RESEARCH REVIEW JOURNALS
Volume-04
Issue-03
March -2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

Spectroscopic Studies on Iron Level Content in the Water and Bottom Sediment of Isapur reservoir Maharashtra

[1]Lolage Y.P. and [2]Bhosle A.B.

[1&2]Assistant Professor, School of Earth Sciences, Swami Ramanand Teerth Marathwada University, Nanded –431606, Maharashtra, India

ARTICLE DETAILS

Article History
Published Online: 15 March 2019

Keywords
Freshwater, Heavy metals, Bio-accumulation studies.

ABSTRACT

Background and Objective:
Iron is the commonly found essential micronutrients widely distributed in an aquatic ecosystem. Iron, in lower amount is important for plants, animals and humans but, can cause severe health problems if present in excess amount. Accumulation of excess amount of iron can give unpleasing flavor, color and odor to the water. The surface runoff and weathering of rocks act as contributing sources for iron in aquatic ecosystem. It is usually found in the divalent soluble reduced form as Ferrous (Fe^{2+}).
An attempt has been made to study the distribution of iron amountin water and bottom sediments of Isapur water reservoir. The studies were also carried out to observe the potential human health risk due to the iron concentration in water body, as iron acts as both essential micronutrient as well as a potential toxin to the surrounding population.

Material and Methods:
Water and sediment samples were collected once in a month and analyzed by using UV Visible spectrophotometer at 510 nmusing APHA as a standard method. Iron was estimated by using widely used Thio-cynate procedure.

Results:
Observations showed that natural and anthropogenic activities contributing in increased level of metal pollution. Average iron values found from four selected water sampling sites, as in monsoon (0.455, 0.4, 0.345 and 0.342), winter (0.39, 0.355, 0.32 and 0.315), summer (0.552, 0.487, 0.415 and 0.382) mg/L. Similarly in sediment samples, average values noted in monsoon were (3662.5, 3665), winter (3230, 3200) and summer (3705, 3740) mg/kg respectively.

Conclusion:
Observed average iron concentration values for water at all four selected sampling sites exceeded the recommended guidelines prescribed by the authorities like World Health Organization (WHO) for domestic water use. Research observations also indicated that the sediment comprised of higher deposits of iron.This excess iron concentration in aquatic ecosystem may lead to common health complaints like nausea, vomiting, cramping, gastrointestinal upset etc. In severe iron toxicity, it may be reason for organ damage, coma or loss of life.The results obtained will contribute for better water quality management and risk assessment for the surrounding populations.

1. Introduction

Bioaccumulation is the process of incremental increase in concentration of particular substance at higher tropic levels with time. Heavy metal bio-accumulates in the aquatic environment and could prove toxic to aquatic life and human[1,2]. There has been significant concern over aquatic water pollution and its potential health riskto the surrounding population due to the persistent and non-degradablenature of heavy metal ions in aquatic body[3].

Heavy metals are approaching water bodies continuously and create a great risk to the aquatic life and human[4]. Heavy metals get accumulated in higher toxic levels and can cause inconsiderate impact on the aquatic organisms lacking any visible sign[5]. The process of heavy metal pollution is irreversible and for longer time period[6]. Aquatic water bodies have been entirely polluted due to the organic and inorganic pollutants like, heavy metals though it is one of the major sources of fresh water.

The eutrophication, not only pollutes the water but has grave impacts on sediments, accumulating these pollutants in the aquatic plants and thereby in the food chain. Volcanic eruptions, rock weathering, leaching of metals into lakes, rivers etc may leads to occur excessive level of trace metals in nature[7].

Heavy metal Pollution in an aquatic ecosystem has been recognized as a major issue of the current time. Contamination of water and soil resource is a rapidly increasing concern in areas worldwide[8]. Even though the iron plays a vital role in human nutrition, it has many negative health consequences if taken in excess amount. Therefore this attempt was made to estimate the iron levels in Isapur dam and its potential risk in future. Similar studies are essential to know the concentration and fate of these metals inside the food chain and later in human body as well as the basic metal chemistry, associated health problems and remedial options.

2. Study Area:

Isapur dam is situated near Pusad tehsil,Yavatmal district of Maharashtra state, it is an earthfill dam located on Penganga river (Perenial river). It was constructed in 1982 for irrigation

purpose (Figure1). It is a major water storage project on river Penganga[9]. The river Penganga originates from Ajantha ranges in Aurangabad district of Maharashtra state and converges into Wardha river in Chandrapur district. It has total length of about 676 kms. The dam is located between 19°43'40"N and 77°26'12"E.

3. Water and Sediment Samplings:

Water and sediment samples were collected every month during June 2012 to May 2013 representing monsoon (June to September 2012), winter (October 2012 to January 2013) and summer (February 2013 to May 2013) seasons respectively. The water samples brought in the laboratory and were preserved with standard techniques in water containers. Collected water samples were placed at a low temperature and were taken immediately to the laboratory for further respective analysis. The analyses were carried out as per the standard methods of APHA.

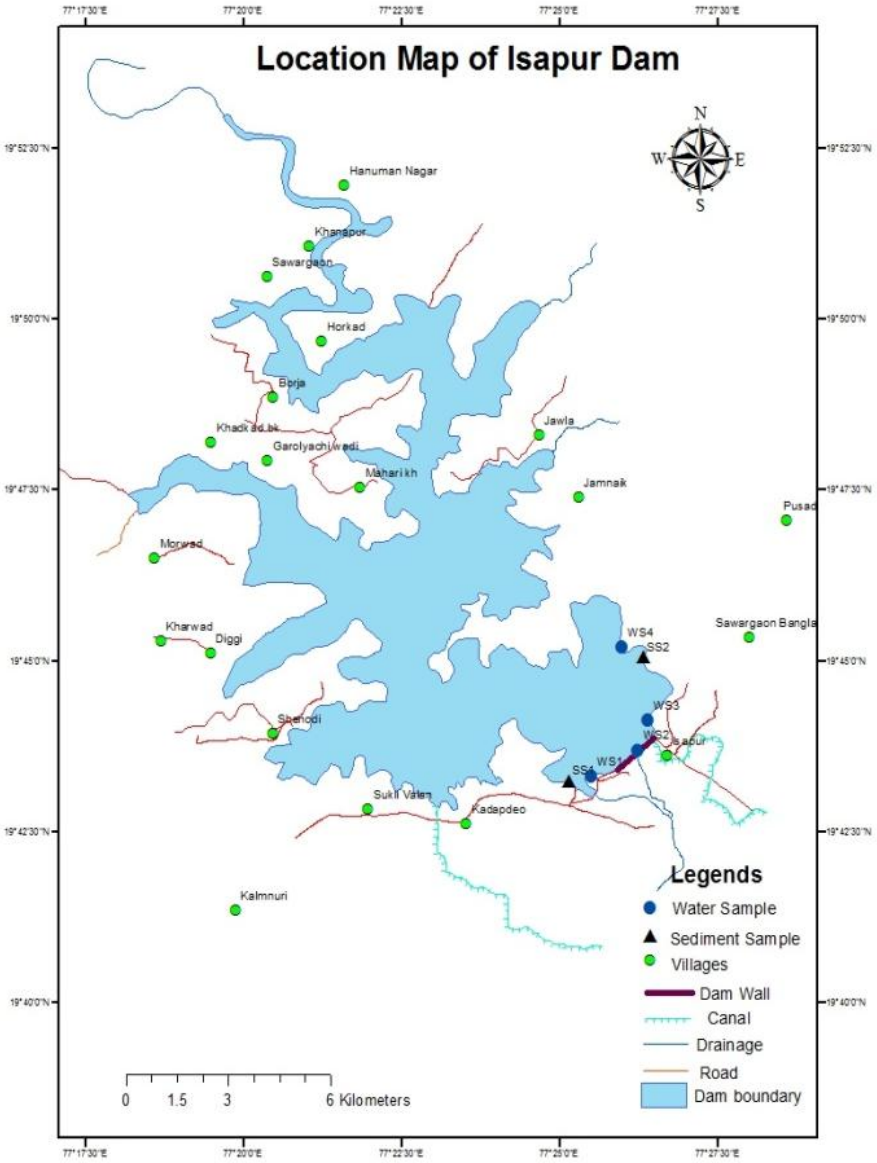

Figure 1: Map showing the location ofIsapur reservoir and selected water sampling sites

4. Material and Methods:

Iron plays a significant role in biological systems. Its distribution and role especially in aquatic ecosystem is imperative. Iron is usually estimated by widely used Thio-cynate procedure. 5 ml 1+1 HCl was added to 100 ml sample. The volume was reduced to 40 ml on hot plate. The solution was cooled at room temperature and potassium permanganate solution was added drop by drop until pink color persists. Later distilled water was added to make volume 50 ml and 1ml dil. HCl and 2 drops of Potassium permanganate was added. 1 ml of Thio-cynate solution was added lastly and the absorbance was recorded at 510 nm wavelength on UV spectrophotometer (SHIMADZU UV 1800). The results obtained were expressed in mg/L. of iron. Similar method was used for sediment analysis after acidifying into ionic forms and results were expressed in mg/kg.

5. Result and Observations:

The considerable variations were observed in the concentration of iron in water and sediments during present

research work for about entire year. The major sources include weathering of rocks and surface agricultural runoff from the surrounding areas. The iron levels in water samples showed the range 0.26 to 0.68 mg/L and sediment concentration ranged from 3110 to 4180 mg/kg (Figure 2 to 5). The average iron values noted nearly at all sampling sites were above the permissible levels as mentioned by WHO. The sediments confirmed higher values than the water. The maximum accumulation of iron in Water and Sediment during summer may be due to less water because of evaporation effect.

The maximum iron concentration was recorded in May 2013 (0.68 mg/L) at WS_1 and minimum concentration was found at site WS_3 in the month of October 2012 i.e. 0.26mg/L at WS_3 with an average 0.397 mg/L. In sediment analysis the maximum and minimum iron level recorded was 4180 and 3110 mg/kg for SS_2 with average 3534 mg/kg (Table 1). The water and sediment showed positive correlation (Table 2), as the sediment acts as one of the major source for iron dissolution into the water.

Table 1: The values of Iron levels in water (mg/L), sediment (mg/kg) during june, 2012 to may, 2013

Season	Month	Iron concentration (mg/L) from Water sample				Iron concentration (mg/kg) for Sediment sample	
		WS 1	WS 2	WS 3	WS 4	SS1	SS2
Monsoon	June	0.61	0.56	0.41	0.4	3940	3980
	July	0.48	0.41	0.37	0.36	3720	3700
	August	0.38	0.33	0.32	0.31	3550	3550
	September	0.35	0.3	0.28	0.3	3440	3430
Winter	October	**0.34**	**0.28**	**0.26**	**0.3**	**3130**	**3110**
	November	0.37	0.34	0.31	0.31	3190	3150
	December	0.41	0.38	0.35	0.32	3260	3210
	January	0.44	0.42	0.36	0.33	3340	3330
Summer	February	0.48	0.42	0.38	0.34	3410	3410
	March	0.5	0.43	0.4	0.38	3520	3510
	April	0.55	0.48	0.42	0.4	3830	3860
	May	**0.68**	**0.62**	**0.46**	**0.41**	**4060**	**4180**
Average		0.466	0.414	0.36	0.346	3532.5	3535
Maximum		0.68	0.62	0.46	0.41	4060	4180
Minimum		0.34	0.28	0.26	0.3	3130	3110

(Note: WS = Water Sample & SS = Sediment Sample)

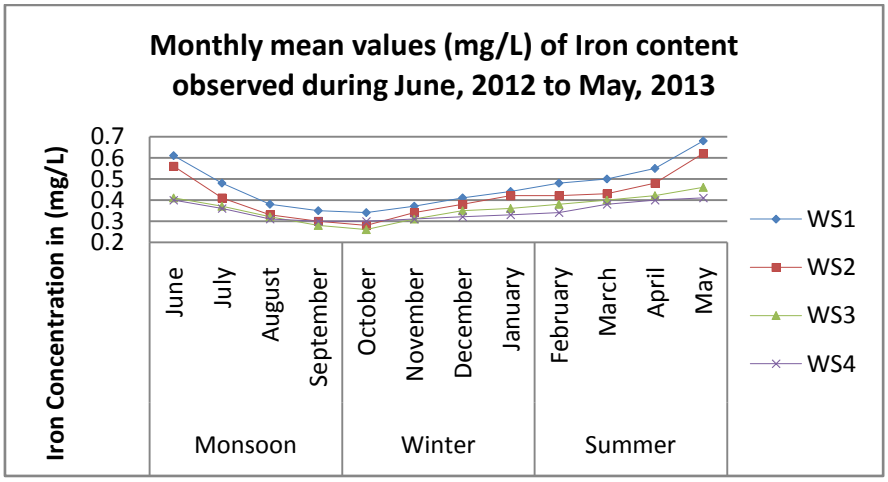

Figure 2: Monthly mean values of Iron level in water (mg/L) from Isapur reservoir during June, 2012 to May, 2013

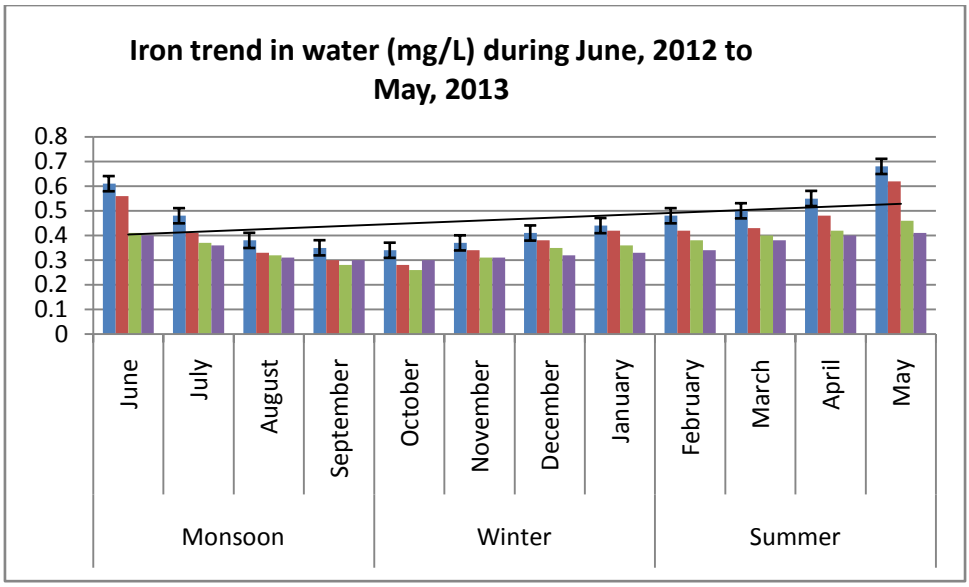

Figure 3: Trends of Iron content in water (mg/L) during June, 2012 to May, 2013

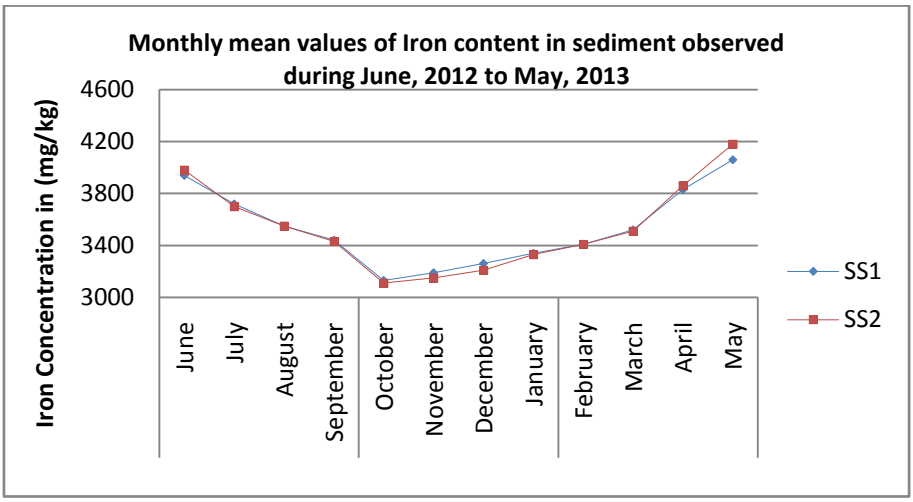

Figure 4: Monthly mean values of Iron in sediment (mg/Kg) from Isapur reservoir during June, 2012 to May, 2013

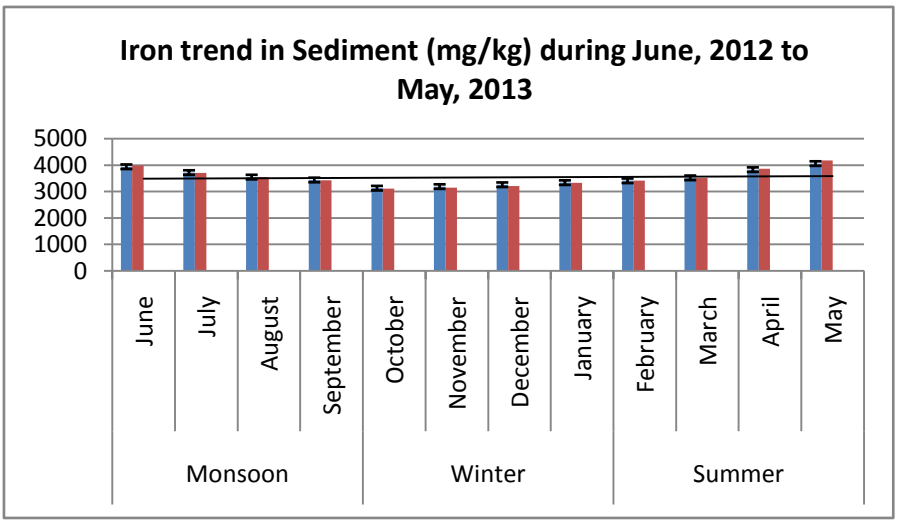

Figure 5: Trend line indicates Iron concentration in the sediment (mg/Kg) from Isapur reservoir during June 2012 to May 2013

Table 2: Correlation between Iron level of water and sediment samples during June, 2012 to May, 2013

	WS_1	WS_2	WS_3	WS_4	SS_1	SS_2
WS_1	1					
WS_2	0.987909	1				
WS_3	0.949552	0.943515	1			
WS_4	0.959734	0.925292	0.937534	1		
SS_1	0.885271	0.847666	0.802526	0.872314	1	
SS_2	0.895749	0.859965	0.804334	0.870911	0.99736	1

6. Discussion:

Shaikh and Bhosle (2013)estimated the iron content of soil near Siddheshwar dam in Maharashtra. They found that the soil content was 60mg/kg in selected sites[10]. Kucuksezginet al.,(2008) monitored the heavy metal levels in water, sediment and particulate matter of river Gediz of western Turkey. During their studies in 1998-1999 they revealed that the iron contents ranged from 1.3 to 682 µg/L and 10629 to 72387 mg/kg respectively for water and sediment samples[11]. Singh et al.,(2005)observed the status of heavy metals in water and sediments of river Gomti using ICP-AES techniques. The iron values were recorded and they rangedas 0.0791-0.3190 mg/L and 5051.485-8291.485 mg/g for water and sediment respectively[12].

Tesfamariam, *et al*.,(2016) assessed the heavy metal in sediment and water in Mainefhi and Toker reservoirs of Asmara city, Eritrea[13]. Joshua et al., (2016) observed the average level of iron in Mvudi river[14]. They noted the values in the range of 0.702–2.645 mg/L and 3840–6982 mg/kg respectively for water and sediment.

The Average iron concentration values were observed 0.242 mg/L and 0.165 mg/L, and for sediment 11,421.9 mg/L and 87,502.6 mg/L respectively. It was observed that the iron contents in water were reasonably higher than the WHO guideline for drinking water.

Raphael et al., (2016) observed heavy metals in Weija dam of Ghana[15]. The iron concentrations in sediments showed the range of 17 to 30.68 mg/kg and 9.86 to 49.53 mg/kg in dry and wet season respectively in the selected 10 sites.

Opaluwaet al.,(2012)assessed the heavy metals in water, sediments and fishes from UKE stream, Nigeria[16]. They recorded that the iron metal had the average concentration of 8.78 mg/g for sediment and 7.51 mg/L water samples.

Vincent-Akpu and Yanadi (2014), determined the iron concentrations in water and sediment from New Calabar River[17]. They noticed that the iron levels in water and sediments were 0.4 mg/L and 160204 mg/kg respectively.

7. Conclusion:

During our investigation, the results obtained from water and sediment of this reservoir will be significantly useful for the surrounding areas, like irrigation, drinking, fisheries, industries etc. Hence, this study is widely applicable for several authorities for future water management policies.

Acknowledgement:

Authors are thankful to School of Earth Sciences, Swami Ramanand Teerth Marathwada University, Nanded for providing necessary laboratory facilities for the experimental work.

References:

1. Lolage Y. P. and Bhosle A.B., 2017. Freshwater Selenium Evaluation and Studies by Spectrophotometer of Isapur Water Reservoir Maharashtra India, Int. J. Pure App. Biosci. 5 (3): 85-91 doi: http://dx.doi.org/10.18782/2320-7051.4005
2. Vasant Wagh, Dipak Panaskar, ManeshAamalawar, Yogesh Lolage, Shrikant Mukate, Narsimha Adimalla (2018) HydrochemicalCharacterisation and Groundwater Suitability for Drinking and Irrigation uses in Semiarid Region of Nashik, Maharashtra, India Hydrospatial Analysis, 2(1), 43-60, doi: https://doi.org/10.21523/gcj3.18020104
3. Nanda P., 2014. Bioaccumulation of Heavy Metals and Physiological Response in Anabas testudineus on Exposure to Paper Mill Effluent. J Environ Anal Toxicol., 4:244. doi: 10.4172/2161-0525.1000244
4. Bhuvaneshwari, R., Mamtha N., Selvam, P and Rajendran, R. B., 2012. Bioaccumulation of metals in muscle, liver and gills of six commercial fish species at Anaikarai dam of river Kaveri, South India. International Journal of Applied Biology and Pharmaceutical Technology, 03:08-14.
5. Mane P. C., Kadam D. D. and Chaudhari R. D., 2013. Accumulation of heavy metal ions in water, sediment and aquatic weeds: A case study of Sudha Dam, Bhokar, India. Advances in Applied Science Research. 4(5):394-400.
6. Shashikanth H. Majagi, K. Vijaykumar and B. Vasanthkaumar, 2008. Concentration of heavy metals in Karanja reservoir, Bidar district, Karnataka, India. Environmental monitoring assessment, 138:273-279.
7. Hariprasad N. V and Dayananda H. S., 2013. Environmental Impact due to Agricultural runoff containing Heavy Metals – A Review. International Journal of Scientific and Research Publications, 3(5):1-6.
8. Giuseppe Bonanno, 2012. Arundo donax as a potential biomonitor of trace element contamination in water and sediment. Ecotoxicology and Environmental Safety, 80:20–27.
9. Keshave Jitesh Vilas, Ananthan P. S. and Asha Landge, 2013. Fish Diversity and Productivity of Isapur Reservoir, Maharashtra State. International Journal of Biomedical and Advance Research 04(12):865–867.
10. Shaikh Parveen R. & Bhosle Arjun B., 2013. Heavy Metal Contamination in Soils near Siddheshwar Dam Maharashtra. Research Journal of Chemical Sciences, 3(1):6-9.
11. Kucuksezgin F., E. Uluturhan and H. Batki, 2008. Distribution of heavy metals in water, particulate matter and sediments of Gediz river (Eastern Aegean). Environ Monit Assess., 141: 213–225.

12. Singh V.K., Singh K.P and Mohan D., 2005. Status of heavy metals in water and bed sediments of river Gomti--a tributary of the Ganga River, India. Environ Monit Assess., 105(1-3):43-67.
13. TesfamariamZerabruk, Younis M.H, Younis Suliman, S. Elsanousi, 2016. Assessment of heavy metal status of sediment and water in Mainefhi and Toker drinking-water reservoirs of Asmara City, Eritrea. American Journal of Research Communication. 4(6):76-88.
14. Joshua N. Edokpayi, John O. Odiyo, Oluwaseun E. Popoola and Titus A. M. Msagati, 2016. Assessment of Trace Metals Contamination of Surface Water and Sediment: A Case Study of Mvudi River, South Africa. Sustainability 8:135; doi:10.3390/su8020135
15. Raphael Kwaku Klake, Vincent Kodzo Nartey and David EdemDinku, 2016. Assessment of Heavy Metal Contamination in the Weija Dam, Ghana. Journal of Natural Sciences Research, 6(2):18-26.
16. Opaluwa O.D., Aremu M. O., Ogbol L.O., Magaji J. I., Odiba I.E., and Ekpo E.R., 2012. Assessment of Heavy Metals in Water, Fish and Sediments from UKE Stream, Nasarawa State, Nigeria. Current World Environment. 7(2),213-220.
17. Vincent-AkpuIjeomaFavour and Yanadi Lewis Obi, 2014. Levels of Lead, Iron and Cadmium Contamination in Fish, Water and Sediment from Iwofe site on New Calabar River, Rivers State. International J Ext Res., 3:10-15.

