SEASONAL VARIATION AND URBANIZATION ON RIVER WATER QUALITY: A CASE STUDY OF ADA RIVER - OKADA, EDO STATE

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Abstract

Investigation on the quality of river water as influenced by seasonal variation and urbanization was carried out on river Ada - Okada, Edo State. At four locations (pre-Okada, Okada I, Okada II and post Okada) water samples were collected during the rainy and dry seasons, July 2006 and February 2007 respectively. The water samples were analyzed in the laboratory using simple correlation. In addition, 315 questionnaires were administered, collected and analyzed to determine the perception of the respondents on the' water quality and usage of the water. There were both seasonal and spatial variations in water quality.

Introduction

Food, housing and clothing are basic needs of man. For the basic needs to come to reality, water is essential for the satisfaction of these basic needs. Man has consciously lived and flourished on land - made - fertile by major rivers like Tigris and Euphrates in Mesopotamia, Nile in Egypt, Indus in India, Hwangito in China and among others. From the above, it is seen that water makes life possible and without it, life, civilization or urbanization cannot survive and develop. In the past, wars have been fought over the availability of water and even now, relationship between nations is strained due to disputes over mismanagement of shared water resources (Odjugo and Konyeme 2005).

Whether water will be use or not depends greatly on its quality. The quality of water in the pre-industrial period was high because pollution of water bodies was less. Pollution, then, was low and mainly organic in nature and watercourse was able to assimilate them and purify itself (Khaiil 2005), On the contrary, with the era of industrialization, which began in the 16th century an population explosion of the 20' century that concentrated more in the urban areas both ground and surface waters are highly polluted mainly with inorganic pollutants such as chemicals and industrial wastes (Rapu 2003). To support the above argument, Odjugo and Ikhile 2002, made a submission that as urban population increase, human activities also increase and more waste are generated. In most developing countries like Nigeria, waste disposal systems are poor. In addition, there is indiscriminate dumping of waste on the land to decay; others are dropped into the rivers and lagoons. In most urban cities in the developing world, Okada inclusive, land surfaces are not covered with grasses and tress but left bare. The bareness of the urban surfaces increased the run-off and most of surface wastes are washed into the rivers. To add, most people see to the surface run off as a good method off as a good method of disposing their wastes by dumping them into runoff. These wastes are finally carried to the river as overland flow.

According to Maigidan (2002), in his work on oil spillage on ground and surface water in Niger Delta region of Nigeria, he stressed that dissolved pollutants infiltrate with water into the soil. The infiltrating water movers laterally in the subsurface soil to join the streams or rivers as subsurface flow.

There are two major sources of water pollution. These are direct and indirect contaminant sources. These could get to the rivers through surface or subsurface. The direct source of water pollution includes effluent outfalls from factories abattoirs, sewages, solid wastes (domestic and industrial). All the pollutant named above affect Ada River. The indirect sources include contaminants that enter the rivers from soils/ ground water systems and from the atmosphere through rainwater. Agricultural residues (fertilizers, pesticides, herbicides etc) are contained in soil and ground waters.

Study Area

Ada River lies in Ovia North-East of Edo State and takes it sources form a highland near Iguomo. The river lies to the west of Okada and eventually discharges its water into river Aden. It has the equatorial climate with heavy rain during the rainy seasonal (March to October) and little rain in the dry season (November to February). It should be noted that there is hardly any month without some element of rainfall. The mean annual rainfall is above 2000mm, relative humidity is 70% to 80% during the rainy season and 60% to 70% in the dry season. The temperature is relatively high about 28°C.

Methodology

The data used for this study were collected through two methods. Firstly, questionnaires were used to elicit the perception of 315 respondents on the quality of water, uses to which they put the water and problems associated with the use of water from Ada River. Based on the difference in population in the four locations. 50 questionnaires were administered each to pre and post Okada while Okada I and II had 80 questionnaires each. The remaining 35 questionnaires were administered to workers of some companies and abattoirs that discharge their effluent directly into the river.

The questionnaires were administered to randomly selected inhabitants of every other inhabited house in the pre and post Okada, while in Okada I and Okada II every third inhabited house was used. In each house, two respondents were randomly determined to fill the questionnaire. It should be noted that all the questionnaires administered were collected due to the fact that none of the questionnaire was left behind. Percentages were used in analyzing the questionnaire data.

Secondly, water samples were collected from four location along Ada River and laboratory analysis was carried out to determine the seasonal variation in water quality of the river. The month of July and February were selected because they represent the core rainy and dry seasons respectively in the study area. The location where samples were collected are pre Okada by Iguomo village; the second is Okada I behind the Secretariat, while Okada II was behind Igbinedion Univeristy, Okada (Old Campus) and post Okada was taken from before the bridge at Iguedo.

The samples were sent to laboratory immediately for analysis using the notable methods explained in details in (Diodetnise 2001). The physical, chemical and microbial parameters were tested for as shown in appendices I and II. The values were compared with World Health Organization (WHO) Standard guidelines for drinking water quality.

The compliance level of the laboratory result with WHO Standard guidelines was computed using (Clek 1984) equation,

$$PC - \frac{NI \times P}{N}$$

Where PC = Percentage compliance
NI - Number of times parameters compiled with the stated standard
N = Total number of measurements
P - 100% (Assumed maximum compliance limit)

._ Water quality classification scheme (Akpan; Ekpo and Ekpe 2003), was used in analyzing the compliance rates as shown in the table I.

Table 1; Water Quality Classification

Quality Score	Quality Class
0-20	Very poor
21-50	Poor
51-70	Moderately polluted
71 -90	Good
91 - 100	Excellent

Source: Akpan et al 2003.

Result

The perception of the respondents on the quality of water was compared with the mean laboratory analysis of dry and rainy seasons as shown in Table 2 (Result of Laboratory analysis are contained in appendices I and II). The perceived water quality did not tally with laboratory analysis.

Pre-Okada respondents perceived the water quality to be excellent for human consumption while the analysis showed that the water quality was good.

Table 2: Water Quality Rating by Respondents (%)

	' Excellent	Good	Moderately Polluted	Poor	Very Poor	X^2 Lab. Analysis rating
Pre Okada	85	7	3	3	2	84 (Good)
Okada I	8	62	21	2	7	69.3 (Moderately Polluted)
|_p_kada II	0	10	81	4	5	27 (Poor)
i Post Okada	3	16	74	6	1	33.2 (Poor)

Source: Fieldwork 2007

The respondents in Okada I (62%) saw the water as good and Okada II (81 %) and post Okada (74%) rated it moderately polluted whereas the laboratory analysis shows that, water was moderately polluted for Okada I and poor for both Okada II and Post Okada.

It should be noticed that the respondents rating is a step higher compared with the laboratory analysis. This, however, agrees with the work of Rapu (2003) and Chimezie (2004) and this revealed that the respondents have poor perception of water quality in their environment. This comparison is very necessary because the respondents perception must have necessitated the usage to which the river was put into in table 3.

Table 3: Usage of Ada River

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Pre Okada	77	82	90	60	-	-	1
Okada I	18	40	16	23	2	20	2
Okada II	6	34	7	38	10	40	-
Post Okada	60	80	28	70	-	-	12

Source: Fieldwork 2007.

On water usage of river Ada, it is of pertinence to note that respondents marked/ticked more than one usage on their questionnaire. The pre-Okada respondents used the river more for drinking (90%) despite the fact that there is bore hole in the village and almost every compound has water storage tank. This is due to the fact that they perceived the water to be excellent (table 2). Another reason given is that the water temperature is lower and is cooler during the dry season and hot days. The Okada I, Okada II and post Okada respondents used the water more for washing, and bath/swimming. The rate of waste dumping (solid/liquid) into the river and its valley by the inhabitants and environmental sanitation agencies is relatively high. This partly account for the poor quality of the water between Okada I and post Okada region of the river.

Table 4 shows, the complaint of health problems associated with the use of Ada River. The complaints of health problems are with Okada II (31.8%) followed by post Okada (25.8%), Okada I (24.2%) and pre Okada (18.6%). This health problem pattern is line with the rate of pollution and compliant rate in appendices I and II. Similar health problems were also identified by Odjugo (2004), in his work on Ubeji community along Ubeji creeks, Warri Nigeria. It could be wise to explain' the higher hypertension rate in Okada II and I ad post Okada region could partly be the concentration of heavy metals like lead, and iron in the water,

Table 4: Health Problems Associated with the Usage of Water(%)

Diseases	Pre Okada	Okada I	Okada 11	Post Okada
Intestinal	14	25	32	29
Typhoid fever	21	25	24	28
Malaria fever	37	25	18	20
Skin	5	28	35	22
Hypertension	6	14	50	30

Source: Fieldwork 2007.

the pre-Okada with water quality compliant rate of 88.5% during the dry season is an indication of good water quality, Okada I, has a compliant rate of 80.8% which also shows that the quality of water is also good, but for Okada II and post Okada have 38.5% and 43.3% respectively show that the water quality both zones are poor. Apart from the biological factors, pre Okada water conforms to the WHO water quality standard. This is also true with Okada I with the exception of ph value that tends to be slightly acidic.

Aesthetically, biological and chemical Okada II and post Okada waters poor during the dry season with parameters conforming to WHO standard.

During the rainy season, the water quality ranges from good in pre Okada (80.8%) to moderately polluted (57.7%) very poor (15.4%) and poor (23.1) in Okada I, Okada II and post Okada respectively. This is as a result of pollutants washed into the river from Okada town.

The poor, very poor and poor in Okada I, Okada II and post Okada could be attributed to cumulative pollutants carried from upstream, while the second and most important. Source is the direct effluent discharge from abattoirs, sewages and detergents from cars and cloths washing. The third factor is indirect which include contaminants that enter the river waters through runoff from residue of human agricultural practices (fertilizers, pesticides, etc), improperly disposed dump waster and atmospheric contaminants. Such as gaseous emissions from automobiles and factories washed down by rain.

From appendices I and II, it is obvious that post Okada water quality is relatively better when compared with the heavily polluted Okada II because natural cleansing of the river itself to contaminants has taken place. The rater of progressive pollution as the river moves from pre Okada through Okada region is a clear indication of the effects of urban environment and human activities.

Recommendations

In light of the above discussion

1. It is therefore, recommended that both the federal and state ministry of environment should monitor closely the river course in order to save the river from being a dumping ground for industries, waste management agencies and households.
2. The government should provide pipe borne water to inhabitants of this region (Okada).
3. Government and NGOs should provide enlightenment campaign on the health implication of drinking, bathing and washing inside polluted water from the river.
4. River water should undergo treatment before it can be put into domestic use.

Conclusion

From the paper, the spatial and seasonal variation of water quality has been revealed. The quality of water during the dry season is higher compared to water quality in the rainy season, while urbanization and attendant human activities degraded the water quality.

Although the perception of respondents did not tally with the laboratory result, but gave the choice to which the water is used.

Due to the wrong perceived rating of the water quality, it has led to suffering of some related water diseases by the respondents.

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Appendix 1: Physig-Chemical Analysis During Dry Seasonal (Mg/L)

Parameters	Pre~Okada	Okada 1	Okada II	Post Okada	WHO
1 . Colour (TCU)	3.25	12.18	16.2	15.6	15.0
2. Odour/Taste (TON)	ND	ND	1.6	1.0	3.0
3. PH	7.46	6.25	5.46	5.12	6.5
4. Conductivity (Ms/cm)	0.06	0.9	0.9	1.08	1.5
5. Turbidity	2.23	4.25	8.16	7.21	5
6. Total Dissolved Solid	150.2	44.2	1250.5	1059.2	1.5
7. Hardness	15.5	225	555.6	552.6	500
8. Chloride (CL)	12.64	26.92	165.2	162.4	250
9. Nitrate (N03)	5.2	12.42	68.2	55.4	50
10. Sulphate (S04)	6.42	57.50	118.3	112.9	250
11. Phosphate (P04)	0.5	3.8	8.9	7.4	5
12. Sodium (Na)	iO.65	25.9	88.6	86.5	200
13. Manganese (Mg)	0.03	0.06	0.14	0.11	0.1
14. Calcium (Ca)	0.02	2.0	5.2	4.1	3
15. Copper (Cu)	0-02	0.04	0.63	0.51	10
16. Manganese	0.03	0.06	0.14	0.11	0.1
17. Lead (Pb)	0.008	0.009	0.02	0.015	0.1
18. Vanadium	ND	ND	0.008	0.004	0.001
19. Nickel (Ni)	0.003	0.005	0.01	0.008	0.02
20. Zinc (Zn)	0.04	0.08	0.08	0.08	0.02
21. Iron (Fe)	0.10	0.31	0.36	0.32	0.3
22. Coliform bacteria (CFC/MI)	3.0	20.0	30.0	26.0	00
23. E. Coil (CFC/ML)	2,0	2.0	6.0	6.0	00
24. E. Faecal Streptoccoci	ND	ND	ND	ND	00
25. Acerbic	>200	>150	>250	>200	100
Mesophilic Count					
26. Yeast	ND	10.0	250.0	180.0	100
Compliance Rate	88.5	80.8	38.5	43.3	

ND. Not Detected Source:
Fieldwork, 2007.