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ASSESSMENT OF TOTAL PETROLEUM HYDROCARBONS (TPH) CONTAMINATION WITH *Kyllinga pumila* And *Spirogyra longata* AROUND NIGERIAN NATIONAL PETROLEUM CORPORATION (NNPC) JOS DEPOT'S EFFLUENT WATER DISCHARGED POINT

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ABSTRACT
One of the major environmental problems today is hydrocarbons contamination resulting from activities related to the petrochemical industry. Accidental releases of petroleum products are of particular concern in to the environment hydrocarbons compounds have been known to belong to the family of carcinogenic and neurotoxin organic pollutants. The use of plants to clean up this contaminated site is a promising technology and the ability of the plants to germinate and grow in petroleum-contaminated soil differs due to plants species as well as petroleum hydrocarbons types. In this study, total petroleum hydrocarbons (TPH) were determined in *Kyllinga pumila* and *Spirogyra longata* growing at Nigerian national petroleum corporation (NNPC) Jos Depot. The chemical analysis was carried out with the aid of Gas Chromatography and Mass Spectrometry (GC-MS) detector, the result showed that *Spirongyra longata* could germinate and grow in petroleum products contaminated site with TPH level of 6881.98595 ppm and *Kyllinga pumila* did not survived in the same site with TPH level of 9536. 88801 ppm.

Key words: Total petroleum hydrocarbons (TPH), plants and environmental contamination.

INTRODUCTION
The environmental impacts of petroleum contamination are complex [1]. The effects of petroleum contamination event may vary with its location, volume and type of petroleum product released, rate of the pollutant released and how does it happen [1].The transport of petroleum hydrocarbons via migration in environment media occurs frequently with adverse environmental and human consequences [1]. Volatile petroleum hydrocarbons of gasoline may travel through the porous soil media underneath buildings and accumulate in hazardous concentrations within the structure and basement of the building.

In addition to soil and groundwater pollution, indoor air pollution as well as combustion hazard became potential risks [1]. Soil is an essential component of the terrestrial ecosystem; it provides the environment for the growth of plants, cycling of nutrients as well as a living base for microbes, insects, animals and humans [1]. Once contaminated with petroleum hydrocarbons, it is very difficult and costly to remedy.

A newly developed treatment technology called phytoremediation [1], which intends to use the plant-microbial-soil system to accelerate the removal of an organic contaminants from soils is now gaining lots of attention [8]. Many plants have a relatively large surface areas covered with waxes that facilitate the accumulation of hydrophobic compounds. The use of the plant as passive samplers of organic compounds in the atmosphere has been suggested by many authors [12].Therefore, this research is aimed to investigate the levels of TPH toxicities in *Kyllinga Pumila* and *Spirogyra longata* sampled around effluent water discharged point of NNPC Jos Depot that could pose a high risk of environmental and human health [4]. However, total petroleum hydrocarbons (TPH) themselves may not be a direct pointer of hazard to human or environment [WHO, 2006, 9], but their presence indicate the health status of the environment and is also used for source tracking of the contaminants in the coastal water and sediments [9].

In this study, GC – MS Detector Agilent Technologist 7890A models, adopting USEPA – 8270, 625 methods were carried out to quantify the TPH content in plant samples (*Kyllinga pumila* and *Spirogyra longata*) collected from the study site.

2. MATERIALS AND METHOD
2.1 MATERIALS
Solvent (n-hexane and acetone), measuring cylinders, separating funnel (250 ml), conical flask, ZD – 2 laboratory mechanical shaking instrument.

2.1.1 STUDY AREA DESCRIPTION
Nigeria National Petroleum Corporation (NNPC) Jos Depot is located at N10^0 02' 56.8", E08^0 52'.29" in Mista – Ali of Bassa Local Government Area, Plateau State – Nigeria.

STUDY SITE

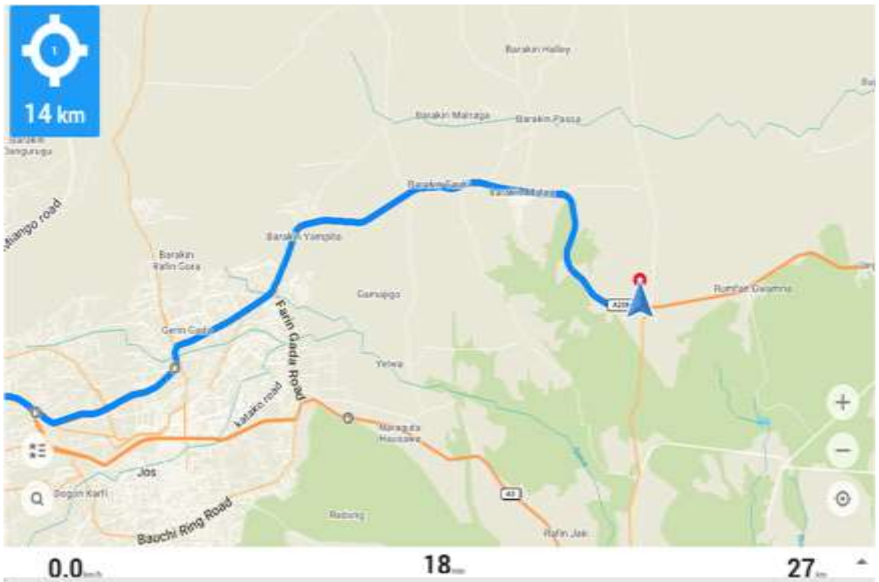

Figure: 1 Map showing the location of the study site, Source: Google Earth

2.1.2 SAMPLE COLLECTION

Biomass samples of *Spirogyra* and *Kyllinga pumila* were collected and clean up from epiphytes. The samples were then authenticated in the herbarium of Federal College of Forestry, Jos. The samples were then shade dried for 2 – 3 days until a constant weight was obtained [5].Dried algae *Spirogyra* and *Kyllinga* were grinded separately into coarse powder to facilitate extraction and placed in clean paper bags as preparation for the solvent extraction process [5].

Plate 1: Jos NNPC Depot effluent water discharge point (study sites).

2.1.3 DATA ANALYSIS

For the statistical presentation and graphical analysis, Microsoft 2007 Excel, 12.0 version was employed.

2.3 METHOD

2.1.3 EXTRACTION

One gram [5] of the dried powdered of each sample was extracted by mechanical shaking according to the method adopted by Sadasivam and Manckan (1996) using n-hexane and acetone in ratio 1:1 as extracting solvent [5], to ensure a complete extraction process, exhaustive extraction was applied with each extract collected separately into a dry clean beaker, and then filtered into Amber-colored sample bottle. Finally, the extracts were pooled to obtain a sample and then refrigerated at 4^0c before TPH analysis.

3. Result and Discussion

Results of the individual concentration of hydrocarbon in *Kyllinga pumila* and *Spirogyra* samples from the site of study [2] are presented in table 1.The Individual concentration of TPH ranged from below detection limit to 1016.92082 ppm in *Kyllinga* (contaminate site sample) [3]with the highest concentration recorded for n-C_{24}. For contaminated site [2] *Spirogyra,* the level of individual hydrocarbons varies from below detection limit to1540.30388 ppm with the highest concentration recorded for n-C_{25} [2].

A comparison of the concentration of the entire individual's total petroleum hydrocarbon on two samples of the contaminated site(*Kyllinga* and *Spirogyra*) and those of the control[15]showed that, the concentration of total petroleum hydrocarbon [2] in the study area samples were higher than those of the control samples. From the contaminated site samples of *Kyllinga* and *Spirongyra* [2], it was observed that the concentration of the total petroleum hydrocarbons in the study samples of the contaminated site was higher than those of the control.

From the contaminated site samples of *Kyllinga* and *Spirogyra*, it was observed that the lighter fraction hydrocarbons were not detected. This may be due to their ability to [2] evaporate rapidly, particularly during a period of high wind and wave activity [2]. For both samples studied, the result obtained indicated that Gasoline Range Organic (GRO), which is between n-C_6 to n-C_{12} and Diesel Range Organic (DRO), which is between n-C_{12} to n-C_{28} were dominant. The abundance of low molecular weight hydrocarbons (< n-C_{23}) suggested that the contamination of this area may have been recent and this may be attributed to improper treatment of effluent water of NNPC depot before discharging [3].

Table 1: Total Petroleum Hydrocarbons Values of the Study Samples (*Kyllinga Pumila* and *Spirogyra longata*)

COMPONENTS	CONCENTRATION(ppm) *KYLLINGA PUMILA*		CONCENTRATION(ppm) *SPIROGYRA*	
`	Contaminated	Control	Contaminated	Control
n – C_8	[7]N.D	N.D	N.D	1.11352
n – C_9	N.D	N.D	N.D	$1.10410e^{-1}$
n – C_{10}	2.93112	2.92077	6.70998	$2.82594e^{-2}$
n – C_{11}	13.41143	5.37723	12.17746	$7.07619e^{-1}$
n – C_{12}	47.80419	9.52520	12.03972	7.00306
n – C_{13}	96.38091	79.32994	5.30453	53.14458
n – C_{14}	1322.24841	7.44195	30.90518	95.31063
n – C_{15}	1004.08762	6.78123	35.99744	361.29162
n – C_{16}	516.47787	184.06079	5.37880	346.86590
C_{17} +	546.02875	35.19214	50.13811	482.69689
n – C_{17}	232.70649	10.13716	200.65790	N.D
C_{18} +	591.89209	16.14375	920.29313	160.38158
n – C_{18}	216.43963	17.65868	219.22978	182.37813
n – C_{19}	556.29640	35.91420	193.81383	356.27846
n – C_{20}	497.26945	1.15701	209.99811	188.72829
n – C_{21}	327.46771	145.45683	1199.73880	99.70147
n – C_{22}	388.54876	15.46475	331.18095	76.50279
n – C_{23}	478.00662	2.33065	288.72115	71.96748

Table 1: Total Petroleum Hydrocarbons Values of the Study Samples (*Kyllinga Pumila* and *Spirogyra longata*) contd.

Key: N.D = Not detected

COMPONENTS	CONCENTRATION(ppm) *KYLLINGA PUMILA*		CONCENTRATION(ppm) *SPIROGYRA*	
`	Contaminated	Control	Contaminated	Control

n – C_{24}	1016.92083	14.58878	335.33679	62.44278
n – C_{25}	529.09404	3709.47432	1540.30338	36.10080
n – C_{26}	291.35548	0.00000	254.65413	18.22252
n – C_{27}	179.97667	0.00000	171.96170	20.79610
n – C_{28}	300.92888	13.98459	189.97358	14.12205
n – C_{29}	104.58401	0.00000	193.38024	48.05228
n – C_{30}	86.91078	0.00000	184.61400	$1.97218e^{-1}$
n – C_{31}	66.88855	0.00000	73.38060	0.00000
n – C_{32}	0.00000	0.00000	45.06014	0.00000
n – C_{33}	39.38412	8.94705	23.19128	$1.17142e^{-2}$
n – C_{34}	4.77025	N.D	14.62723	$2.49818e^{-2}$
n – C_{35}	N.D	N.D	18.66793	N.D
n – C_{36}	78.07693	50.64549	114.55009	1.51620
n – C_{37}	N.D	N.D	N.D	N.D
n – C_{38}	N.D	N.D	N.D	N.D
n – C_{39}	N.D	N.D	N.D	N.D
n – C_{40}	N.D	N.D	N.D	N.D
Total	9536.88801	4372.53253	6881.98595	2685.69731

Key: N.D = Not detected

On comparing the concentrations of TPH obtained in this study with the results obtained from other research, it was observed that [3] the concentration reported in this study were very high. For instance, the concentrations of total petroleum hydrocarbons in this study were within the range of (110.2934 to $2.80130e^4$), in a research conducted by Ikpe *et al*., 2016, the total petroleum hydrocarbons in plants, surface river water and fish samples from around River Ethiope Oghara community in Delta State, Nigeria. The result of the study showed that the level of the TPH in plants ranged from (0.004 to 00.03) and (0.008 to 0.0088ppm) [2] which was far below the level obtained in this study. The high value recorded in this study may therefore account for the un-survivability of *Kyllinga pumila*, while the *Spirogyra longata* survival may be through accumulation.

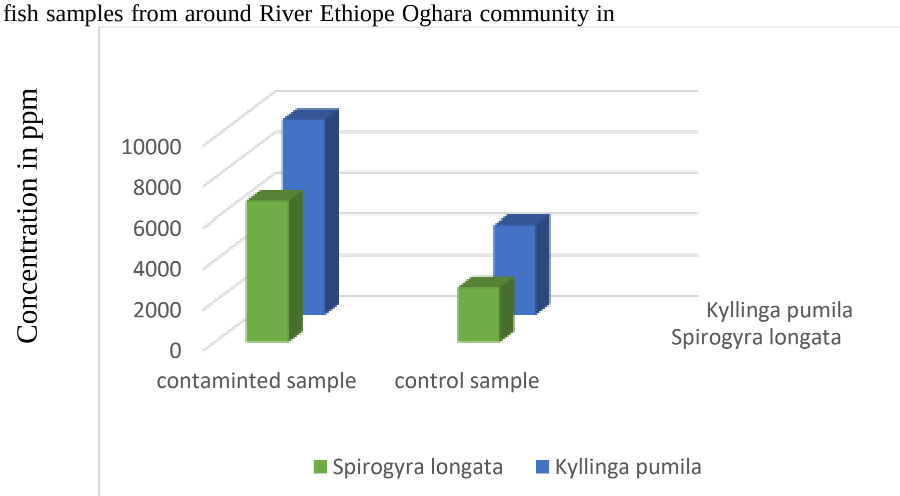

FIGURE 2: Graphical Presentation of Concentration of the Study Samples

4. CONCLUSION

In conclusion, the result of the study showed that the total petroleum hydrocarbon level in plants samples obtained from the study site ranged from lower level to moderate. On comparing the levels obtained with different standards, it was observed that the concentration of TPH was higher than the stipulated limit set by these agencies. This could be responsible factor that makes *Kyllinga pumila* not surviving.

However, *Spirogyra longata* could germinate and grow in the same study site. Although the TPH value obtained in *Spirogyra* sample was lower when compared with that obtained in *Kyllinga*, this could be responsible for the fact that *Spirogyra* can remediate through any of the processes (Phytoextraction, Phytovolatilization). It could also be responsible for that the chemical structure of Polyaromatic hydrocarbons (PAHs) [10] is identical to that of growth hormones and the pollutants affect the ratio between auxins and cytokins which is known to govern plant growth and development.

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