Challenges of Emission and Pollution Control Measures in Automobile Technology Industries in Bayelsa State, Nigeria

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Abstract
The study determined the challenges of emission and pollution control measures in the automobile industries in Yenagoa, Bayelsa State, Nigeria. The research was guided by two purposes, two research questions and two null hypotheses. A descriptive research design was employed, with a population of 150 respondents using a random sampling technique. Data were collected using structured questionnaire titled challenges of emission and pollution control in the Automobile Mechanic Village in Yenagoa, Bayelsa State, Nigeria, adapted on a 5-point rating scale with 20 items and validated by three experts. The reliability coefficient of the instrument was 0.85, established using Cronbach's Alpha technique. Data analysis was conducted using SPSS Version 23, while Mean and Standard Deviation were used to answered the research questions and t-test statistics used to test hypotheses at 0.05 significance level. Findings of the study revealed among others that several activities and practices in the automobile mechanic village serves as major sources of environmental contaminants in the automobile mechanic workshop environment; as a result, soil, plants, animals and human health are adversely affected. The study recommended among others: that there should be regular orientation of auto mechanics on the dangers of their poor sanitary practices on the environment; provision of proper sanitary facilities and proper waste management plan in the automobile mechanic village; and proper disposal of solid and liquid automobile waste around the mechanic village environment.
Keywords: Automobile, Technology, Emission, Pollution Control Measures,Automobile Mechanic.

Introduction

Automobilesconstituteoneofthemajormodesoftransportationforconveyingpeople andgoodsinanynationoftheworld.Theusefulnessofthismodeoftransportationisnot withoutcost. Themajorcostispollution andemission of differentmagnitude (Poripo, 2025). Operationally, automobilepollutionand emissionaretwo relatedactivitiesthat involvereleasing harmful hydrocarbon andchemicalsubstancesintotheatmosphere orenvironmentleadingtothe contaminationoftheair,water,soilandothernatural environmentalresources (Poripo, 2025 & 2024). Akoto, et al, (2008) classifiedthepollutioncostofautomobiletransportationinto twomaingroups suchasoperational andthemaintenancecost.Theoperationalcostof automobiletransportation occurswhenvehiclesaredrivenfrom oneplacetotheotherwhilethemaintenancedimension occursduringvehiclerepairs (Poripo, 2023).Robinson&Robinson(1999)observedthat 48%of total atmosphericpollutioncomesfromthesetwoforms of automobileactivities.Theirmajorgaseous pollutantsare Sulphurdioxide, nitrogenoxide, ozone, carbon monoxideand hydrocarbons. InternationalforumsuchasEarthSummitfocused moreattentiononthereductionofoperational costofautomobilepollutionbyrecommendingthe useofethanolandhydrogenasalternative fuel forpoweringautomobiles,removalofleadfromgasoline,useofelectrictrainsforinnercity transportation,amongothers.

Emission and pollution control in automobile workshops is essential for safeguarding occupational health, reducing

environmental degradation, and ensuring compliance with environmental regulations. Automobile workshops generate a variety of pollutants, including exhaust emissions, fuel vapors, particulate matter, and hazardous chemicals from lubricants, solvents, and coatings. If inadequately managed, these pollutants can degrade indoor air quality and contribute to broader environmental pollution (World Health Organization (WHO), 2018). The adoption of emission control measures such as mechanical ventilation, exhaust gas extraction systems, regular vehicle emission testing, and proper handling of fuels and chemicals significantly reduces the concentration of harmful pollutants, including carbon monoxide, nitrogen oxides, and volatile organic compounds. These controls are critical in minimizing workers' exposure to toxic substances, thereby reducing the risk of respiratory disorders, neurological effects, and other long-term health impacts (Environmental Protection Agency (EPA), 2020).

More so, effective pollution control practices, including proper waste segregation, recycling of used oils, and prevention of chemical leaks, limit soil and water contamination and support sustainable workshop operations. Compliance with emission and pollution control standards could only enhances environmental protection but could improves workplace safety, operational efficiency, and regulatory adherence, reinforcing the role of automobile workshops in sustainable automotive service practices (International Labour Organization (ILO), 2019).

In addition to health benefits, pollution control in automobile workshops minimizes environmental contamination through responsible waste management, recycling of used oils and materials, and prevention of chemical spills. Such practices could reduce the release of hazardous substances into ecosystems and support sustainable industrial operations. Furthermore, adherence to emission and pollution control standards could enhance operational efficiency, improves workplace safety, and ensurescompliance with environmental regulations, reinforcing the workshop's role in sustainable automotive maintenance and repair practices.

Most of thesesuggestionshavebeenimplementedinsomedevelopedcountrieswhile somehavebeeninterpretedintolocal contentsof some developingcountrieswaitingfor implementation(Earth summit,2002).However,lessattentionispaidtopollutioncausedbythe maintenancedimensionofautomobile transportation (automechanicactivities).Automechanic activities are actually producing 75 percent of pollutants due to their intensive operations (Ann & Makyur, 2025; Balogun et al., 2025). Chemicalssuch asrefrigeratorgasesusedinvehicleairconditioners are madeupofchlorofluorocarbons which whenallowedtoescapeinlargerquantitiesintothe atmospherecandepletethe ozonelayerandcauseagreenhouseeffectandconsequentlyleading toglobalwarming(Duru et al., 2024). Thissituationcannotbeallowedtocontinueespecially with thecurrentchangesinclimatewithintheregionasshown by(Duru et al., 2024).study.Theuseof chemical solvents and fumes may cause lower ground ozone/smog formation and global warming(Anthony, LagowskiandJohnson2003).Acidrainarisingfromthechemicalreactions between atmospheric gasses and rain water can corrodezinc, paintings, monuments and buildings, thusdestroying theaestheticquality of theenvironment,leading toacceleratedslum formation.

Abdulahi(2008)inanalyzingbudgetaryallocationsandselected sectors' contributionto economicdevelopmentinNigeria,highlightedtransportsectorascentralto economicactivitiesandthereforeparamount

thatthissectorbegivenmoreattention thanthe governmentiscurrentlydoing.Whileanautomobile engineisrunning,themotor oilcollects particlesofheavymetalssuchasLead,Cadmium,Chromium,Iron,Zincandcopper.Used engineoilortransmission fluidpouredonthegroundthereforeenrichesthesoilwithheavy metals,whichcandrain intobothsurfacewaterwaysandgroundwater.Spilling waste automobile fluidson theground,andtheprocessesofmetalcorrosion willthereforeenrichthesoilwith heavymetals.Thereareseveral common sources ofsoilcontaminantsinamechanicvillage.

Perhapsthe most serious occupational hazard of mechanics is spraying and painting, as mechanics performingthistask gets exposed to paint dust andfumes capable ofcausing respiratoryandpulmonarydiseases.Fineparticles ofmetalandpaintbecomeaerosol, eventually returningtothesoilthroughrainorassettlingdust.

In Nigeria,soilpollution problemsassociatedwithautomobilewasteshasbeenreported byOkebalama et al., (2024), various studies of metal fractionation in soil profiles at automobilemechanicwastedumpsaroundPort-Harcourt,and observed thatthemetalspresent wererelatively mobile,butmoreinthesurfacethaninthesubsurface.Theyalsolamentedonthe numerousadverseeffectstheseautomobilewastehasontheenvironmental plant,animaland humanhealth.Thisstudythereforestrivestoinvestigatethechallenges of emissionandpollutioncontrolintheautomobilemechanicworkshopinYenagoa, BayelsaState,Nigeria.

Statement of Problems

Themenacesof auto-mechanicactivitieshavebeenaseriousconcerntogovernments, stakeholdersandnon-governmentalorganizationsin Nigeria and the world at large.Presentlyeffortsare madeinmostdeveloped countriestocreateasustainableenvironmentbyimposingstrict environmentalregulationsforautomobileworkshops.Provisionofenvironmentalreviewthat coversservicing,mechanicalrepairsinpremises,soundenvironmentalmanagementsystem of wastegeneratedandinextremecases sitting oftheseworkshopsarelackinginNigeria. InBayelsaState especiallyinYenagoa town,automobilemaintenance andrepair activitiescarriedoutby automechanicoperators,artisans,craftsmenandtechniciansdoesnot complywithanyofthestandardssetbyinternational organizationsor both theFederal and State Ministries of Environmentstandards.Thereisindiscriminateciting of auto mechanicworkshops anddisposalof hazardouswastessuchasbrake fluid,greases,spent oil,radiator coolant,soot, fuel,metalscraps, chemicalsandothervolatilecompoundsintotheair andthesurroundingenvironment.Thesechemicals arenotbiodegradableandthereforepersistintheenvironment.They havenumerous adverseeffectsontheplants,animalsandhumanhealth.Theaimof thisstudy, therefore,istoassessthe effect of emissionandpollution controlneedsintheautomobileworkshopin Yenagoa, BayelsaState,Nigeria.

Purpose of the Study

The generalpurposeofthestudywastoinvestigate the challengesofemissionand pollutioncontrol measures intheauto-mechanicworkshopin BayelsaState,Nigeria. Specifically,thestudy sought to:

1. Identifiedthemajor sourcesofenvironmentalcontaminants intheautomobileindustries in Yenagoa, Bayelsa State.
2. Identified the emissions and pollution control measures needed in the automobile mechanic village environment.

ResearchQuestion

The followingresearchquestionwasformulatedtoguidethestudy:

1. Whatarethemajor sourcesofenvironmentalcontaminants intheautomobileindustries in Yenagoa, Bayelsa State?
2. What are the major sources of environmental contaminants control measures needed in the automobile mechanic village environment?

Hypotheses

The following null hypotheses guided the study:

1. Thereisnosignificantdifferenceinthemeanresponsesofauto-mechanics inmechanic villagesandindustrialauto-mechanicsonthemajor sourcesofenvironmentalcontaminants in theautomobileworkshop in Yenagoa, Bayelsa State.

2. There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the control measures needed to be adopted for major sources of environmental contaminants in the automobile workshop in Yenagoa, Bayelsa State.

Methodology

Thestudy adoptedsurveyresearchdesign. The studywascarriedoutinYenagoa and its environs.Thepopulationofthestudywas 150respondents,comprisingof50 Industry-basedautomobile mechanicsand 100 master automobilemechanicshavingworkshopinmechanicvillages.Yenagoawasusedforthisstudy because Yenagoa is themajor capital cityinBayelsaState,Nigeriawhere thereishighinflux ofmotorvehicle usage aswellasmaintenanceandrepairactivities.A20-itemquestionnairestructuredona5Likert scaleresponsewasusedtocollectdata fromthe respondentsranging fromstronglyAgree (SA) = 5, Agreed (A) = 4,Undecided (UD) =3,Disagree(D)=2 andStrongly Disagree(SD)=1.The instrumentwasvalidatedbythree expertsfromMetalwork/Automobile Technology unit of the Institute of Entrepreneurship and Vocational Training Elebele. Thereliabilityoftheinstrumentwas foundtobe0.87usingCronbachAlphareliability test.TheMean andStandardDeviation (SD)wereusedtoanswertheresearch questions. Therefore, items with mean score below 3.50 (cut off mark) were regarded as disagreewhile thosewithmeanscoreof 3.50andabovewereregardedasagree.The t-test statisticswasusedtotest thehypothesis at0.05levelof significance.Thet-criticalvaluefor acceptingorrejectingthenullhypothesiswas ±1.98.

Results

ResearchQuestion1

Whatarethemajor sourcesofenvironmentalcontaminants in theautomobilemechanic workshop?

Table1

Meanresponsesonthemajorsourcesof environmentalcontaminants intheautomobilemechanicworkshop in Bayelsa State.

S/N	ITEM STATEMENT	X_1	SD_1	X_2	SD_2	REMARKS
1	Spillingofusedelectrolytefrombattery chargingactivities.	4.33	0.60	3.82	0.40	Agree
2	Spillingofpaintsfromspraypaintingonthe workshopfloor.	4.68	0.30	4.05	0.10	Agree
3	Indiscriminate dumpingofcarbidesbypanel beaters.	4.34	1.20	3.74	0.30	Agree
4	Pouringofwasheryfluidandhuman excrementaroundtheworkshop area.	4.00	0.36	4.60	0.70	Agree
5	Discardingleadplatesonautomechanic shop site.	4.01	1.21	4.75	0.65	Agree
6	Pouringofdirtyengineoilontheworkshop environment.	4.10	0.83	3.71	1.27	Agree
7	Tailpipeemissions releasingexhaustgases and soot.	4.20	0.32	4.01	0.81	Agree
8	Wrongdisposalofmetallicwastefromused sparepartsduringrepairactivity.	4.71	1.00	4.36	0.72	Agree
9	Indiscriminatecitingofmechanicworkshops.	4.56	1.39	4.70	0.63	Agree
10	Poorhandlingofhazardouschemical from vehicleairconditioningrefrigerant.	4.71	1.29	4.45	0.74	Agree

TheresultinTable 1showsthatalltheitemspresentedhad theirweighted mean values rangedfrom3.71-4.75. These valuesareabovethecutoffmarkof3.50whichsignifiesthattherespondentsagreedtotheitemsasthemajor sourcesofenvironmentalcontaminants inthe automobilemechanicworkshopenvironment in Yenagoa, Bayelsa State.

Research Question 2

What are the major sources of environmental contaminants control measures needed in the automobile mechanic village environment in Yenagoa, Bayelsa State?

Table2

Meanresponses of respondentsonthemajor sources of environmental contaminants control measures needed intheautomobilemechanicvillage, Yenagoa, Bayelsa State.

S/N	Item Statements	X_1	SD_1	X_2	SD_2	Remarks
11	Properdisposalofharmfulautomobilesolid wastesuchassootandscrapmetal.	4.09	0.68	3.90	0.70	Agree
12	Efficientdisposalofusedautomobile liquid wastesuchasbrakefluid,engineandcoolant.	3.77	0.48	3.75	0.71	Agree
13	Recyclingofmetallicwasteanddevelopingof wastemanagementplaninautomechanic shops.	4.68	1.10	4.10	1.41	Agree
14	Collectionofusedengineoilforreusebyother alternativeuserssuchaswoodworkers.	3.70	1.15	4.45	1.14	Agree
15	Properplanningandsittingofautomechanic workshop.	4.04	0.96	4.40	0.41	Agree
16	Establishingastandard codeofpracticeto controlautomechanicsprofessionalpractices.	4.74	1.39	4.12	1.07	Agree
17	Establishingstronglinkagebetween auto mechanicworkshop&traininginstitutions.	4.68	0.36	3.54	0.69	Agree
18	Provisionofadequatesanitaryfacilitiessuch astoilets,drainageandwastebininstrategic areas.	4.11	0.42	3.71	0.74	Agree
19	Periodicorientationofautomechanicsonthe dangersof theirpoorsanitarypracticesonthe environment.	4.35	1.12	3.65	1.15	Agree
20	Properhandlingofautomobilewastegenerated duringrepairactivities.	4.34	0.78	4.05	0.67	Agree

The data in Table 2 revealed that all the items had their mean scores ranged from 3.54-4.74. Since the values are above the cut off mark of 3.50. It shows that proper disposal of harmful automobile solid waste such as soot and scrap metal, efficient disposal of used automobile liquid waste such as brake fluid, engine and coolant, recycling of metallic waste and developing of waste management plan in auto mechanic shops and collection of used engine oil for reuse by other alternative users such as wood workers are among the emissions and pollution control needs in the automobile mechanic workshop.

Hypothesis 1

There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the effects of automobile emissions and pollution in the automobile workshop environment.

Table 3
T-test analysis of mean responses of respondents on the major sources of environment alcontaminants in the automobilemechanicworkshop.

S/N	ITEM STATEMENT	X_1	SD_1	X_2	SD_2	t-cal	REMARKS
1	Spillingofusedelectrolytefrombattery chargingactivities.	4.33	0.60	3.82	0.40	0.34	NS
2	Spillingofpaintsfromspraypaintingonthe workshopfloor.	4.68	0.30	4.05	0.10	0.88	NS
3	Indiscriminate dumpingofcarbidesbypanel beaters.	4.34	1.20	3.74	0.30	0.62	NS
4	Pouringofwasheryfluidandhuman excrementaroundtheworkshop area.	4.00	0.36	4.06	0.70	1.25	NS
5	Discardingleadplatesonautomechanic shop site.	4.01	1.21	4.75	0.65	1.21	NS
6	Pouringofdirtyengineoilontheworkshop environment.	4.10	0.83	3.71	1.27	0.60	NS
7	Tailpipeemissions releasingexhaustgases and soot.	4.20	0.32	4.01	0.81	0.50	NS
8	Wrongdisposalofmetallicwastefromused sparepartsduringrepairactivity.	4.71	1.00	4.36	0.72	0.59	NS
9	Indiscriminatecitingofmechanicworkshops.	4.56	1.39	4.70	0.63	0.50	NS
10	Poorhandlingofhazardouschemical from vehicleairconditioningrefrigerant.	4.71	1.29	4.45	0.74	0.21	NS

The result in Table 3 shows t-testanalysisrevealedthatalltheitemshadtheirt-calculated valueslessthanthet-table valueof±1.98. Thisimpliesthatthere wasnosignificant (NS)differenceinthemeanratingsof theresponsesoftherespondentsonthemajor sourcesofenvironmentalcontaminants inthe automobilemechanicworkshop in Yenagaoa.

Hypothesis 2

There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the control measures needed to be adopted for major sources of environmental contaminants in the automobile workshop in Yenagoa, Bayelsa State.

Table 4

t-testanalysisofmeanresponses of respondentsonthemajor sources of environmental contaminants control neededintheautomobilemechanicvillage in Yenagoa, Bayelsa State.

S/N	ITEM STATEMENT	X_1	SD_1	X_2	SD_2	t-cal	Decision
11	Properdisposalofharmfulautomobilesolid wastesuchassootandscrapmetal.	4.09	0.68	3.90	0.70	0.44	NS
12	Efficientdisposalofusedautomobile liquid wastesuchasbrakefluid,engineandcoolant.	3.77	0.48	3.75	0.71	0.83	NS
13	Recyclingofmetallicwasteanddevelopingof Wastemanagementplaninautomechanic shops.	4.68	1.10	4.10	1.41	0.67	NS
14	Collectionofusedengineoilforreusebyother alternativeuserssuchaswoodworkers.	3.70	1.15	3.54	0.45	1.26	NS
15	Properplanningandsittingofautomechanic workshop.	4.04	0.96	4.40	0.41	1.17	NS
16	Establishingastandard codeofpracticeto controlautomechanicsprofessionalpractices.	4.74	1.39	4.12	1.07	0.65	NS
17	Establishingstronglinkagebetween auto mechanicworkshop&traininginstitutions.	4.68	0.36	3.90	0.70	0.44	NS
18	Provisionofadequatesanitaryfacilitiessuch astoilets,drainageandwastebininstrategic areas.	4.11	0.42	3.71	0.74	0.56	NS
19	Periodicorientationofautomechanicsonthe dangersof theirpoorsanitarypracticesonthe environment.	4.35	1.12	3.65	1.15	0.66	NS
20	Properhandlingofautomobilewastegenerated duringrepairactivities.	4.34	0.78	4.05	0.67	0.23	NS

Data in Table 4 shows that all the items had the irt-calculated values less thanthet-table valueof±1.98. This implies that there was no significant (NS) difference in the meanratingsof theresponsesoftherespondentsonthemajor sources of environmental contaminants controlneeded intheautomobile mechanicvillage in Yenagoa, Bayelsa State.

Findings of the Study

On themajor sources of environmentalcontaminants intheautomobilemechanicworkshop area, thestudyrevealedamongothersthefollowingasma jor sources:

1. Mostoftheenvironmentalcontaminantsinthe automobilemechanicworkshoparearesults from spillingofautomobileliquidwaste(usedengin eoil,brakefluid,gearoil&coolant)and solidwaste(sootand metalscrap) onthesurroundingenvironmentoftheworksh op.
2. Indiscriminatedumpingofused automobilesparepartsand humanexcrement.
3. Poor handling of hazardous chemical from vehicle air conditioning refrigerant and spray-paintingactivities.
4. Improperplanningand sittingofautomobileworkshop.
5. On the major sources of environmental

contaminants control measures needed in the automobile mechanic workshop area, the study revealed among others the following as major sources of environmental contaminants control measures:

6. Proper planning and sitting of auto mechanic workshop.
7. Establishing a standard code of practice to control auto mechanics professional practices.
8. Establishing strong linkage between auto-mechanic workshop & training institutions.
9. Provision of adequate sanitary facilities such as toilets, drainage and waste bin in strategic
10. areas.
11. Periodic orientation of auto mechanics on the dangers of their poor sanitary practices on the environment.
12. Proper handling of automobile waste generated during repair activities.

Discussion

Analysis from Table 1 and 2 shows that the respondent sagreed with the 10 itemstobeamong majorsourcesofenvironmental contaminantsintheautomobilemechanicworksho parea.For instance,therespondent'sopinionthatmostofthee nvironmentalcontaminantsintheautomobile mechanicworkshopenvironment resultsfromspilling of automobileliquidwaste(usedengine oil,brakefluid,gearoil&coolant)andsolidwaste(s ootandmetal scrap)onthesurrounding environmentoftheworkshop, this is in linewith Iwegbue(2007), AdieandOsibanjo(2009). studiedmetalfractionationinsoilprofilesatautom obilemechanicwastedumps aroundAbuja, andobserved thatthemetalspresentwere relativelymobile,butmorein thesurfacethanin the subsurfaceduetospillingof usedautomobileengineoil,brakefluid,gearoil&co olantliquid, soot and scrap spare parts. This was supportedbyIpeaiyedaand Dawodu, (2008) who investigating theheavymetalscontamination oftopsoil.Hediscoveredthatautomobilewaste dumps will consist predominantlyof auto body scraps, pieces of mild steel, electrical componentsand wires.

The result in Table 3 and 4 above shows t-test analysis revealed that all the items had their t-calculated values less than the t-table value of ±1.98. This implies that there was no significant (NS) difference in the mean ratings of the responses of the respondents on the major sources of environmental contaminants in the automobile mechanic workshop in Yenagaoa. Theopinionsoftherespondentsshowthatauto industries and mechanicsrarelyobey safety practices in the automobileworkplace and this has alwaysresulted to automobile accidents onhighways andaccidentsintheworkplace.Thewassupportedb yJain(2010) who attributed thehighrateofaccidentstopoorattitudeofworkers towardssafetypractices,poor attitudesofemployerstowardsprovision ofsafetyawareness trainingcoursesandincomplete instructionsonsafepracticesandtechnical know-howontheoperation oftools,equipmentand machines.

Conclusion

Thestudy revealedseveralmajorsourcesofenvironmentalpo llutionand contaminants intheautomobilemechanicworkshopenvironmen t and theirconsequent effectson thecontaminatedsoilandenvironment.Several emission andpollutioncontrolmeasureswerealso revealed by therespondentsto help reduce emissionand pollutionon the auto mechanic workshop soiland environment in Yenagoa, Bayelsa State.

Recommendations of the Study

To achieveacleanenvironment freefrompollutionfromautomobile maintenanceand repair activities,thefollowing

recommendations were made:

1. The government of Bayelsa State should give proper land use zoning where the activities of this vital sector are confined to specific locations for easy management of wastes generated by it.
2. Planting of local phyto-remediation plants should be encouraged by the government of Bayelsa State in all the workshops to help in the reduction of the obnoxious gases through the process of photosynthesis thereby making the air environment of these premises fresh all year round.
3. Car painting by Auto-Mechanics should be done in enclosed areas with less spraying so as to reduce obnoxious gas production into the atmosphere.
4. Mechanicworkshopsshouldbecitedin environmentalnon-sensitiveareasandresidentialland usesshouldbe discouragedfrommigratingtosuchareas.
5. Planningauthoritiesshouldsetup aregulatorybodytoensurethatallautomechanic workshopsestablishedwithinthemetropolisapplyforand receive consentinline withthe planningprovisions.Thiswillhelpenforcecompliancetotheprovisionofthedraft2008 master plan.
6. Allobnoxious gases should be reduced at source through proper land use zoning to ensure a sustainable air environment in the face of growing climate by the government of Bayelsa State and Auto-Mechanic Association in Yenagoa.

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