are globally known to impact negatively on the environment. These inland water ways include lagoons, rivers, lakes or dams which are important hydrological features. Out of the various kinds of pollution, the high contamination of aquatic systems with toxic heavy metals is of a major concern since these elements are not biodegradable (Barakat et al., 2012). Heavy metals enter these aquatic systems mainly through natural inputs such as weathering and erosion of rocks and anthropogenic sources including industrial, agricultural activities, terrestrial run off and sewage disposal (Cevik et al., 2009). Heavy metals discharged into aquatic system may be immobilized within the stream sediment by processes such as adsorption, flocculation and co-precipitation. Sediments in aquatic environments therefore serve as a pool that can retain metals or releases metals to the water column by various processes of remobilization (Barakat et al., 2012; Caccia et al., 2003; Marchand et al., 2006). Several studies have shown that the concentration of metal contaminants in sediments can be a sensitive indicator of contaminants in aquatic system (Bellucci et al., 2002; Bloundi et al., 2009; Suthar et al., 2009; Sekabira et al., 2010).

Most water sources in the world flowing through or located near populated areas are vulnerable to heavy metals pollution due to urbanization and industrialization. Anthropogenic impacts and geologic process deteriorate sediment and water quality. Therefore studies on the determination of the degree of anthropogenic activities are especially relevant over the last decades (Pirju and Narayana 2007; Nabi et al., 2007; Biati et al., 2010). The greatest challenges facing the water supply profession today are the control and removal of poisonous non-living contaminants, the chemicals and isotopes that are being produced in bewildering array of new compounds. These chemicals do end up in open water bodies. Iguisi et al. (2001) observes that several chemical elements have their origins in the decomposing high refuse dumps that dot the landscape of the built up section of the catchment area of Kubanni Dam. Adakole and Abolude (2012) are of the view that anthropogenic activities like mining, final disposal of treated and untreated waste effluents containing toxic metals as well as chelates from different industries such as tannery, steel plants, battery industries, thermal power plants and also the indiscriminate use of heavy metals containing fertilizers and pesticides in agriculture are some of the main causes of metal pollution in aquatic ecosystems.

Monitoring metals in aquatic environment is important for safety assessment of the environment and human health in particular. Several studies have been done on the Kubanni dam, but no attempt has been made to route the sources of the metal pollutants. Regarding this background, this study will assess the levels of concentration of metal pollutants in Kubanni dam and the environmental factors variables within the Kubanni catchment area with the aim of generating data for environmental monitoring and regulatory enforcement of action plan for pollution abatement in Kubanni dam since it is the major source of domestic water for Ahmadu Bello University (ABU) community.

2. The study area

The Kubanni dam, popularly called ABU dam was constructed on RIver Kubanni Zaria, Nigeria in 1973. The ABU dam is a small earth dam built by excavating the valley of River Kubanni and using the over burden as an embankment across the valley at about 300 metres downstream of Kubanni confluence (Iguisi, 1997). The dam has a length of 800 metres and a concrete central section of 10.36 metres above the river bed (Ologe, 1973). The lake major use is to supply water to the Ahmadu Bello University community. The dam catchment area is 57km^2, depth is 6 metres, water level during wet season is 644.81 metres and the corresponding crest is 646.34 metres (Adakole and Abolude, 2012). The lake is located approximately within latitude 11°11'N and longitude 7°38'E in Samaru Zaria, Kaduna State Nigeria. It is located within the premises of Ahmadu Bello University (ABU) main campus. The Kubanni dam's two major tributaries are the Kampangi and Samaru streams. The Kampagi stream originates from a rural and intensive agricultural settlements and has a seasonal flow, whereas Samaru stream that originates from a semi-urban and passes through the densely populated Samaru settlement and ABU main campus has an all year-round flow due to its sustenance by urban run offs and seepages.

3. Materials and method

3.1. Materials

The main sources of data for this study are sediments from two different strategic sampling points along the long profile of Kubanni dam, Zaria, Nigeria. The sediment samples were collected in January, April, July and October 2008. A total of 8 samples were collected (4 from each sample location), the choice of sediments for this study is because metals are known to be more concentrated in sediments than surface water (Rognerad and Field, 1993). Sediments in aquatic environment serve as pool that can retain and release metals to the water column by various methods of remobilization (Caccia et al., 2003; Pekey, 2006; Machand et al., 2006).

3.2. Methodology

The long profile of the dam was divided into the upper, and the lower part and the sampling points were code named Points A and B. The sediment samples were obtained at each sampling point along River Kubanni using sediment core made of polyethylene plastic with a column length of one meter. A total of 8 samples were collected from each sampling point in the months of January, April, July and October. The sediments were collected from each sampling points in the month of April, July and October. The sediment samples were treated with Nitric acid to prevent the growth of micro-organisms. The samples were then prepared in the laboratory according to standard method. To determine the calibration factor for all the chemical elements, the certified reference materials. IAEA -SL- 3 (Sediment) was used. The Instrumental Neutron Activation Analysis (INAA) technique was adopted for the data analysis using Nigeria Research Reactor -1 (NIRR-1). Jonah et al (2006) is of the view that NIRR-1 is most accurate for analysis of metal concentration in sediment because it is a low power nuclear reactor.

Two irradiation schemes were adopted in the analysis of the samples. Short lived activation was done by irradiating the prepared samples in an outer irradiation channel B4. The first counting was carried out for 10 min (i.e S1) after a cooling time of 2-5 min, then the second counting was done for 10 min (i.e S2) after a waiting time of 3-4 hours. In the long lived activation irradiation regime, the samples were irradiated for 6 hours in the inner irradiation channel, then the initial counting was done for 30 min after a cooling period of 4-5 days the second counting for 60 min after a waiting period of 10-15 days. Then the concentration of each of the chemical elements present in the samples was determined by the identification of gamma-ray of product radionuclide through their energies and quantitative analysis. Finally, the value for each element in the sample in part per million (ppm) was obtained by using the gamma-ray spectrum analysis software WINSPAN 2004. The entire data generated by laboratory analysis of the sediments were summarized by simple descriptive statistics such as mean (in part per million), standard deviation and coefficient of variation. The levels of concentration of each of the metals in all the sampling points were summed up and the mean was taken to be the representative value in the entire dam.

4. Results and discussion

The results as shown on Table 1 showed that the main concentration of Mg is 2200 ppm, standard deviation is 565.69 and coefficient of variation is 25.7%. Aluminium (Al) mean concentration is 32025 ppm while standard deviation is 12452.48 and coefficient of variation is 38.9%. Calcium (Ca) mean concentration is 1430ppm, standard deviation is 389.22 and coefficient of variation is 27.1%. Titanium (Ti) has mean concentration of 2700 ppm while standard deviation is 10092.75 and coefficient of variability is 40%. Vanadium (V), maximum mean concentration is 41.13 ppm while standard deviation is 26.76 and coefficient of variation is 65.1%. Manganese (Mn) mean concentration is 287.5 ppm. Standard deviation is 74.7 and coefficient of variation is 26.0%. Dysprosium (Dy) mean concentration is 4.7 ppm while the standard deviation is 1.25 and coefficient of variation is 26.7%. The mean concentration of Na is 1700 ppm while standard deviation is 541.82 and coefficient of variation is 31.4%. Potassium (K)'s mean concentration is 20600 ppm while standard deviation is 6217.03 and coefficient of variation is 30.2%.

Arsenic (As), mean concentration is 1.19ppm, standard deviation is 0.57 and coefficient of variation is 47.7%. Bromine (Br), mean concentration is 0.49ppm, standard deviation is 0.21 and coefficient of variation is 42.0%. Lanthanium (La), mean concentration is 28.49 ppm, standard deviation is 13.5 and coefficient of variation is 47.3%. The mean concentration is 45.32 ppm, standard deviation is 111.9 and coefficient of variation is 246.8%. Yittarbium (Yb), mean concentration is 4.45 ppm, standard deviation is 4.58 and coefficient of variation is 102.8%. Uranium (U) mean concentration is 5.4 ppm, standard deviation is 3.4 and coefficient of variation is 63.0%. Scadium (Sc) mean concentration is 2.50 ppm, standard deviation is 0.94 and coefficient of variation is 37.6%. Chromium (Cr) mean concentration is 21.3ppm%, standard deviation 4.64% and coefficient of variation is 21.8%. (Fe) is 23000 ppm, the mean concentration of Iron (Fe) is 15562.50ppm standard deviation is 3589.64 and coefficient of variation is 23.1%. The mean concentration of cobalt (Co) is 3.36 ppm, standard deviation is 1.45 and coefficient of variation is 43.1%. Zinc (Zn) has mean concentration of 35.4 ppm standard deviation is 19.39 while coefficient of variation is 54.8%. Rubidium (Rb) mean concentration is 100.63 ppm, standard deviation is 23.5 and coefficient of variation is 23.8%. Caesium (Cs) mean concentration is 2.03 ppm, standard deviation is 0.58 and coefficient of variation is 28.9%.

Table 1. The level of concentration of metals in sediment at Kubanni (ABU) dam

	POINT A				POINT B						
METAL (ppm)	***19/1***	***4/4***	***5/7***	***4/10***	***19/1***	***4/4***	***5/7***	***4/10***	***MEAN***	***SD***	***CV%***
Magnesium	*BDL*	*BDL*	*BDL*	*2600*	*BDL*	*1800*	*BDL*	*BDL*	*2200.00*	*565.69*	*25.7*
Aluminium	*30000*	*2600*	*30000*	*32000*	*37000*	*35000*	*46600*	*43000*	*32025.00*	*12452.48*	*38.9*
Calcium	*1200*	*1300*	*BDL*	*2000*	*1200*	*BDL*	*BDL*	*BDL*	*1425.00*	*386.22*	*27.1*
Titanium	*1100*	*4500*	*3000*	*4000*	*2500*	*2200*	*2600*	*2000*	*2737.50*	*1092.75*	*40*
Vanadium	*24*	*31*	*32*	*35*	*25*	*40*	*36*	*106*	*41.13*	*26.76*	*65.1*
Manganese	*308*	*336*	*400*	*346*	*224*	*218*	*287*	*181*	*287.50*	*74.70*	*26.0*
Dyspiosium	*6*	*6.2*	*3.1*	*4.4*	*4.7*	*4*	*6*	*3.2*	*4.70*	*1.25*	*26.7*
Sodium	*2000*	*1800*	*2000*	*2400*	*1500*	*1500*	*600*	*2000*	*1725.00*	*541.82*	*31.4*
Potassium	*21000*	*20000*	*21000*	*34000*	*14000*	*20000*	*13800*	*21000*	*20600.00*	*6217.03*	*30.2*
Arsenic	*0.52*	*0.7*	*2*	*1.9*	*0/62*	*1.3*	*1.38*	*1.1*	*1.19*	*0.57*	*47.7*
Bromine	*BDL*	*0.6*	*BDL*	*0.3*	*BDL*	*BDL*	*0.73*	*0.34*	*0.49*	*0.21*	*42.0*
Lanthanium	*27*	*30*	*34.7*	*17*	*57*	*16.2*	*29*	*17*	*28.49*	*13.5*	*47.3*
Samarium	*4.8*	*5.1*	*6*	*3*	*15.5*	*3.1*	*322*	*3.1*	*45.32*	*111.9*	*246.8*
Yittarbium	*3*	*2.8*	*2.5*	*1.23*	*14.5*	*2*	*8*	*1.6*	*4.45*	*4.58*	*102.8*
Uranium	*4.4*	*4.6*	*5*	*4*	*BDL*	*3.5*	*13*	*3.3*	*5.40*	*3.40*	*63.0*
Scadium	*1.8*	*3.5*	*2.2*	*1.8*	*2.1*	*2.2*	*4.4*	*2*	*2.50*	*0.94*	*37.6*
Chromium	*14*	*22*	*21*	*23*	*28*	*22*	*25*	*15.4*	*21.30*	*4.64*	*21.8*
Iron	*10200*	*14000*	*23000*	*16300*	*16000*	*15000*	*16000*	*14000*	*15562.50*	*3589.64*	*23.1*
Cobalt	*1.7*	*4.2*	*2.8*	*4.1*	*2.5*	*2.7*	*6.3*	*2.6*	*3.36*	*1.45*	*43.1*
Zinc	*BDL*	*49*	*13.4*	*24*	*67*	*32*	*BDL*	*27*	*35.40*	*19.39*	*54.8*
Rubidium	*99*	*107*	*110*	*144*	*80*	*94*	*64*	*107*	*100.63*	*23.49*	*23.3*
Caesium	*1.3*	*2.7*	*2*	*2.1*	*1.5*	*2*	*3*	*1.6*	*2.03*	*0.58*	*28.9*
Barium	*428*	*476*	*344*	*496*	*319*	*436*	*139*	*347*	*373.13*	*114.59*	*30.7*
Europium	*0.43*	*0.54*	*0.6*	*0.6*	*0.5*	*1*	*1*	*0.7*	*0.67*	*0.22*	*32.4*
Lutatium	*0.43*	*0.4*	*0.32*	*0.2*	*2.1*	*0.3*	*0.4*	*0.2*	*0.55*	*0.63*	*115.6*
Hafnium	*19*	*19*	*20*	*10*	*23*	*15.2*	*10*	*10*	*15.78*	*5.23*	*33.1*
Tantanium	*2.15*	*2*	*2.4*	*1.2*	*5.2*	*1.1*	*2*	*2.5*	*15.78*	*5.23*	*33.1*
Antiniony	*0.4*	*0.2*	*0.22*	*BDL*	*BDL*	*BDL*	*BDL*	*0.2*	*0.25*	*0.11*	*43.4*
Thorium	*18*	*15*	*25*	*10*	*42*	*10*	*11*	*11*	*17.75*	*11.08*	*62.4*

BDL: Below Detectable Limit

The mean concentration of Bromine (Br) is 373.13 ppm, standard deviation is 114.6 and coefficient of variation is 30.7%. Europium (Eu)'s mean concentration is 0.67 ppm, standard deviation is 0.22 and coefficient of variation is 32.4%. Lutetium mean concentration is 0.55 ppm, standard deviation is 0.63 and coefficient of variation is 115.6%. Hafnium (Hf) mean concentration is 15.78 ppm, standard deviation is 5.23 and coefficient of variation is 33.1%. The mean concentration of tantalum (Ta) is 2.32 ppm, standard deviation is 1.27 and coefficient of variation is 54.8%. For antimony (Sb) is 0.4ppm, minimum is 0.2, range is 0.2, mean concentration is 0.25 ppm, standard deviation is 0.11 and coefficient of variation is 43.4%. Thorium (Th) has maximum concentration of 42 ppm, minimum 10.00 ppm, range is 32, mean concentration is 17.75ppm, standard deviation is 11.08 and coefficient of variation is 62.4%

From the analysis as shown on Table 1 it is observed that the level of concentration of Mg in the sediment in the dam is below detectable limit on several days of the sampling period but the mean concentration is 2200 ppm. It is therefore obvious that this metal must have gradually been released from soil regolith system through subsurface and base flows into the river. Mg is also suspected to have entered the Kubanni dam from other diffuse sources in the environment and from debris that are been transported into the dam during storms. The mean concentration of Al in sediment in the dam is 34900 ppm. It is therefore very obvious that there is high concentration of Al in underlying bedrock and this element must have gradually been released from the soil regolith system through subsurface or underground flow into the dam. It is also very possible that Al must have filtrated or percolated deep into the soil during surface run off from the ABU main campus and Samaru settlement and finally drained into the dam through base or surface flow. The mean value of Ca in sediments in the dam is 1400 ppm. It is therefore very clear that the amount Calcium in Kubanni Dam is attributed to routing of debris from the catchment area, through overland flow, especially from ABU main campus and Samaru village. Calcium is a common chemical in the community.

The mean concentration of Ti in the sediment in the dam is very high. This is therefore a reflection of the abundance of this chemical element in the catchment area of the dam and the ease with which overland or surface flow transport this chemical into the reserviour. The mean concentration of V in the sediment in ABU dam is high. It therefore means that vanadium is abundant in the catchment area and it must have been released from these areas (ABU main campus, Samaru and College of Agriculture) and drained into the dam through runoffs. The Ahmadu Bello University and College of Agriculture Samaru are academic institutions where this chemical element is commonly use and the likelihood of these institutions been the sole source of this chemical element through diffuse method into the river cannot be overstressed.

The mean concentration of Mn in Kubanni dam is 287.5 ppm. The high concentration of Mn in Kubanni dam is attributed to draining of debris from refuse dumps containing used batteries, public gutters from Samaru Village, effluents from ABU main campus and agricultural chemicals from the farmlands into the river. The mean concentration of Dy is high in the sediment in the dam. This therefore means that there is high concentration of Dy in the catchment area and the source of this element is likely to be from the weathered rocks which must have released this metal that finally migrates into the dam through base or subsurface flow and or this chemical element must have found its way into the soil and finally into the dam through the large refuse dumps that dot Samaru village.

The mean concentration of Na in sediment in the dam is 1700 ppm. It is apparent therefore that the main source of Na into this dam is from the debris that are loaded into the reserviour through overland flow from the ABU, Samaru village and the vast farmlands of the catchments area. The mean concentration of K in sediment in the dam is high. The main source of this metal into the dam is likely linked to the abundance of this element in the basement complex. It is therefore suspected that K must have been released into the soil during weathering process and must have been drained into the dam through underground flow. It is also possible that this element must have drained into the dam through surface run offs from ABU and Samaru communities as well as from the farmlands that are common in the catchments area in combination with other elements.

The level of concentration of As in sediment in the dam is high. Arsenic is a chemical element that is found widely in the earth crust mostly in oxidation form. With high concentration of arsenic in the sediment of dam, it is therefore obvious that the catchment area, particularly ABU and Samaru communities are the sole origins from which this chemical element is routed from through surface runoffs. Toxic Water Solution (2009) states that As enters drinking water supplies from natural deposits in the earth or from agricultural (ochards) and industrial practices (from glass and electronic production wastes) and these practices are common in this catchment area. The level of concentration of Br in sediment in the dam is high. It therefore means that this element is abundant in the surrounding area and it is been released by weathering process and drained into the dam through base flow. It is also possible that Br must have been drained into the dam from ABU and Samaru area during storm. The level of concentration of La was below detectable on most days of the sampling period; however the mean concentration of La in sediment in the dam is 28.4 ppm. Since there is very high concentration of La in the sediment, the main source of this element the in dam could be from debris from the catchment area. It therefore means that there is abundance of this element in the surrounding environment, it is been washed into ABU Dam through subsurface or base flow.

The mean concentration of Sm in the sediment in the dam is low. It is obvious therefore that there is less Sm even in the basement complex of the catchment area. It is observed from the analysis that the level of concentration of Yb in sediment in the dam is low. The main source of this chemical element into the dam is from diffuse sources in low concentration. The mean concentration of Uranium in sediment in ABU dam is 5.40 ppm. The main source of U into ABU dam is likely to be from the geologic formation since the element is known to exist in the soil. This metal must have been released during weathering process and finally drained into the dam through subsurface flow. Uranium is also likely to have entered the dam in trace quantity from routing of debris or chemical effluents from the University and Samaru environment into the dam through surface runoff. The analysis shows a lower level of concentration of Sc in sediment. It is therefore clear that the main source of this element is from surrounding settlements within the catchment area. Scandium can be found in household equipments such as TV, fluorescent lamps and other electronics, and when this equipment are discarded indiscriminately the metal got released and got accumulated easily in soils and water (Lentech, 2009).

The mean concentration of Cr in sediment in Kubanni dam is 21.30 ppm. It is possible that Cr must have gradually been released through the soil regolith system and drained into the dam through base or subsurface flow, but the main source of Cr into Kubanni dam is suspected to be from chromium electroplated materials and leather tanning process within the busy and populated area of ABU main campus and the Samaru urban settlement. The mean concentration of Fe in sediment in the dam is 15600 ppm. The coefficient of variation of Fe in the sediment is 23.1%. The main source of iron into this Kubanni dam may be from weathering process and routing of lateritic materials into the dam. Thorp (1970) is of the view that the catchment area contained a lot of biotite rocks which releases Fe through weathering into the drainage basin. The study revealed that there is high level of concentration of Co in sediment of Kubanni dam. It is also suspected that this chemical element is being washed into the dam from ABU main campus and Samaru settlement through different sources such as from household materials and other synthetic substances.

The level of concentration of Zn in sediment in the ABU dam is high. It is most likely that Zn is been released during weathering process and drained by subsurface flow into the stream. The concentration of Zn in the dam can also be attributed to loading of debris containing this element into the dam from ABU main campus and Samaru area. It could also be from consumer products, agricultural operations especially the use of phosphate fertilizer and from other household products from the densely populated settlements around Kubanni dam catchment area. The mean concentration of Rb in sediment is very high. Since the concentration in the sediment is high, it therefore clearly means that this element is been brought into the dam from other undefined (diffuse) sources from the catchment area. These diffuse or non-point sources are traceable to refuse dumps, public gutters, effluents from the ABU main campus and Samaru town and debris from farmlands that are found along the dam area. The level of concentration of Cs in sediment is low. It is therefore obvious that this metal is derived from the basement complex of the area. it is suspected that the element is been released from weathered rock and drained into the stream through base flow in low quantity. The mean concentration of Ba in sediment is very high. The reason for high concentration of Ba in Kubanni reserviour is attributed to loading of debris and effluents from ABU main campus and Samaru into the river through surface runoff.

The level of concentration of Eu in the sediment of the dam is low. It is therefore obvious that Eu is released in trace quantities into the soil through weathering process and gradually end up in the dam through subsurface flow. It could also be suspected that some quantity of this chemical element must have entered the reserviour through other undefined sources such as migration of debris and effluents from the University and the neighbouring Samaru into the dam through overland flow. The level of concentration of Lu in sediment in ABU dam is observed to be low. The main source of this chemical element into this dam is therefore attributed to routing of debris and other chemical substances which might contain this metal into the dam from the various anthropogenic activities from ABU campus and the neighbouring settlements around the dam catchment area. The level of concentration of Hf in sediment in ABU dam is high. It therefore means that there is high concentration of this metal in the basement complex and indeed this metal is gradually released into the soil during weathering process and finally ends up into the river through base flow. It is also suspected that this metal pollutant is transported into the dam through overland during rain storm.

The mean concentration of Ta in sediment in the dam is 2.32 ppm. It is therefore suspected that the bulk of this metal is been attributed to the routing of debris and effluents from ABU campus and the settlements around the catchment area into the dam. It is also possible that the element is also been fed into the reserviour from the soil where it is been released during weathering process. The level of concentration of Sb in sediment in the lake is high. It is obvious that the main source of this metal is from the ABU campus and Samaru environment. This metal is believed to have been transported into the river through overland flow in mixture with other debris. Antinomy is a metal used in antinomy trioxide, a flame retardants, It is also found in batteries, pigments, ceramics and glasses which are commonly found in the catchment area and are easily transported into the dam by storm runoff. The level of concentration of Th in sediment in the reserviour is high. This therefore means that the main source of Th into the dam is from the human activities within the catchment area. It is suspected that the various debris and effluents that emanate from the ABU campus and he Samaru settlement which are constantly transported into the dam through surface runoff accounts mainly for the presence of Th in this water body.

The study looked at the sources and levels concentration of metal pollutants in the Kubanni (ABU) dam, Zaria. It is observed that 29 metal contaminants are present in the dam. The sources and levels of concentration of each of these metals identified in the dam are due to the peculiar human activities within the dam catchment area. Most metallic elements are embedded in the geologic formations and constantly released through soil regolith system while other exist in mixtures, compounds, or alloys with other chemical elements and are used in house-hold as synthetic materials. Metal pollutants that their sources are traceable to refuse dumps, farm lands, public drains and effluents from the various research Institutions and Samaru settlement show higher levels of concentrations than the ones that are gradually released from the soil regolith system. These variations are therefore the reflection of abundance of these chemical contaminants in the catchment area of ABU dam and the ease at which overland, surface and based flow transport them in the reservoiur.

5. Conclusion

The study has established that 29 different types of metal contaminants; Mg, Al, Ca, Ti, V, Mn, Dy, Na, K, As, La, Sm, Yb, U, Sc, Cr, Fe, Co, Rd, Zn, Br, Cs, Ba, Eu, Lu, Hg, Ta, Sb, and Th presently exist in the Kubanni dam in various levels of concentration. It is observed from the study that metal pollutants which are readily detached and entrained by overland flow tend to exhibit higher levels of concentration than the ones that are gradually released by soil regolith system through subsurface and base flow. It is also observed that the anthropogenic activities around the Kubanni dam catchment area have greatly contributed to the loading of the dam with metal contaminants with possible severe consequences on the health of the human population that depends on the water and other aquatic foods from the dam because metal pollutants are known to be toxic to humans when consumed in excess quantity over a long period. Water is a very essential natural resource, without which life on earth would be impossible. This therefore stresses the need for proper monitoring, management and protection of available water sources from pollution by metal pollutants.

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