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Research Article

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Impact of Automobile Wastes Discharge on Water Quality in a Developing Country

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Abstract Automobile workshops scattered all over the city of Ado-Ekiti release organic compounds that find their way into the surface and underground water. Thus, physiochemical parameter of influences of these organic compound on the water quality of the study area were analyzed. Water samples from six locations were taken from wells and flowing water bodies (upstream and downstream) around the workshops. Laboratory tests were conducted on them and compared with World Health Organization (WHO) and the Nigerian Standard for Drinking Water Quality (NSDWQ) Standards. Calcium has a mean concentration of 267.1mg/l for upstream, 288.6mg/l for downstream and 259.5mg/l for well. Chloride with a mean value of 797.2mg/l, 371.75 and 2032.9mg/l respectively. Nickel has mean values of 0.005mg/l, 0.003mg/l and 0.006mg/l. copper has a mean value of 0.34, 0.10 and 0.20mg/l respectively. Cadmium has a mean values of 0.003, 0.012 and 0.008mg/l. Iron with a mean values of 0.33, 0.27 and 0.22mg/l. Manganese has a mean values of 0.025, 0.03 and 0.04mg/l and Lead with a mean values of 0.004, 0.004 and 0.19mg/l respectively. The result shows that some of the parameters tested for does not fall within the acceptable limit standards for consumption purposes. Therefore, indiscriminate sitting of automobile workshop close to residential houses should be discouraged while government and private individuals focus on construction of eco-friendly mechanic workshop in and within Ado metropolis.

Keywords Automobile wastes, Pollution, Developing countries, Water quality.

Introduction

Pollution is described as the introduction, by man into the environment, substances or energy, liable to cause hazard to human health, harm to living resources [1]. Pollution is a substance that occurs in the environment, at least in part, as a result of human activities and which has deleterious effect on the human environment [2]. Water pollution threatens human health, economic development and social property. The effect of oil spill from motor servicing centers popularly known as mechanic workshops on the surface and underground water has been very glaring in terms of the negative effect in many urban areas in which Ado-Ekiti is not an exemption. Environmental pollution with petroleum products (complete mixture of hydrocarbon) has been recognized as a serious environmental problem especially as it is being spilled on large scale [3].

The indiscriminate location of roadside automobile workshops (*i.e.* panel beating, mechanical, vulcanizing, etc.) in residential areas of developing countries like Nigeria is common sight. The effect of oil from automobile workshop have reached a disturbing level, environmental contamination are widely distributed in the soil as groundwater thereby having effect on the tropic chain, plants, animals and man [4]. Although traced metal are usually present are usually present in the biological world in acceptable quantities, an increase of this through anthropogenic activities in the last century has been known to affect microbial growth, numbers, survivals, biomass and its abundance [5]. Wastes such as used black oils, carbides, contaminated fuel, etc. from these workshops when discharged/dumped on land surface are washed by precipitation, thereby percolating and infiltrating the unsaturated zone while the rest reach the water table causing groundwater and surface water

pollution. Thus, surface and underground water which serves as means of livelihood in developing countries are exposed to danger resulting to communicable diseases such as abdominal pain, chronic bronchitis, kidney diseases, dysentery and cholera etc [6].

The current interest in the environmental system from the concern that man is disrupting the natural processes and that the quality of life is being threatened Automobile workshops are scattered all over the city of Ado-Ekiti and occupy almost every vacant plot especially along roads, streets. Wastes from these workshops are indiscriminately dumped on every available space thereby seeping into the water bodies. This practice is very common in many developing countries especially Nigeria where there is high population growth due to urbanization, industrialization and modernization [7-8]. The past research works of [6-13] looked into the problem of associated with automobile wastes in the quality especially in developing countries where inappropriate disposal from automobile workshops and poor management is rampant. Also, [14] reported that about 20 million gallons of waste engine oil are generated in Nigeria annually from automobile workshop which are discharged carelessly into the environment, whereas a liter of used engine oil is enough to contaminate one million gallons of fresh water.

There are provisions under the Environmental Protection Act 1986 to control the disposal of waste water from mechanic workshops through license condition set by the Department of Environmental Protection Agency. But the agency has not been able to do much to save ground discharges from automobile premises. In order to maintain a good health, however water is expected to be safe to drink and meet the local standards and international standards too dour, taste and appearance [15]. The study intends to evaluate the influence of organic compounds from automobile workshops sites on the water quality of Ado. The result will help and provide dependable scientific facts, engineering information, characteristics and quality of available water in Ado metropolis located in Southwestern part of Nigeria. To obtain the desirable water resources and ensure sustainability, local and international criteria and guidelines established for water quality standards are used [16-18].

Materials and Method

a) Study Area

The study area are Bawa road [Location A], Bank road [Location B], Iyin road [Location C], Ikere road [Location D] Polytechnic road [Location E] and Basiri road [Location F] all in Ado – Ekiti metropolis. Ado Ekiti being a state capital of Ekiti State is located in the Southwestern zone of Nigeria, between latitude $7^0$15'N and $8^0$51'N and latitude $4^0$51'E and $5^0$45'E. It has a mean annual temperature of 27 °C and an annual mean rainfall of 1334mm. Presently, the town has a population of 1,111,953 since 2010. The town is growing into a thickly populated town caused by the influx of civil servants, business people, presence of six tertiary institutions within and around the town, establishment of branches of commercial banks which has led to increase in the inflow and outflow of vehicles in the town. Geologically Ekiti state is underlain by metamorphic rocks of the Precambrian basement complex of southwest part of Nigeria the great majority of which are ancient in age. The soil obtained from the basement complex rock are usually well drained, having medium to coarse in texture. The geological nature of the study area and the increased in urbanization has made it more vulnerable to public health concern when it comes to water quality [7,8,19].

b) Sample Collection And Analysis

Water samples were collected from six locations at the upstream, downstream and wells in the study area during the day time before the sunset using sterilized plastic containers of 2 liters capacity. The caps of the plastic containers were carefully removed and dipped into the streams. The mouth were directed to the direction of flow at about 0.3m depth and the cap securely tightened. The temperature of the water sample was taken immediately and labeled accordingly. The sampling containers where properly rinsed with distilled water before used. The samples were taken to the laboratory where tests and analysis commence in earnest.

All test were carried out on the water samples in accordance with [6,16,20] standard methods. The test conducted on the water samples are physical and chemical tests respectively. The physical test includes temperature, appearance, colour, hardness, odour, turbidity, and dissolved solids. The chemical tests are

potential hydrogen (PH), contents of calcium, chloride, lead, iron, total alkalinity, Bi-carbonate and dissolved oxygen.

The PH values of the water samples were determined electrically using a PH meter comprising of an indicator electrode which has been calibrated with a standard buffer solution. The turbidity was determined by the Nephelometric method [21]. In which the samples were thoroughly shaken and then poured into a sample cell to at least two-third full. The turbid meter was then used to determine the values. The Bi-carbonate, Total Alkalinity, Chloride concentration, calcium were determined by titrimetric methods in which 50ml of samples pipette into 250ml conical flask. The total hardness was determined by titration of 5oml water sample with standard EDTA using Erichrome black T indicator. The results were then compared with the relevant and approved standards [16,17,20].

Results and Discussions

The physiochemical parameters of water samples obtained from the upstream, downstream and wells in Ado local government council are presented in tables 1, 2 and 3 respectively. Table 1, shows the physical analysis while Table 2 shows the chemical analysis and Table 3 shows the mean values of water samples and ranges compared with standards [16, 18].

Table 1: Physical qualities of the selected upstream, downstream and well water samples

Parameters	Location: Upstream						Location: Downstream						Location: Well					
	A	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**
Temp (°C)	26.2	25.4	25	26.1	25.6	24.1	27	25	26.5	28	24.2	24.5	27.4	24.6	27	27.4	24.2	26.5
Turbidity (NTU)	M	M	SM	CL	SC	SC	SC	C	CL	C	C	M	C	C	C	SL	C	C
Colour (TCU)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Odour	Odourless																	
Appearance	C	M	C	C	C	C	C	C	M	C	C	C	SC	C	S	CL	CL	CL
TDS (mg/l)	14000	2000	2000	2000	2000	7000	2000	2000	2000	2000	2000	2000	4250	2002	2000	2000	2000	6000
TH (mg/l)	1120	75	124.4	73.9	50.6	500	104.8	105.7	158.5	107.9	20.9	200	1000	60.54	23.9	141.8	200	700

Note: M – Milky; C – Clear; SM – Slightly cloudy; SC – Slightly cloudy; CL – Cloudy; S – Sparky

Table 2: Chemical qualities of the selected upstream, downstream and well water samples

Parameters	Location: Upstream						Location: Downstream						Location: Well					
	A	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**
pH	6.7	6.1	6.6	7.0	6.8	6.8	7.2	6.4	6.3	7.3	6.1	6.7	6.9	6.8	6.7	7.1	6.7	6.9
Calcium (mg/l)	376	528	46.5	24.1	240	38.8	652	288	16.1	33.7	292	450	600	332	27.3	72.2	252	500
Chloride (mg/l)	517.6	496.3	1233.7	978.4	921.7	635.4	1587.7	815.4	850.8	985.5	1276.2	2500	3723	531.8	652.3	1262	1028.5	5000
Bi-carbonate (mg/l)	14.4	15.6	120	34.2	22.8	30.4	75.6	28.8	147.6	53.7	20.4	25.4	44.4	14.4	161.4	58.6	19.2	40.5
D-Oxygen (ppm)	6.7	6.3	6.4	6.5	6.4	6.5	7.0	6.2	6.5	7.0	6.5	6.4	6.6	6.4	6.6	6.7	6.7	6.9

Temperature

The temperature of the water samples from the upstream ranged between 24.1 – 26.2 °C with a mean value of 25.4 °C, downstream ranged between 24.2 – 27 °C with mean value of 25.9 °C and well ranged between 24.2 – 27.4 °C with a mean value of 26.5 °C. These values are outside the range of the [16,18] of 5 °C for domestic water purposes. The increase in temperature is an indication of presence of active micro-organism.

Total Hardness

total hardness for upstream ranged between 50.55 – 1120mg/l with a mean value of 323.9mg/l, downstream ranged between 104.8 – 158.5mg/l with a mean value of 124.7mg/l, while the well is between 41.8 – 1000mg/l with a mean value of 373.6mg/l. The result shows that the downstream has the highest mean value followed by the upstream and the well respectively. These values do not comply with recommended limit of NSDWQ. The

water sample from the downstream is soft. The problem with hard water is that it wastes soap and causes problem with plumbing appliances.

Colour

All the water samples have a value of 5TCU which is within the set limits of acceptable standards of drinking and domestic water.

Dissolved Solid

The upstream water sample ranged between 200–7000 mg/l with mean value of 4833.5 mg/l, downstream between 0–2000 mg/l with mean value of 2000 mg/l while well is between 200–6000 mg/l with mean value of 3033.3 mg/l, which does not fall within the acceptable standard.

Dissolved Oxygen

This is an essential factor used for determining water control quality. The upstream dissolved oxygen ranged between 6.3-6.7 mg/l with a mean value of 6.5 mg/l, downstream ranged between 6.2-7.0 mg/l with a mean value of 6.6 mg/l while well ranged between 6.4-6.9 mg/l with a mean value of 6.7 mg/l.

Calcium

The upstream ranged between 24.1-528 mg/l with a mean value of 267.1 mg/l, downstream between 16.03-652 mg/l with a mean value of 288.6 mg/l, while well ranged between 27.23-600 mg/l with a mean value of 259.2 mg/l. These values are higher compared with relevant standards, upstream water samples having higher values.

Chloride Concentration

The chloride ranged between 496.3-1233.7 mg/l for upstream with a mean value of 797.2 mg/l, downstream ranged between 815.4-1587.7 mg/l with mean of 3717.5 mg/l, while well is between 538.1-5000 mg/l with mean value of 2032.9 mg/l. These values do not comply with recommended values of WHO of 200-300 mg/l. However, values above 250 mg/l for chloride would result in detectable tastes which an indication of contamination from urine or sewage.

pH

The pH for upstream water sample ranged between 6.1-7.0 with a mean value of 6.7, downstream between 6.1-7.3, with mean value of 6.7 while the well is between 6.7-7.1 with mean value of 6.9. Though the water samples are within the set standard, the water samples are acidic and alkaline in some places. The acidic nature is an indication of toxic metals.

Iron and Lead

The upstream water samples ranged between 0.004-0.36 mg/l with mean value of 0.33 mg/l, downstream between 0.04-0.40 mg/l with mean value of 0.27 mg/l while the well is between 0.002-0.36 mg/l, with mean value of 0.22 mg/l for Iron concentration. Lead ranged between 0.001-0.005 mg/l with mean value of 0.004 mg/l for upstream, 0.001-0.005 mg/l with a mean value of 0.004 mg/l for downstream while the well ranged between 0.009-1.10 mg/l with a mean value of 0.19 mg/l. All these water samples except upstream falls within the limits standard of 0.3 mg/l for Iron and 0.01 mg/l for lead [16,18]. The accumulation of lead over time above 0.01 mg/l may cause cancer interference with vitamin D metabolism, affect mental development in infants and toxic to the central and peripheral nervous system. The presence of lead, iron is an indication of toxic wastes from disposed battery cells, aerosol can and some toxic materials. It was reported that the formation of goiter in Adults was the result of consumption with quantity of iron above the recommended values [1,13].

Manganese

The water sample obtained at the upstream ranged between 0.004-0.08 mg/l, with mean value of 0.025 mg/l, downstream between 0.006-0.05 mg/l with mean value of 0.03 mg/l while the well ranged between 0.004-0.09

mg/l with mean value of 0.04 mg/l. All these values are within the recommended values. However, the accumulation of this metal in excess between 0.01-0.02 mg/l can cause neurological disorder in human.

Cadmium

The upstream water samples ranged between 0.007-0.01 mg/l with mean value of 0.003 mg/l, downstream between 0.001-0.008 mg/l with mean value of 0.012 mg/l while well is between 0.007 – 0.009 mg/l with mean value of 0.08 mg/l. These values are within the recommended values. However, accumulation of cadmium could be toxic to the kidney.

Copper

The upstream water samples is between 0.01-1.66 mg/l with mean value of 0.34 mg/l, downstream between 0.008-0.01 mg/l with mean value of 0.10 mg/l while well ranged between 0.03-0.5 mg/l, with mean value of 0.20 mg/l. All these values are within the acceptable limit standard but an increase due to accumulation between 1 and 2.0 mg/l would cause health problem such as gastrointestinal disorder.

Conclusion

The result of the study on some parameters examined when compared with [16-18] portable drinking water standard and effluent discharged from Automobile workshop in Ado – Ekiti metropolis reveals the extent of pollution done to the environment as a result of livelihood, services to the public and industrialization.

The TDS from all the water samples are above the acceptable limits. Also, the water samples from the upstream revealed high concentration of Iron in the water samples. The higher concentration of this metal can result to formation of goiter in Adults. Concentration of heavy metal such as manganese, cadmium, lead and copper should be properly monitored over time because of the possible threats to both the animal and human when there is accumulation of these metals. When these metals are consumed at higher concentration, health problems such as cancer, poor metal development in infants, kidney infections, neurological disorder and gastrointestinal disorder are imminent. The hardness in the water samples was higher due to the leaching of magnesium and calcium into groundwater table. However, boiling of water at boiling temperature will naturally remove temporary hardness while addition of carbonates and sulphate would be needed to eliminate permanent hardness.

The usual improper disposal of these water demands special attention in order to protect surface and underground water system. Therefore, it is advisable that automobile mechanic village should be built and sited far away from residential areas to avoid transfer of these metals into the ground and surface water body. State legislative should enact law forbidden individual from given out plots of land for location of automobile workshop within Ado metropolis. Ministry of Environment in collaboration with all relevant agency concerned should constant mount public enlightenment campaign using posters and media houses to educate the public on the hazards associated with location of automobile workshops within the residential area.

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