



ASSESSMENT OF AUTOMOBILE WASTE MANAGEMENT PRACTICES IN OSUN STATE, NIGERIA

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Abstract

The purpose of the study was to assess automobile waste management practices in Osun State, Nigeria. The study answered two research questions and two null hypotheses were formulated and tested at 0.05 level of significance. Descriptive survey research design was adopted for the study and population for the study was 388 respondents comprised of 208 registered automobile mechanics master craftsmen and 180 officials of all waste management regulatory agencies in Osun State. A structured questionnaire which contains 37 items designed to obtain information from the respondents. The data collected were analyzed using mean, standard deviation, and z-test statistics was used to test the null hypotheses 1 and 2. Based on the data analyzed, the following findings among others revealed that hazardous automobile waste are not usually stored in closed containers neither collected by licensed agencies, used refrigerants from vehicle are not collected in approved recovery equipment for off-site reclamation, the used oils generated from mechanics workshop are disposed around their workshop to control dust and weeds, battery charger discharge used acid anywhere around their shop. Based on the findings of the study, the following recommendations were made: environmental agencies should introduce public enlightenment and education on the consequences of indiscriminate disposal of automobile wastes, periodical monitoring and assessment of automobile waste management by environmental agencies should be conducted as stipulated by law, and shops alleged for environmental pollution be sanctioned.

Keywords: *Assessment, Automobile, Waste, Management*

Introduction

The importance of automobile in the economic and social development of any nation cannot be overemphasized. Automobile have affected all aspects of society, such as economy and environment; it directly contributed to the wellbeing of people through their use for the transportation of persons, goods and services from one place to another for personal or business activities (Qiksearch, 2017). It is therefore very unfortunate to note that while automobiles enhanced our lives, they also contributed to the growing global problem of waste management. SmallstarterThinktank (2013) however reported that Nigeria is the primary destination for used vehicles, used engines and other used automobile spare parts ultimately resulting in automobile wastes.

Waste is any solid, liquid, gaseous, discarded material that has ceased to be of any value and potentially to be disposed (Hoornweg and Bhada -Tata, 2012). Therefore, the waste that is generated and obtained from automobile is called automobile waste. This is a generic term embracing what is made of automobile which include various forms of metal, polymer composite and plastics, fluids and lubricant, rubber, glass, textiles and other miscellaneous materials as well, that have ceased to be serviceable or ready for disposal (Kellogg, 2016). Automobile waste may be considered hazardous based on the following characteristics: ignitability, reactivity, corrosivity and toxicity (Hazardous Waste Expert, 2017). The waste from automobile can be broadly categorized as solid waste, liquid waste and gaseous waste. Solid waste in automobile includes plastics, rubbers, batteries, metals, wood, glass, cables and tyres. Liquid waste is related to petrol, diesel, and grease, cleaning solvents, acids from batteries, wastewater, and anti-freeze. Freon and combustion emission (Carbon monoxide (Co) constitute gaseous waste. These wastes are potentially dangerous to human health and the environment (World Bank, 2012). Classically, automobile wastes are generated from the following sources among others: automobile mechanic workshops and garages; vehicle users; automobile dealers; automobile industries. These include scrap components, liquid and gaseous substances and other miscellaneous materials. These wastes containing heavy metals and other environmental toxins that causing environment pollution and greenhouse gas emissions which contribute to climate change (Utamge *etal.*, 2013). Therefore an effective waste management practices needed to be adopted.

Waste management is knowledge about waste and its management which is premised on the prevention of waste from causing harm to human and environmental health (Research Gate, 2014a). In that respect, automobile waste management in the opinion of PR Newswire (2015); Abdhahah *etal* (2016) is the planning, financing and implementation of programmes for automobile waste collection and transportation, treatment, resource recovery (recycling), and final disposal back with regulations in sound environmentally sustainable best practices. Effective and sustainable automobile waste management therefore requires adherence to set standards at every stages of the management practices (World Health Organisation, 2014). This in consequence will impact positively ineffective of automobile waste management practices in Nigeria, especially in Osun State.

Waste management practices are those activities and actions required to manage waste from its inception to its final disposal. However, waste management practices identified by Davidson (2011) include: collection practices; disposal practices; recycling practices. Other practices in waste management acknowledged by Uwadiegwa and Chukwu (2013) are waste management regulations and strategies for its effectiveness. Consequently, one of the biggest challenges in establishing an effective and efficient automobile waste management system in Nigeria is modern and sustainable collection practices. Waste collection in waste management practices involves the transfer of waste materials (recyclables and non-recyclables) from the source of generation either for recycling purposes or final disposal. Cal Poly Pomona (n.d) described automobile waste collection as the emptying and transfer of different forms of waste (solid, liquid and gases) generated from various activities with automobile for recycling, reuse, energy recovery or ultimate disposal. This practice is influenced by the activities of scrap merchant and waste scavengers', number of collection points, waste quantity, storage capacity, costs of collection vehicles and distance to recycling plant, and disposal facilities (Das & Bhattacharyya, 2015). Improper collection and storage of fluid, used parts, tyres and wrecked vehicles is noted to cause environmental pollution (Cossu, 2013; Sharma *etal*, 2016). Therefore an explanation to effective automobile waste management practices is to reduce waste build-up, provide for collection equipment and facilities, and provide for waste treatment and adopt right disposal practices.

Waste disposal is significant and critical aspect in waste management practices and environmental issues. Cherdaturkul (2012) described waste disposal as the final process whereby the ultimate wastes that have no further use to the society hit the land. In this regard the position of disposal practices in automobile waste management system cannot be overemphasised. These practices constitute those activities associated with ultimate removal of automobile waste which include collection and transportation directly to a landfill site when all form of diversion; reuse and volarisation are exhausted (Cossu, 2013; Ritzkowski & Stegmann, 2013). It is a practice at the final stage of the entire waste management practices. An improperly disposed automobile wastes is confirmed causing environmental and soil pollution, and ground water contamination (Jonathan and Elaine, 2012). It is therefore necessary to assess the management of automobile waste holistically.

Assessment as described by Coulshed and Orme (2012) is the systematic and participatory process that seeks to understand situation and set a basis for planning how change or improvement can be achieved. Therefore, assessment in the context of automobile waste management practices is the measurement for effectiveness of the management practices with aim of improving the current collection and disposal practices. However, most states in Nigeria and indeed Osun State generate automobile waste at an alarming rate specifically, by the automobile mechanics during engine reconditioning, over hauling and servicing. The different types of automobile waste produce are noted not being properly managed the reason which may be due to lack of effective waste management practices. Therefore, the study is designed to assessment of automobile waste management practices in Osun State, Nigeria.

Research Questions

1. What are the collection practices of automobile waste management in Osun State, Nigeria?
2. What are the disposal practices of automobile waste management in Osun State, Nigeria?

Methodology

Descriptive survey research design was adopted for the study. The study was carried out in Osun State. The population for the study was 388 respondents

comprised of 208 registered automobile mechanics master craftsmen and 180 officials of all waste management regulatory agencies in Osun State. A structured questionnaire was the instrument for data collection. The instrument was face and content validated by two experts, one from the Department of Industrial and Technology Education Automobile Technology Option, Federal University of Technology Minna Niger State and the other from Osun Waste Management Agency. To determine the ability of the instrument, it was pilot-tested on 30 respondents in Ibadan, Oyo State that was not part of the study. Cronbach alpha was used to determine internal consistency of the instrument and it yielded a reliability coefficient of 0.84. Thus the instrument was considered appropriate for use by the researcher. The questionnaire was administered by the researcher with the help of five research assistants and 347 instruments were retrieved and analysed. A four (4) rating scale was used in the study from Strongly Agree (SA) – 4 points to Strongly Disagree (SD) – 1 point. The decision rule was based on the theory of true limit class limits of numbers with numerical values:

4 Strongly Agreed (SA)	3.50-4.00
3 Agreed (A)	2.50-3.49
2 Disagreed (D)	1.50-2.49
1 Strongly Disagreed (SD)	0.50-1.49

Therefore, the mean responses of the respondents were interpreted based on the true limits of numbers as highlighted above. The data collected from the study were analysed using Mean and Standard Deviation. The two null hypotheses were tested using z-test at 0.05 level of confidence.

Results

Research Question 1

What are the collection practices of automobile waste management in Osun State, Nigeria?

Table 1: Mean Responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Collection Practices of Automobile Waste Management

N1 = 187, N2 = 160

S/N	Statements	X ₁	X ₂	X _T	SD	SD	SD	Decisi on
					1	2	T	
1.	Oil rags are placed in a sealed container for ease of collection	2.1 0	2.1 0	2.1 0	.54 0	.49 1	.51 6	Disagr ee
2.	Hazardous automobile waste are usually stored in closed containers for collection by licensed agencies	2.0 6	2.0 2	2.0 4	.49 9	.45 5	.47 7	Disagr ee
3.	Used solvent are kept in sealed drums for collection	2.0 1	1.9 8	2.0 0	.47 5	.42 7	.45 1	Disagr ee
4.	Used oil filters are crushed for collection by metal recycler	2.0 9	2.0 2	2.0 5	.64 2	.49 5	.56 8	Disagr ee
5.	Waste oils are stored in separate drums for collection	2.1 0	2.0 7	2.0 9	.60 9	.33 9	.47 4	Disagr ee
6.	Only metallic scraps of automobile waste are collected by waste pickers	2.7 1	2.8 8	2.7 9	.77 9	.83 0	.80 4	Agree
7.	There are modern waste collection facilities for automobile waste in all the local governments	2.0 4	2.0 2	2.0 3	.39 9	.50 7	.45 3	Disagr ee
8.	Registered private waste collectors provide services for the collection of automobile waste	2.0 1	2.0 4	2.0 2	.35 2	.47 4	.41 3	Disagr ee
9.	Informal waste pickers collect metallic scraps of automobile waste from	2.5 1	3.0 0	2.7 6	.87 0	.44 9	.65 9	Agree

	mechanic shops, vehicle users and dump sites								
10.	There is curbside used oil collection programme for oil recycling incentives.	1.9	2.0	2.0	.37	.44	.41	Disagree	
		5	8	2	8	8	3	ee	
11.	Waste antifreeze is stored in separate closed container for collection	2.0	2.0	2.0	.44	.38	.41	Disagree	
		7	6	7	6	3	5	ee	
12.	Catalytic converters are taken to a catalytic converter collection centres for profit	2.1	2.1	2.1	.54	.54	.54	Disagree	
		3	5	4	3	0	2	ee	
13.	Bad batteries are stored separately from other flammable hazardous chemical for collection by recycler	2.1	2.2	2.1	.63	.59	.61	Disagree	
		2	6	9	1	6	4	ee	
14.	Drip pans are kept under stored vehicles with oil leaks for collection during repair work	3.0	3.1	3.1	.63	.34	.48	Strongly Agree	
		8	4	1	0	5	8		
15.	Used refrigerants from vehicle are collected in approved recovery equipment for off-site reclamation	2.0	2.1	2.0	.58	.45	.52	Disagree	
		6	0	8	8	1	0	ee	
16.	Used tyres are collected for landfilling	2.1	2.1	2.1	.58	.46	.52	Disagree	
		3	4	3	2	9	5	ee	
17.	Punctured and emptied aerosol cans are stored in a container for ease of collection by scrap merchants	2.1	2.1	2.1	.55	.52	.54	Disagree	
		1	8	4	8	5	1	ee	

18.	Metals such as lead, copper, aluminum and steel are stored in a secure container for collection by a metal recycler.	2.0	2.2	2.1	.49	.58	.53	Disagr ee
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Key

$N_1, N_2, N_T =$ Numbers of Registered Automobile Mechanics Master Craftsmen, Officials of all the Waste Management Regulatory Agencies in Osun State and Total Numbers of Respondents

$X_1 =$ Mean of Registered Automobile Mechanics Master Craftsmen

$X_2 =$ Mean of Officials of all the Waste Management Regulatory Agencies in Osun State

$X_T =$ Mean of All Respondents

$SD_1 =$ Standard Deviation of Registered Automobile Mechanics Master Craftsmen

$SD_2 =$ Standard Deviation of Officials of all the Waste Management Regulatory Agencies in Osun State

$SD_T =$ Average Standard Deviation

Table 1 above presents the results on collection practices of automobile waste management in Osun State, Nigeria. The results revealed that Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State agreed that only three items which are items 4, 8 and 16 are the major ways by which automobile wastes are being collected in Osun State, Nigeria. This implies that other items suggested are not widely practised within the state understudied. The average standard deviation ranges from 0.26 to 0.81 which inferred that the respondents were closer to each other in their responses to the items.

Research Question 2

What are the disposal practices of automobile waste management in Osun State, Nigeria?

Table 2: Mean Responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Disposal Practices of Automobile Waste Management
 N1 = 187, N2 = 160

S/N	Statements	X ₁	X ₂	X _T	SD ₁	SD ₂	SD _T	Decision
1.	Automobile waste dumping sites around the workshop are demarcated for disposal	2.03	2.08	2.05	.394	.308	.351	Disagree
2.	Used oil drained into drip pans are disposed into waste oil drum or tank separately	2.24	2.21	2.23	.578	.506	.542	Disagree
3.	Waste antifreeze is discharged into land rivers/streams/drains/canals for disposal	3.02	3.11	3.06	.523	.309	.416	Strongly Agree
4.	Used oil filters are punctured, drained and crushed for disposal	2.11	2.26	2.18	.427	.619	.523	Disagree
5.	Mechanics workshops do not have sink drain for wastewater	2.94	3.07	3.00	.525	.357	.441	Strongly Agree
6.	Used oils generated from mechanics workshop are disposed around their workshop to control dust and weeds	3.04	3.13	3.09	.271	.490	.381	Strongly Agree
7.	There are public landfills for disposing automobile waste	2.00	2.04	2.02	.207	.361	.284	Disagree
8.	Automobile wastes such as plastics, used tyres, rags or	3.06	3.23	3.15	.246	.423	.334	Strongly Agree

	absorbents are disposed through burning							
9.	Battery charger discharge used acid anywhere around their shop	3.00	3.03	3.01	.180	.404	.292	Strongly Agree
10.	Vehicle air conditioning refrigerants are discharged into the air	3.02	2.85	2.93	.264	.702	.483	Agree
11.	Automobile wastes such as polymer bumper, glass, dash board, seat foam and clothing are disposed with domestic waste	3.03	3.10	3.06	.242	.540	.391	Strongly Agree
12.	Automobile mechanics workshop, vehicle users, dealers, and automobile industries are responsible for their wastes disposal	3.01	3.09	3.05	.320	.511	.416	Strongly Agree
13.	Used oils are discharged to the ground, sewers, drainage, ditches, septic tanks or streams.	3.04	3.08	3.06	.190	.413	.302	Strongly Agree
14.	Used motor oils are exchange for new oil from refinery agents at reduced price for disposal	2.02	2.14	2.08	.206	.402	.304	Disagree
15.	Used oils are burnt for fuel.	2.11	2.43	2.27	.333	.522	.427	Disagree
16.	Lead wheel (tyre) weight unused are returned to supplier and not put in dumpster	2.04	2.16	2.10	.290	.496	.393	Disagree
17.	Undeployed airbags are sold for reuse.	2.03	2.08	2.06	.372	.560	.466	Disagree
18.	Catalytic converters are specially sell to core buyers	2.05	2.13	2.09	.288	.445	.367	Disagree

19	Used batteries are disposed in a trash	2.04	2.11	2.07	.334	.521	.428	Disagree
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Key

N_1, N_2, N_T = Numbers of Registered Automobile Mechanics Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State and Total Respondents

X_1 = Mean of Registered Automobile Mechanics Master Craftsmen

X_2 = Mean of Officials of all the Waste Management Regulatory Agencies in Osun State

X_T = Mean of All Respondents

SD_1 = Standard Deviation of Registered Automobile Mechanics Master Craftsmen

SD_2 = Standard Deviation of Officials of all the Waste Management Regulatory Agencies in Osun State

SD_T = Average Mean of Standard Deviation

The result of analysis as presented in Table 2 on the disposal practices of automobile waste management in Osun State, Nigeria showed that the respondent disagree with items 1, 2, 4, 7, 14, 15, and 16 as well as items 17, and 18 as regards the disposal practice adopted in managing automobile waste. This is evident from the mean results which shows that all the items indicated have their average mean not less than 1.50 and not more than 2.49. This implies that other items presented in the table are the disposal practice of automobile waste adopted in Osun State, Nigeria. A grand average showed a standard deviation (SD) of 0.308 to 0.702 indicating that the respondents are not too far from the mean and not from one another in their responses.

Hypothesis One

There is no significant difference in the mean responses between registered automobile master craftsmen and officials of all the waste management regulatory agencies in Osun State as regards the collection practices of automobile waste management in Osun State, Nigeria

Table 3: z-test analysis of significant difference in the mean responses between registered automobile master craftsmen and officials of all the

waste management regulatory agencies in Osun State as regards the collection practices of automobile waste management in Osun State

N1 = 187, N2 = 160

Hartley Test for Equal Variance z-test for Equality of Means										
		F	Sig.	Mean	Std. Error	Z	Df	Sig. (2-tailed)	95% Confidence Interval (2-Difference)	for
				Diff.					Lower	Upper
Equal variances assumed		1.31	0.04	-.060	.057	-1.053	345	.293	-.172	.052
Equal variances not assumed				-.060	.056	-1.064		.288	-.171	.051

Table 3 shows the z-test analysis of differences in the responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Collection Practices of Automobile Waste Management. The table reveals that the probability value obtained was found to be 0.288 which is greater than the probability value of 0.05 in comparison. The null hypothesis was therefore accepted. Therefore, there is no significant difference in the mean responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Collection Practices of Automobile Waste Management in Osun State.

Hypothesis Two

There is no significant difference in the mean responses between registered automobile master craftsmen and officials of all the waste management regulatory agencies in Osun State as regards the disposal practices of automobile waste management in Osun State, Nigeria

Table 4: z-test analysis of significant difference in the mean responses between registered automobile master craftsmen and officials of all the

waste management regulatory agencies in Osun State as regards the disposal practices of automobile waste management in Osun State

N1 = 187, N2 = 160

		Hartley Test for Equal Variance		z-test for Equality of Means				95% Confidence Interval for (2-Difference)	
	F	Sig.	Mean Diff.	Std. Error Diff.	Z	Sig. (2-tailed)	Lower	Upper	
Equal variances assumed	2.48	0.00	0.000	.046	0.000	1.000	-.091	.091	
Equal variances not assumed			0.000	.048	0.000	1.000	-.094	.094	

Table 4 shows the z-test analysis of differences in the responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Collection Practices of Automobile Waste Management. The table reveals that the probability value obtained was found to be 1.000 which is greater than the probability value of 0.05 in comparison. The null hypothesis was therefore accepted. Therefore, there is no significant difference in the mean responses of Registered Automobile Master Craftsmen and Officials of all the Waste Management Regulatory Agencies in Osun State as regards the Disposal Practices of Automobile Waste Management Osun State.

Findings of the Study

The findings of the study were based on the data collected and analysed with reference to the research questions and hypotheses that guided the study.

Findings of the study are therefore as follows:

1. The finding on the collection practices of automobile waste management revealed that hazardous automobile wastes are not usually stored in closed containers neither collected by licensed agencies, waste antifreeze is not stored in separate closed container for collection, used refrigerants from vehicle are not collected in approved recovery equipment for off-site reclamation, and used tyres are not collected for landfilling.

2. Findings on the disposal practices of automobile waste management revealed that the used oils generated from mechanics workshop are disposed around their workshop to control dust and weeds; no public landfills site for disposing automobile waste; battery charger discharge used acid anywhere around their shop; vehicle air conditioning refrigerants are discharged into the air; automobile wastes such as polymer bumper, glass, dash board, seat foam and clothing are disposed with domestic waste; and discharged of used motor oil to the ground, sewers, drainage, ditches, septic tanks or streams as usual disposal practice.

Finding of the study on test of hypotheses revealed the following:

- 1 There is no significant difference in the mean responses between registered automobile master craftsmen and officials of all the waste management regulatory agencies in Osun State as regards the collection practices of automobile waste management in Osun State, Nigeria.
- 2 There is no significant difference in the mean responses between registered automobile master craftsmen and officials of all the waste management regulatory agencies in Osun State as regards the disposal practices of automobile waste management in Osun State, Nigeria

Discussion of Findings

Findings on the collection practices of automobile waste management revealed that hazardous automobile waste are not usually stored in closed containers neither collected by licensed agencies in the study area this might be as a result of lack of knowledge on their potential hazards on the part of automobile mechanics. This finding is in support of Abarca *etal*, (2013); Agarwal *etal*, (2015) who reported that the risk of exposure to automobile waste is influenced by poor management practice or neglect characterised by ineffective collection, unsafe disposal and absence of good polices. The findings of this study also shows that used waste motor oils, waste antifreeze and other material are not neither properly kept nor collected for appropriate disposal but subsequently dumped in every available space and places, especially around automobile mechanics workshops. Lack of information and public enlightenment on health implication of improperly collected and disposed automobile waste might be

responsible for this. This might also be attributed to lack of regulatory framework specifically for automobile waste in the general and state environmental laws, standards and regulation. European Commission (EUC) (2010); Modak *etal*, (2012); Abarca *etal*, (2013) corroborated this finding that the waste management regulatory agencies must encourage the prevention or reduction of automobile waste and its impacts on the environment by encouraging the development of recycling and recovery technologies, improved eco-friendly products and disposal techniques in line with global practices. Abdhallahi (2015); Warlito & Charlie (2015) suggested that to avoid exposure to risk from automobile waste requires stringent management practices with adherence to safety standards in handling automobile waste particularly liquid waste.

The findings also revealed that used solvent generated in the cause repairs and maintenance work by automobile mechanics shops are properly stored and not collected by licensed agency but disposed irregularly. Solvent can cause damage to our skin, eyes, nose and throat, and respiratory system as well, which can result in chronic bronchitis and lung disease. In support of this Commonwealth of Massachusetts (2017) explained that cleaning liquid wastes are hazardous and therefore require proper treatment and disposal. CIWMB (2003) opined that mineral spirits containing volatile organic compounds (VOC) contributed to smog formation and may be toxic when inhaled or ingested. The finding also revealed that automobile air-conditioning repair mechanics do not have recommended recovery equipment for used refrigerants let alone sending it for reclamation but usually vents it into the air. This trend is not acceptable because refrigerants vents it into the air is one of the chemical known to destroy the ozone layers, causing a rise in skin cancer and cataracts problems or permanent blindness. Also toxic fume from burned refrigerant is confirmed to be poisonous. According to Hazardous Waste Experts (2017) recycling and reclamation are the two methods usually used to manage refrigerant rather than disposing it improperly. In support of this CIWMB (2003) advocated that Freon gas is one of the chemical known to destroy the ozone layers, our planet's protection against harmful rays from the sun and thus causing a rise in skin cancer and cataracts problems and can result to frostbite or permanent blindness. It is therefore become very necessary for the automobile mechanics and others specialties in automobile maintenance sector

including technical staff in automobile industries to be aware of the consequences of discharging automobile air-conditioning refrigerant into the air rather than properly contained it.

Findings on the disposal practices of automobile waste management revealed that automobile wastes such as plastics, used tyres, rags or absorbents are disposed through burning. This trend is not only unhealthy but contributed to air pollution which is a threat not only to the environment, but also residents that live in close proximity to the location of burning. The finding is in conformity with the observation of Abdhahah *etal*, (2016) which stated that the particulates matter released from uncontrolled burning of automobile waste has been proven to affect lungs especially people with asthma, heart disease, allergies and climate change. This observation is also in harmony with the opinion of Al-Delaimy *etal*, (2014) who noted that most often automobile waste generators, informal collectors (waste scavengers), those working or living near disposal sites, waste management staff be it government or private sector and those living near or working in waste treatment or recycling facilities are at high side to these risks. That is why it is important to give automobile waste proper management it deserves.

The finding also indicated that used motor oils generated from mechanics workshop are disposed around their workshop to control dust and weeds; used oils are discharged to the ground, sewers, drainage, ditches, septic tanks or streams; used oil filters are not punctured, drained and crushed for disposal. It should be noted that waste motor oil discharged into the soil has been confirmed to be the single largest source of ground water contamination which is toxic to human health. This finding is in consonant with Jonathan and Elaine (2012) who reported that improperly managed motor oil is the major largest source of oil pollution that results in major environmental damage. For example, the benzene based aromatic component in oil can cause cancer and other health problems if the oil is inhaled or ingested. Therefore, all used oil drained, should be collected and properly managed. The finding further revealed that battery charger discharge used acid anywhere around their shop. This practice is against requirement for managing used acid from battery because it is hazardous and can pose serious environmental and health risk. This finding is in agreement with Cossu (2013); Commonwealth of Massachusetts (2017) who reported that although, automobile waste contains considerable quantities of valuable

material such as metal but some are potentially hazardous if improperly disposed for instance discarded batteries, air conditioners parts when disposed in landfills produce hazardous substance like acids, mercury and chlorofluorocarbon (CFC) which leaches the soil, contaminating and polluting the ground water in the process. The result is also in conformity with submission made by Utamge *etal*, (2013) who concluded that improperly handled or discarded automobile waste can affect the PH value of water both surface and underground, pollute and reduce the quality of water; threatening terrestrial and aquatic life, cause soil acidification, and effects on human health. However the objectives of environmentally sound automobile waste disposal cannot be achievable if automobile waste is continually disposed improperly.

Conclusion

This study on the assessment of automobile waste management practices in Osun State, Nigeria, It is concluded that the automobile mechanics, and officials of all the waste management regulatory agencies are not aware of the effects of indiscriminate disposal of automobile waste. It is in this regard that the automobile mechanics and government waste regulatory agencies officials have to be enlightened on the consequences of improperly collected and disposed automobile waste especially liquid wastes. Therefore the various environmental agencies responsible for effective management of automobile waste should put appropriate monitoring and assessment system in place for the management of automobile waste in order for our environment to be secured. It is necessary that any mechanics workshop alleged for environmental pollution be sanctioned in line with environmental laws.

Recommendations

1. Automobile mechanics should be educated by environmental agencies on automobile waste best management practices, and this could be achieved through their association.
2. Hazardous automobile wastes generated by automobile mechanics shops should always be removed by licensed personnel under the supervision of environmental agencies.

3. Periodical monitoring and assessment of automobile waste management by environmental agencies should be conducted as stipulated by law, and shops alleged for environmental pollution be sanctioned.

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