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 Spirogyra 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°02’ 56.8”, E08°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).

FUDMA Journal of Sciences (FJS) Vol. 5 No. 3, September, 2021, pp 350 - 354
2.1.3 DATA ANALYSIS
For the statistical presentation and graphical analysis, Microsoft 2007 Excel, 12.0 version was employed.

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, to ensure a complete extraction process. Each extract was filtered into Amber-colored sample bottle. Finally, the extracts were pooled to obtain a sample and then refrigerated at 4°C before TPH analysis.

2.3 METHOD
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 Spirogyra [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-C6 to n-C12 and Diesel Range Organic (DRO), which is between n-C12 to n-C36 were dominant. The abundance of low molecular weight hydrocarbons (< n-C23) 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 – C8     | [7] N.D           | N.D             | N.D               | 1.11352   |
| n – C9     | N.D               | N.D             | N.D               | 1.00140e-1 |
| n – C10    | 2.31112           | 2.90277         | 6.70998           | 2.82594e-2 |
| n – C11    | 13.41143          | 5.37723         | 12.17746          | 7.07619e-1 |
| n – C12    | 47.80419          | 9.53250         | 12.03972          | 7.00306   |
| n – C13    | 96.38091          | 79.32994        | 5.30453           | 53.14458  |
| n – C14    | 1322.24841        | 7.44195         | 30.90518          | 95.31063  |
| n – C15    | 1004.08762        | 6.78123         | 35.99744          | 361.29162 |
| n – C16    | 516.74787         | 184.06079       | 5.37880           | 346.86590 |
| C17+       | 546.02875         | 35.19214        | 50.13811          | 482.69689 |
| n – C17    | 232.70649         | 10.13716        | 200.65790         | N.D       |
| C18+       | 591.89209         | 16.14375        | 920.29313         | 160.38158 |
| n – C18    | 216.43963         | 17.65868        | 219.22798         | 182.37813 |
| n – C19    | 556.29640         | 35.91420        | 193.81383         | 356.27846 |
| n – C20    | 497.26945         | 1.15701         | 209.99811         | 188.72829 |
| n – C21    | 327.46771         | 145.45683       | 1199.73880        | N.D       |
| n – C22    | 388.54876         | 15.46475        | 331.18095         | 76.50279  |
| n – C23    | 478.00662         | 2.33065         | 288.72115         | 71.96748  |

FUDMA Journal of Sciences (FJS) Vol. 5 No. 3, September, 2021, pp 350 - 354

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

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 $2.80130 \times 10^4$), 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 0.008) 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.

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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ASSSESSMENT OF TOTAL PETROLEUM HYDROCARBONS (TPH)...

Abdulmumin, Dashak, and Joseph

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FUDMA Journal of Sciences (FJS) Vol. 5 No. 3, September, 2021, pp 350 - 354