



Assessment of polycyclic aromatic hydrocarbons in three selected auto-mechanic sites Soil within Ijebu Igbo, Ogun State

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Article Info

ISSN (online): 2582-7138

Volume: 05

Issue: 05

September-October 2024

Received: 16-07-2024

Accepted: 22-08-2024

Page No: 426-430

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are organic pollutants which can end up in the soil due to anthropogenic activities in vehicle repair shops. There is an indirect rise in environmental contamination as population and technology grow which results in a persistent and rapid deterioration of the environment's quality with capacity to support life. Among other environmental components, soils are often where PAHs are deposited. The concentrations of PAHs accumulated in a three auto-mechanic workshops were examined in this study. For the purpose of this study, soil samples were taken seven days in a row from three busy auto-mechanic workshops: Opeyemi Automobile Workshop (O.P.W.S), Ayoola Automobile Workshop (A.Y.W.S) and Ajobiewe Automobile Workshop (A.J.W.S). The examinations of PAHs were performed utilizing conventional analytical techniques.). For A.J.W.S naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthalene, fluorene, anthracene, benzo(a)anthracene, chrysene and benzo(b)fluoranthene had 0.18, 0.17, 0.03, 0.05, 0.16, 0.14, 0.12, 0.14 and 0.19 mg/kg respectively. The concentrations of phenanthrene, anthracene, pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and indeno (1,2,3-cd) pyrene were confirmed to be higher than 1.00 mg/kg in O.P.W.S which confirmed that O.P.W.S is seriously polluted.

Keywords: Auto-mobiles, PAHs, Soil, Workshop

Introduction

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of organic chemicals that occur naturally in coal, petroleum and petroleum products like gasoline which can also occur artificially through anthropogenic activities like combustion of oil, garbage, coal.^[1] The major sources of PAHs are the anthropogenic sources resulting from vehicular emissions, fossil fuel combustion, as well as incineration of diesel oil, wood, and coal.^[2] Auto-mobile workshops are establishments where skilled technicians and other tradespeople fix automobiles. When mechanics and other craftsmen work on cars, they often discard or accidentally release used motor oils, lubricants and organic solvents, which can contaminate their workspaces and nearby areas with toxic substances. Waste oils and organic solvents used in most workshops constitute a major part of the hazardous contaminants usually released from automobile mechanic workshops in most Nigerian cities ^[3]. Spent engine oils migrate with ease into the soil and filtration of leachates from materials contained in waste engine oil may pose serious threats to groundwater quality and the ecosystem. ^[4] PAHs have been proven to be a major source of environmental contamination, particularly from vehicular sources. This is because their existence has an impact on health because neither plants nor animals need them for any purpose. In Nigeria, there are few regulations governing the development of auto-mechanic workshops, which has led to a surge in the number of mechanical engineers turning residential areas into auto-mechanic workshops and raising the risk of pollution. The purpose of this study is to assess the PAH concentrations in soil of the town's three busiest chosen auto-mechanic site.

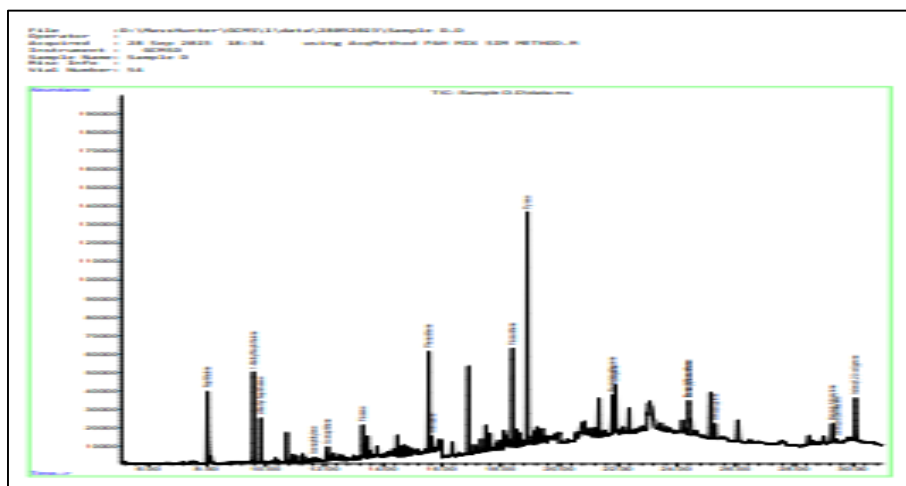


Fig 3: Chromatogram of PAHs in A.Y.W.S

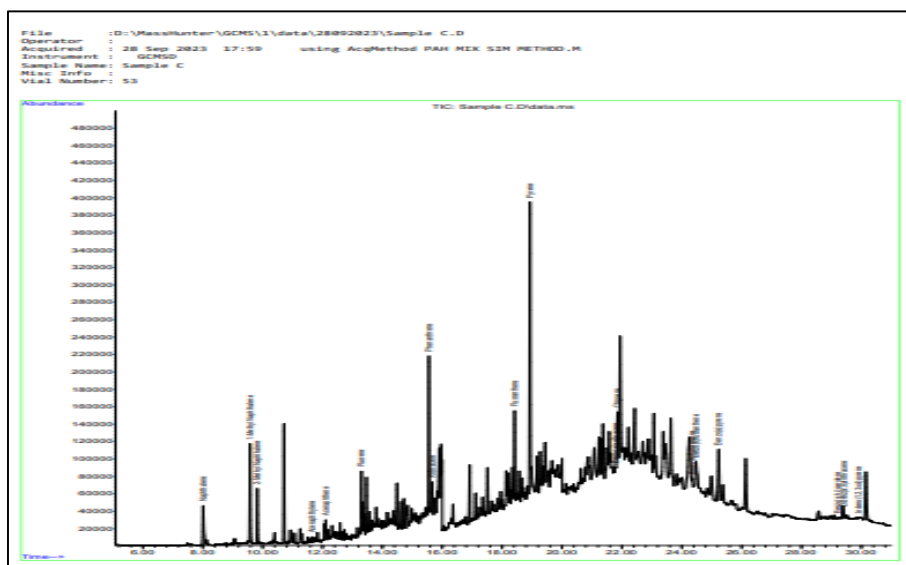


Fig 4: Chromatogram of PAHs in A.J.W.S

Table 1: Concentrations of polycyclic aromatic hydrocarbons of selected auto-mechanic site soil

S/N	Compounds	O.P.W.S (mg/kg)	A.Y.W.S (mg/kg)	A.J.W.S (mg/kg)
1	Naphthalene	0.00	0.14	0.18
2	1-methylnaphthalene	0.00	0.12	0.30
3	2-methylnaphthalene	0.00	0.05	0.17
4	Acenaphthylene	0.02	0.02	0.03
5	Acenaphthene	0.00	0.01	0.05
6	Fluorene	0.15	0.04	0.16
7	Phenanthrene	1.31	0.13	0.44
8	Anthracene	1.55	0.06	0.14
9	Fluoranthene	0.84	0.14	0.29
10	Pyrene	1.61	0.32	0.89
11	Benzo (a) anthracene	1.01	0.16	0.12
12	Chrysene	0.91	0.15	0.14
13	Benzo (b) fluoranthene	1.12	0.29	0.19
14	Benzo (k) fluoranthene	1.07	0.27	0.50
15	Benzo (a) pyrene	1.22	0.26	0.64
16	Benzo (g, h, i) perylene	0.11	0.40	0.31
17	Di benz (a, h)anthracene	0.45	0.30	0.30
18	Indeno (1,2,3-cd) pyrene	1.85	0.46	0.27

Note: O.P.W.S= Opeyemi Auto-Mechanic Workshop Soil, A.Y.W.S=Ayoola Auto-Mechanic Workshop Soil, A.J.W.S=Ajobiewe Auto-Mechanic Workshop Soil

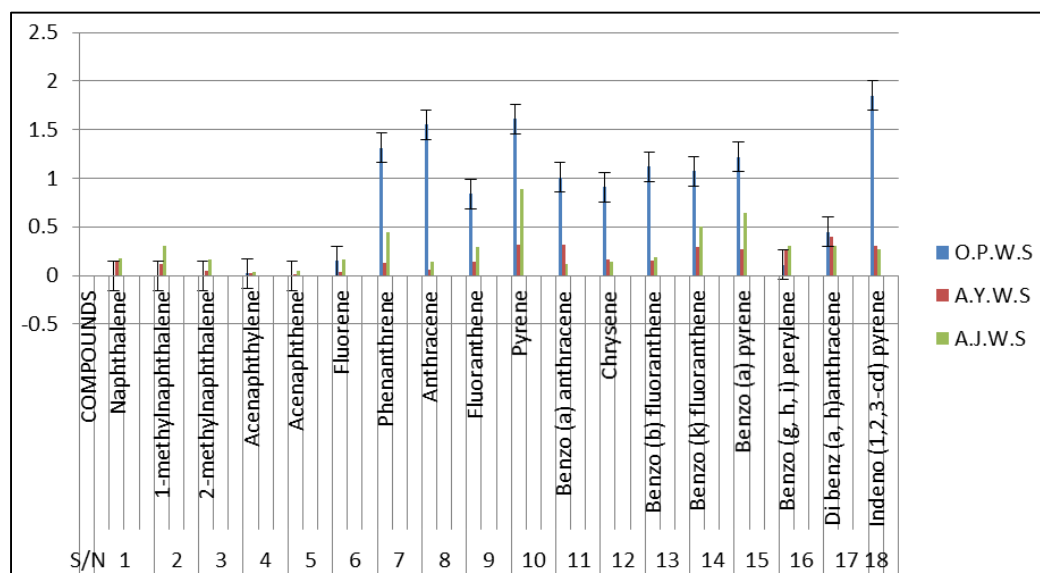


Fig 5: Bar chart of polycyclic aromatic hydrocarbons of selected auto-mechanic site soil

Discussion

Table 1 revealed the concentrations of PAHs present in selected auto-mechanic site soil of O.P.W.S, A.Y.W.S and A.J.W.S within Ijebu Igbo, Ogun State. Eighteen PAHs were confirmed in the three auto-mechanic sites. According to Ailijiang *et al.*, 2022, PAH contaminated soil can be divided into four levels: no pollution (< 0.200 mg/kg), slight pollution (0.200 – 0.600 mg/kg), medium pollution (0.600 – 1.000 mg/kg) and serious pollution (> 1.000 mg/kg). Naphthalene, 1-methylnaphthalene, 2-methylnaphthalene and acenaphthene were found below calibration in O.P.W.S but were present in A.Y.W.S and A.J.W.S respectively. 0.02 , 0.15 and 0.11 mg/kg were recorded for acenaphthylene, fluorene and benzo (g, h, i) perylene in O.P.W.S. Concentrations of fluoranthene, chrysene and dibenz (a, h) anthracene were 0.84 , 0.91 0.45 mg/kg and were within the slightly polluted region (0.200 – 0.600 mg/kg). The concentrations of phenanthrene, anthracene, pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and indeno (1,2,3-cd) pyrene were confirmed to be higher than 1.00 mg/kg (seriously polluted region). Concentrations of naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthalene, fluorene, phenanthrene, anthracene, fluoranthene, chrysene and benzo(a)anthracene recorded for A.Y.W.S were less than 0.200 mg/kg (classified as non-pollution region) while pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, Benzo (g, h, i) perylene, dibenz (a, h)anthracene and indeno (1,2,3-cd) pyrene fell within the slightly polluted range (0.200 – 0.600 mg/kg). For A.J.W.S naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthalene, fluorene, anthracene, benzo(a)anthracene, chrysene and benzo(b)fluoranthene had 0.18 , 0.17 , 0.03 , 0.05 , 0.16 , 0.14 , 0.12 , 0.14 and 0.19 mg/kg respectively and were classified to be in the non-polluted region. 1-methylnaphthalene, phenanthrene, fluoranthene, benzo(k)fluoranthene, Benzo (g, h, i) perylene, dibenz (a, h)anthracene and indeno (1,2,3-cd) pyrene concentrations fell within the slightly polluted region but the concentrations of pyrene and benzo(a)pyrene concentrations fell within the medium polluted region. The concentration of benzo(a)anthracene in all the three auto-mechanic workshop

soil were higher than 0.02 mg/kg reported by [7] for PAHs in soil around mechanic workshop in Abakaliki, Nigeria. Chrysene is produced as smoke during incomplete combustion of coal, gasoline and when inhaled, it can cause liver tumors in male and female.

The USEPA suggests that benzo (a) anthracene, chrysene, benzo (b) fluoranthene and benzo (k) flu-oranthene are carcinogens [8].

Conclusion

This study confirmed that A.Y.W.S and A.J.W.S are slightly polluted while O.P.W.S is seriously polluted. There is concern that the workers in these auto-mechanic hamlets particularly (O.P.W.S) and its environs may be at increased risk of developing cancer because exposure to PAH chemicals for an extended period of time via contaminated soils.

References

- Okoko JO, Yerima EA, Shintema A, Yakubu S, Bilyaminu H. Polycyclic aromatic hydrocarbon (PAHs) levels in treated spent engine oil contaminated soil from automechanic workshop site in Wukari, Nigeria. *Lafia Journal of Scientific and Industrial Research*. 2024;2(1):70-77. <https://doi.org/10.62050/ljsir2024.v2n1.308>.
- Emoyan OO, Onocha EO, Tesi GO. Concentration assessment and source evaluation of 16 priority polycyclic aromatic hydrocarbons in soils from selected vehicle-parks in southern Nigeria. *Scientific African*. 2020;7(e00296):1-13.
- Ipeaiyeda AR, Dawodu M. Heavy metals contamination of topsoil and dispersion in the vicinities of reclaimed auto-repair workshops in Iwo, Nigeria. *Bulletin of the Chemical Society of Ethiopia*. 2008;22(6):339-348. DOI:10.4314/bcse.v22i3.61205.
- Olugboji OA, Ogunwole OA. Use of spent engine oil. *Asian University Journal of Technology*. 2008;12(1):67-71.
- Adekoya SA, Coker JO, Oladunjoye HT, Adenuga OA. Aquifer characterization of some parts of Ijebu Igbo using electrical resistivity methods. *IOP Conference*

- Series: Journal of Physics: Conference Series.
2019;1299:012075. doi:10.1088/1742-6596/1299/1/012075.
6. NuerlaAilijiang, Zhong N, Zhou X, Mamat A, Chang J, Cao S, Hua Z, Li N. Levels, sources, and risk assessment of PAHs residues in soil and plants in urban parks of Northwest China. Scientific Reports; c2022. <https://doi.org/10.1038/s41598-022-25879-8>.
 7. Obini U, Okafor JU, Afiukwa G. Determination of levels of polycyclic aromatic hydrocarbons in soil contaminated with spent motor engine oil in Abakaliki Auto-Mechanic Village. Journal of Applied Science and Environmental Management. 2013;17(2):169-175. <http://dx.doi.org/10.4314/jasem.v17i2>.
 8. United States Environmental Protection Agency (USEPA). Method 3550C, Ultrasonic Extraction. United States Environmental Protection Agency; c2007. <http://www.3.epa.gov/epawaste/hazard/testmethods/SW846/pdfs/3550C.pdf>.