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Effect of Oily Effluent on Leaf Characteristics of Insitu Park Plants in Guinea Savanna Agroecological Zone of Nigeria

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Abstract

Spent engine oil is the hydrocarbon product of crude oil and it is unsatisfactory for plant growth due to insufficient reaction of the soil and the microbes because of the displacement of air from spaces between soil particles This research looked at two major trees used as park plants (Azerdirachta indica and Gliricidia sepium) in Ogbomoso North environment of Oyo State. Leaf samples were collected from three different mechanic workshops and three different farmlands in the study area.

The leaf samples collected were analyzed using the following parameters, Weight of leaf, Stomata quantity, Leaf area, Leaf acidity and Leaf color difference.

The result of the analysis for Azerdirachta indica indicated that leaf weight of polluted trees had a higher average weight of 1.84mm^2 compared to that of the unpolluted tree 1.75mm^2. The leaf stomata (upper surface) of polluted trees had a higher average value 38mm$^{-2.}$ Results for leaf acidity indicated that unpolluted trees had a greater value of 0.142ug/g compared to the average acidity value of 1.423ug/g for polluted trees. Measuring the colour difference; Azerdirachta indica (A. Juss) on unpolluted site had the highest colour difference of 0.1566ug/g

The result of the analysis for Gliricidia sepium (Jacq.) indicated that leaf weight of polluted trees had a higher average weight of 2.81mm^2 compared to that of unpolluted trees 1.42mm^2. The leaf stomata (upper surface) of polluted trees had a higher average value of 58mm^{-2}. Result s for leaf acidity indicated that unpolluted trees had a greater value of 0.142ug/g compared to the average acidity value of 1.423ug/g for polluted trees. Measuring the colour difference; Gliricidia sepium on unpolluted site had the highest colour difference of 0.1566ug/g. The generic composition of these trees may change over time due to the level of pollution recorded it is therefore recommended that the mechanics should build their workshops far away from trees and the general public should be educated on the danger of using the park plants medicinal purposes.

Keywords: Park plants, Effluent, Farmland, Mechanic Workshop, Stomata.

Introduction

Park Plants Defined

Trees that are said to be park plants have open crowns. The crown of a tree is defined as the upper part of a tree which includes the branches and leaves (McGraw-Hill Dictionary, 2003). The trees are very useful for shade creation in places like mechanic workshops, farmlands, front of houses, front of companies etc.

Oily Effluents

Effluent can be defined as something that flows out or forth, especially: a stream flowing out of a body of water, an outflow from a sewer or sewage system, a discharge of liquid waste, as from a factory or nuclear plant (American Heritage dictionary, 2009). Spent engine oil is the hydrocarbon product of crude oil with C_{15}-C_{20} in molecular nature. It is dense in nature and black in color.

Origin of Park Plants Identified In the Study Area

Azerdirachta indica

Azadirachta indica, commonly known as "Neem", is a specie of tree indigenous to India, Burma (Mynamar), Bangladesh, Pakistan and Africa (Ganguli, 2002). For thousands of years the beneficial properties of Neem (*Azadirachta indica* A. Juss) have been recognized in the Indian tradition. Each part of the neem tree has some medicinal property. Biswas *et al*. (2002) have recently reviewed the biological activities some of the neem compounds, pharmacological actions of the neem extracts, clinical study and plausible medicinal applications of neem along with their safety evaluation.It is thought the tree has a cure or treatment for more than forty different diseases and medical conditions. A standard Neem will achieve a height of 25-30m in a relatively short period of growth Azadirachta is a genus of two species of trees in the flowering plant family Meliaceae (Mahogany family). Numerous species have been described in the genus but only two are currently recognized, A. excelsa (Jack) Jacobs, and the economically important Neem tree, A. indica (Juss.) (Pennington & Styles, 1975). Both species are native to the Indomalaysian region, and A. indica is also widely cultivated and naturalized outside its native range. The resin from the trees has been attributed with medical benefits.

Gliricidia sepium

Gliricidia Sepium is a tree belonging to the Fabaceae family, a native of Central America and Mexico. It is a fast growing, perennial leguminous tree which supplies fodder. *Gliricidia sepium* is a medium-sized leguminous tree (Rico-Gray *et. al,.* 1991) and thus can serve as a cheap alternative to fertilizer. It can therefore support other crops rather than act in direct competition. The temperature requirements of *G. sepium* are not too exacting as shown by the wide variation in mean monthly temperature (20.7-29.2°C) at native sites. It will, however, not tolerate frosts which partly explain its absence above 1,200 m in the native range. Whiteman *et al.* (1986) in southeast Queensland found that trees became leafless when night temperatures fell below 15°C. Gliricidia can, however, be managed in a coppice system in areas with light frost, by cutting the new growth before frosts occur (Stewart *et al.,* 1992). It grows well in native tropical and sub-tropical climates with low acid and medium fertility soils. The tree is most frequently grown to serve as de facto fence posts, planted in straight lines with fencing strung in between each tree. Tree foliage is often fed to cattle during the hotter months. It has now been widely introduced as an exotic in many parts of the tropics due to its high productivity and adaptability to a wide range of sites. It is easy to germinate, to establish and to grow either as an agroforestry species or as a pure crop. The tree is a small thorn less, semi-deciduous tree normally growing to 15 m if allowed, and will develop a trunk of about 30 cm diameter; however it is often grown under management systems which keep its overall size and development much smaller than this and its overall shape within agricultural environments tends to be modified by lopping and pruning.

Environmental Effect of Oil Pollution

Oil has been an important part of the economy since vast reserves of petroleum were discovered in Nigeria in the 1950’s. For example revenues from oil have increased from 219 million naira to 10.6 billion naira in 1979. Shell oil operates many of its facilities in the oil rich delta region of Nigeria. The Ogonis, an ethnic group that predominate in the delta region, has protested that shells oil production has only devastated the local environment, but has destroyed the economic viability of the region for local farmers and producers.

The Damage to Soil

The damage to soil is basically caused by two different components, the nature of the oil which can lead to physical contamination or smothering and the chemical makeup of the oil which can have toxic effects or the accumulation of such chemicals can cause certain abnormalities to the soil organisms. The effect on plants and wildlife are separated into different categories, environmental, external and internal. The external effects are the

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most noticeable and are the most immediate to destruction. The most common external effect is when the plant or animal gets covered with oil and cannot perform its normal functions such as maintaining body temperature for animals or not being able to diffuse oxygen for plants. Internal effects are just as dangerous and can be life threatening, they damage animals digestive systems so they cannot have the food or water necessary for survival and they can penetrate the plant tissue which disrupts the membrane structure of the plant.

Smothering is one of the main threats to marine life after an oil spill. It is most common to the plants and animals that come into contact with the contaminated sea surface, such as marine mammals and reptiles, birds that feed by diving or form flocks on the seas surface and marines lf along the shoreline. The most toxic components in the oil are those that are quickly lost through evaporation, but the lethal concentrations of the toxins in the oil largely affect marine life. Sub lethal effects can impair the ability of marine organism to reproduce, grow, feed, or perform other functions due to their exposure to the oil and can sometimes cause death. The animals that live in the shallower waters such as, oysters, mussels and clams filter the sea water to get their food and are very likely to intake the toxins of the oil.

Methodology

Experimental Site

The site for the collection of samples in the study area was:

- Three mechanic workshops for each plant (polluted)
- Three farmlands for each plants (non-polluted)

No of replicates=3

A leaf sample of *Azedirachta indica* was collected from each mechanic workshop and also from each farmland.

A similar process was followed for the collection of the leaf samples of *Gliricidia sepium* after which they were taken to the laboratory for analysis.

Materials for the Study

- Hand trowel was used to pack the soil needed for analysis.
- A sharp knife was used to carefully cut the leaf sample of the trees for analysis.
- Envelopes were used to pack the samples to the laboratory for analysis

Parameters Studied

Weight of leaf (g)

- Stomata quantity (mm^{-2}); was carried out by the use of a microscope with a micrometer scale. The stomata count was taken from surfaces of the leaf namely the upper and the lower surfaces. Five leaves from each plant sample was used for this experiment.

Each leaf was covered with a thick coat of clear finger nail polish large enough to be examined under a microscope. After it dried, a piece of large tape large enough to cover the area is cut and applied to the leaf. The tape was then slowly peeled off lifting the clear finger nail polish layer with it giving an impression of the leaf. This layer is then stick to the slide and examined under 400x magnification. The number of stomata per mm^2 of field view was counted and results of counts averaged.

- leaf area was determined by drawing an outline of a particular leaf sample on a graph sheet and the number of squares counted in cm^2 to obtain leaf area.
- Leaf extract or acidity was determined by dissolving 5g of leaves in 50ml of dissolved water and homogenised appropriately in a waring blender. The mixture obtained was filtered through a whatman number 42 filter paper into a 100ml conical flask. The filterate or extract was titerated against 0.1M NaOH. The acidity was obtained using the formular: (Titerate value x0.1 x0.0089/volume of extract obtained) x100/1
- Leaf color differences was carried out by determining the chlorophyl content which is the green coloured pigments in the leaf.

1g of fresh leaf was crushed in an HPLC grade acetone 80% with pestle and morter. The mixture was mixed up to 100ml volume and the absorbence read at the desired wavelenght of chlorophyl a, chlorophyl b and total chlorophyl.

Chlorophyl a(μg/g)= 12.25(A663.6)-2.55(A646.6)
Chlorophyl b(μg/g)=20.31(A646.6)-20.31(A663.6)
Total chlorophyl(μg/g)=17.76(A646.6)+7.34(A663.6)

The difference between chlorophyl a & b gives the leaf color difference in μg/g

Experimental Layout

P-Polluted site
U-Unpolluted site

Results and Discussion

Azerdirachta indica

Effect of oily effluent on weight of leaf
The laboratory analysis on weight of the leaf samples collected from the first sites, shows that the leaf weight of the unpolluted site(1.35g) is greater than the leaf weight of the

polluted site(1.07g). The weight of the leaf samples collected from the second sites shows that the leaf weight of the unpolluted site(1.84g) is less than the leaf weight of the polluted site(2.56g). The weight of the leaf samples collected from the third sites shows that the leaf weight of the unpolluted site (2.06g) is greater than the leaf weight of the polluted site(1.90g).

Table 1: Effect of oily effluent on weight of leaf

Weight of leaf(g)				
1	polluted	1.07	unpolluted	1.35
2	polluted	2.56	unpolluted	1.84
3	polluted	1.90	unpolluted	2.06

Effect of oily effluent on leaf stomata quantity

The laboratory analysis on the leaf stomata quantity(lower surface) of the samples collected from the first sites shows that the leaf stomata quantity(lower surface) of the unpolluted site(13mm^{-2}) is greater than that of the polluted site(11mm^{-2}). For the second sites the leaf stomata quantity(lower surface) of the unpolluted site(36mm^{-2}) is lesser than that of the polluted site(61mm^{-2}). The result for the third sites shows that the leaf stomata quantity(lower surface) of the unpolluted site(41mm^{-2}) is less than that of the polluted site(42mm^{-2})

The laboratory analysis on the leaf stomata quantity(upper surface) of the samples collected from the first sites shows that the leaf stomata quantity(upper surface) of the unpolluted site(32mm^{-2}) is lesser than that of the polluted site(36mm^{-2}). For the second sites the leaf stomata quantity(upper surface) of the unpolluted site(23mm^{-2}) is lesser than that of the polluted site(45mm^{-2}). The result for the third sites shows that the leaf stomata quantity (upper surface) of the unpolluted site (29mm^{-2}) is the same as that of the polluted site(29mm^{-2})

Table 2: Effect of oily effluent on leaf stomata quantity (lower surface)

Stomata Quantity/mm^{-2}(Lower surface)				
1	polluted	11	unpolluted	13
2	polluted	61	unpolluted	36
3	Polluted	42	unpolluted	41

Table 3: Effect of oily effluent on leaf stomata quantity (upper surface)

Stomata Quantity/mm^{-2}(Upper surface)				
1	polluted	36	unpolluted	32
2	unpolluted	23	polluted	45
3	polluted	29	unpolluted	29

Stomata are minute apperture structures of plants found typically on the outer leaf skin layer, also known as the eppidermis. This consist of two specialised cells called guard cells that surround a tiny pore called stoma (Ecyclopedia, 2010) the word stoma means mouth in Greek because they allow communication between their internal and external environment of the plant. Their main function is to allow gasses such as co_2 water vapor to move rapidly in and out of the leaf. They are formed during the initial stages of the development of these various plant organs and therefore reflect the environmental conditions under which they grow. Trees that have been grown on good soil and conducive environmental condition , but after few years the soil is then polluted, this may lead to growth stress for the tree, and so indoor to adapt and maintain its growth, it may lead to an increase in the production of stomata in order to fight the unconducive reaction of the soil

According to Dejong (1980) crude oil spillage makes it unsatisfactory for plant growth. This is due to insufficient aeration of the soil because of the displacement of air from the spaces between the soil particles by crude oil (Rowel, 1977). It is known that the tool stress reduces the leaf growth via stomata conductance (Smith et al., 1972) stated that mineral ions absorbed initially by the root are finally received by the mesophyl cells of the leaves. According to Udo and Fayemi (1975) growth of plants growing in oil polluted soils was generally retarded and chlorosis of the leaves results coupled with dehydration of the plants indicating water defficiency. The impact of oil spill on plant lies with its coating effects indoor to produce food and energy, a plant must be able to carry out gas exchange with the environment. The coating of oil on the leaves of plants prevents the stomata or pores from receiving co2 from the atmosphere. The result is slow growth and eventual death of the plant(Chris Dirusen Rogers)

Effect of Oily Effluent on leaf Area

The laboratory analysis on the leaf area of the samples collected from the first sites shows that the leaf area of the unpolluted site(17cm^2) is greater than that of the polluted site(15cm^2). For the second sites the leaf area of the unpolluted site(26cm^2) is lesser than that of the polluted site(41cm^2). The result for the third sites shows that the leaf area of the unpolluted site(31cm^2) is greater than that of the polluted site(29cm^2)

Table 4 : Effect of Oily Effluent on leaf Area

Leaf area(cm^2)				
1	polluted	15	Unpolluted	17
2	polluted	41	Unpolluted	26
3	polluted	29	Unpolluted	31

Effect of Oily Effluent on leaf Percentage acidify

The laboratory analysis on the leaf percentage acidity of the samples collected from the first sites shows that the leaf percentage acidity of the unpolluted site(0.097) is greater than that of the polluted site(0.086). For the second sites the leaf percentage acidity of the unpolluted site(0.116) is lesser than that of the polluted site(0.272). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(0.214) is greater than that of the polluted site(0.121)

Table 5: Effect of oily effluent on leaf percentage acidity

Percentage acidity				
1	polluted	0.086	Unpolluted	0.097
2	polluted	0.272	unpolluted	0.116
3	polluted	0.121	unpolluted	0.214

Effect of oily effluent on leaf color

The laboratory analysis on the leaf color (chlorophyl a) of the samples collected from the first sites shows that the leaf color (chlorophyl a) of the unpolluted site (2.21ug/g) is greater than that of the polluted site (2.11ug/g). For the second sites the leaf color(chlorophyl a) of the unpolluted site(2.36ug/g) is lesser than that of the polluted site(3.46ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(3.06ug/g) is greater than that of the polluted site(2.37ug/g).

The laboratory analysis on the leaf color (chlorophyl b) of the samples collected from the first sites shows that the leaf color (chlorophyl b) of the unpolluted site (2.11ug/g) is greater than that of the polluted site (2.03ug/g). For the second sites the leaf color(chlorophyl b) of the unpolluted site(2.21ug/g) is lesser than that of the polluted site(3.28ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(2.84ug/g) is greater than that of the polluted site(2.26ug/g).

The laboratory analysis on the leaf color difference (chlorophyl a-b) of the samples collected from the first sites shows that the leaf color difference (chlorophyl a-b) of the unpolluted site (0.10ug/g) is greater than that of the polluted site (0.08ug/g). For the second sites the leaf color difference(chlorophyl a-b) of the unpolluted site(0.15ug/g) is lesser than that of the polluted site(0.16ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site (0.22ug/g) is greater than that of the polluted site (0.11ug/g)

Table 6: Effect of oily effluent on leaf color (Chlorophyl a)

Chlorophyl a(uGu/g)				
1	polluted	2.11	unpolluted	2.21
2	unpolluted	2.36	polluted	3.46
3	polluted	2.37	unpolluted	3.06

Table 7: Effect of oily effluent on leaf color (Chlorophyl b)

Chlorophyl b(ug/g)				
1	polluted	2.03	unpolluted	2.11
2	unpolluted	2.21	polluted	3.28
3	polluted	2.26	unpolluted	2.84

Table 8: Effect of oily effluent on leaf color difference (a-b)

Color difference (a-b) ug/g				
1	polluted	0.08	unpolluted	0.10
2	unpolluted	0.15	polluted	0.16
3	polluted	0.11	unpolluted	0.22

Gliricidia sepium

Effect of oily effluent on weight of leaf

The laboratory analysis on weight of the leaf samples collected from the first sites, shows that the leaf weight of the unpolluted site(1.85g) is lesser than the leaf weight of the polluted site(2.29g). The weight of the leaf samples collected from the second sites shows that the leaf weight of the unpolluted site(1.49g) is lesser than the leaf weight of the polluted site(2.08g). The weight of the leaf samples collected from the third sites shows that the leaf weight of the unpolluted site(0.93g) is greater than the leaf weight of the polluted site(4.06g).

Table 9: Effect of oily effluent on weight of leaf

	Weight of leaf(g)			
1	polluted	2.29	unpolluted	1.85
2	polluted	2.08	unpolluted	1.49
3	polluted	4.06	unpolluted	0.93

Effect of oily effluent on leaf stomata quantity

The laboratory analysis on the leaf stomata quantity(lower surface) of the samples collected from the first sites shows that the leaf stomata quantity(lower surface) of the unpolluted site(35mm^{-2}) is lesser than that of the polluted site(53mm^{-2}). For the second sites the leaf stomata quantity(lower surface) of the unpolluted site(16mm^{-2}) is lesser than that of the polluted site(48mm^{-2}). The result for the third sites shows that the leaf stomata quantity(lower surface) of the unpolluted site(12mm^{-2}) is less than that of the polluted site(73mm^{-2}). The laboratory analysis on the leaf stomata quantity(upper surface) of the samples collected from the first sites shows that the leaf stomata quantity(upper surface) of the unpolluted site(21mm^{-2}) is lesser than that of the polluted site(37mm^{-2}). For the second sites the leaf stomata quantity(upper surface) of the unpolluted site(34mm^{-2}) is lesser than that of the polluted site(32mm^{-2}). The result for the third sites shows that the leaf stomata quantity(upper surface) of the unpolluted site(26mm^{-2}) is the same as that of the polluted site(52mm^{-2})

Table 10: Effect of oily effluent on leaf stomata quantity (lower surface)

	Stomata Quantity/mm^{-2}(Lower surface)			
1	Polluted	53	unpolluted	35
2	polluted	48	unpolluted	16
3	Polluted	73	unpolluted	12

Table 11: Effect of oily effluent on leaf stomata quantity (upper surface)

	Stomata Quantity/mm^{-2}(Upper surface)			
1	polluted	37	unpolluted	21
2	polluted	32	unpolluted	34
3	polluted	52	unpolluted	26

Stomata are minute apperture structures of plants found typically on the outer leaf skin layer, also known as the eppidermis. This consist of two specialised cells called guard cells that surround a tiny pore called stoma (Ecyclopedia, 2010) the word stoma means mouth in Greek because they allow communication between their internal and external environment of the plant. Their main function is to allow gasses such as CO_2 water vapor to move rapidly in and out of the leaf. They are formed during the initial stages of the development of these various plant organs and therefore reflect the environmental conditions under which they grow. Trees that have been grown on good soil and conducive environmental condition , but after few years the soil is then polluted, this may lead to growth stress for the tree, and so indoor to adapt and maintain its growth, it may lead to an increase in the production of stomata in order to fight the unconducive reaction of the soil. According to Dejong (1980) crude oil spillage makes it unsatisfactory for plant growth. This is due to insufficient aeration of the soil because of the displacement of air from the spaces between the soil particles by crude oil (Rowel, 1977). It is known that the tool stress reduces the leaf growth via stomata conductance (Smith et al., 1972) stated that mineral ions absorbed initially by the root are finally received by the mesophyl cells of the leaves. According to Udo and Fayemi (1975) growth of plants growing in oil polluted soils was generally retarded and chlorosis of the leaves results coupled with dehydration of the plants indicating water deficiency. The impact of oil spill on plant lies with its coating effects in order to produce food and energy, a plant must be able to carry out gas exchange with the environment. The coating of oil on the leaves of plants prevents the stomata or pores from receiving CO_2 from the atmosphere. The result is slow growth and eventual death of the plant.

Effect of Oily Effluent on leaf Area

The laboratory analysis on the leaf area of the samples collected from the first sites shows that the leaf area of the unpolluted site(24cm^2) is greater than that of the polluted site(36cm^2). For the second sites the leaf area of the unpolluted site(19cm^2) is lesser than that of the polluted site(33cm^2). The result for the third sites shows that the leaf area of the unpolluted site(11cm^2) is greater than that of the polluted site(54cm^2)

Table 12 : Effect of Oily Effluent on leaf Area

Leaf area(cm^2)				
1	polluted	36	unpolluted	24
2	polluted	33	unpolluted	19
3	polluted	54	unpolluted	11

Effect of Oily Effluent on leaf Area Percentage acidity

The laboratory analysis on the leaf percentage acidity of the samples collected from the first sites shows that the leaf percentage acidity of the unpolluted site(0.118) is lesser than that of the polluted site(0.243). For the second sites the leaf percentage acidity of the unpolluted site(0.106) is lesser than that of the polluted site(0.218). The result for the third sites shows that the leaf percentage acidity of the unpolluted site (0.078) is lesser than that of the polluted site(0.396)

Table 13: Effect of oily effluent on leaf percentage acidity

Percentage acidity				
1	polluted	0.243	unpolluted	0.118
2	polluted	0.218	unpolluted	0.106
3	polluted	0.396	unpolluted	0.078

Effect of oily effluent on leaf color

The laboratory analysis on the leaf color (chlorophyl a) of the samples collected from the first sites shows that the leaf color (chlorophyl a) of the unpolluted site (2.79ug/g) is greater than that of the polluted site (3.12ug/g). For the second sites the leaf color(chlorophyl a) of the unpolluted site(2.38ug/g) is lesser than that of the polluted site(3.09ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(2.07ug/g) is greater than that of the polluted site(5.46ug/g).

The laboratory analysis on the leaf color (chlorophyl b) of the samples collected from the first sites shows that the leaf color (chlorophyl b) of the unpolluted site (2.23ug/g) is greater than that of the polluted site (3.04ug/g). For the second sites the leaf color(chlorophyl b) of the unpolluted site(2.15ug/g) is lesser than that of the polluted site(2.91ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(1.89ug/g) is greater than that of the polluted site(5.28ug/g).

The laboratory analysis on the leaf color difference (chlorophyl a-b) of the samples collected from the first sites shows that the leaf color difference (chlorophyl a-b) of the unpolluted site (0.56ug/g) is greater than that of the polluted site (0.08ug/g). For the second sites the leaf color difference(chlorophyl a-b) of the unpolluted site(0.23ug/g) is lesser than that of the polluted site(0.18ug/g). The result for the third sites shows that the leaf percentage acidity of the unpolluted site(0.18ug/g) is greater than that of the polluted site(0.18ug/g)

Table 14: Effect of oily effluent on leaf color (Chlorophyl a)

Chlorophyl a(ug/g)				
1	polluted	3.12	unpolluted	2.79
2	polluted	3.09	unpolluted	2.38
3	polluted	5.46	unpolluted	2.07

Table 15: Effect of oily effluent on leaf color (Chlorophyl b)

Chlorophyl b(ug/g)				
1	polluted	3.04	unpolluted	2.23
2	polluted	2.91	unpolluted	2.15
3	polluted	5.28	unpolluted	1.89

Table 16: Effect of oily effluent on leaf color difference (a-b)

Color difference (a-b) ug/g				
1	polluted	0.08	unpolluted	0.56
2	unpolluted	0.23	polluted	0.18
3	polluted	0.18	unpolluted	0.18

Conclusion and Recommendation

There could be so many factors responsible for the higher numbers of stomata observed in the polluted site, this could be due to the type of soil and environmental factors. The leaf stomata could increase as a ploy for the trees to establish equilibrium between the internal turgidity of cells and the external deficiency/sufficiency in air supply. This research has shown that with a matter of time the oil pollution will affect the trees negatively, therefore, it is recommended that the mechanics should stop sitting there workshops under or near these trees in order to stop exposing the trees to pollution.

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