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# Effect of Diesel Oil Polluted Soil on Proximate Compositions and Mineral Elements of Scent Leaf (*Occimum Gratisimum)* in AkwaIbom State, Nigeria

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## Abstract

*Studies of effect in diesel oil pollution on proximate compositions and mineral nutrients in the leaves of Occimumgratissimum were investigated. Five levels (0ml, 75ml, 150ml, 225ml and 300ml) of diesel oil pollution were mixed with 5kg of soil. Each treatment was replicated three times. Plant samples were watered daily for 16 weeks (four months). At the end of 16 weeks, the leave samples were harvested for laboratory analysis. The proximate compositions and mineral nutrients of the leave samples were determined. The results revealed that mean percentage protein(1.57±0.02), fats (0.95±0.02), Ash (0.74±0.25),fibre (1.03±0.03) content and carbohydrate (4.15±0.25) of leave samples were significantly (P<0.05) lower in (300ml) treatment of diesel pollution compare to the corresponding values protein (18.30±0.01), crude fat(22.17±0.13), total ash( 12.05±0.07), crude fibre ( 9.16±0.15) and carbohydrate ( 47.01±0.04) recorded in the (0ml) control experiment respectively. The percentage moisture and dry matter contents were significantly high (P<0.05) in control (0ml) experiment (62.15%, 47.07%) respectively. Treatment with 300ml and 2250ml of diesel oil pollution recorded the least values of moisture and dry matter contents in the leave samples. The mineral nutrientsCa, P, K, Mg, Na, Fe and Zn were also found to reduce significantly as the level of diesel oil pollution increased in the soil compare to values recorded in control experiment (0ml). It is recommended that remediation of diesel oil polluted soil should be carried out before any agricultural activities is carried out in the area.*

**Keyword:** Diesel Oil Pollution, Proximate Compositions, Mineral Nutrients, *Occimumgratissimum*

## Introduction

Diesel oil pollution often occurred mostly in oil producing communities of Niger Delta region of Nigeria. Diesel pollution may occur through pipe linevandarization, accidents along major high ways through tankers, and through refining process of crude oil[1]. The pollution can enter into the environment through leakage from storage containers, refueling of vehicles, wrecks of oil tankers and improper disposal by mechanics or diesel tankers. Venossa *et al.*[2], reported that processing and distribution of petroleum hydrocarbons and theuse of petroleum products leads to contamination of environment. Changes in soil physical and chemical properties due to contamination with petroleum-derivative have been studied extensively by many researchers[3]. Contamination of the environment by petroleum derivatives also limit the photosynthetic process in plants, upset metabolic activity, affect its nutrient uptakes and negatively influence the proximate compositions and mineral elements of plants[4]. The introduction by man directly or indirectly of diesel oil into the environment result in deleterious effects in ecosystem and also have adverse effect on soils fertility and plants nutrients, health hazard to human beings and other livingorganisms[5]. The increasing use of diesel oil in our daily live has led to an increased demand for diesel oil [6]. Diesel oil pollution can occurred through accidental discharged of diesel along high ways roads. These affect both surface and underground water and pollute agricultural lands. Diesel oil is one of the major products of crude oil and it constitutes a major source of environmental challenges in the Niger Delta region of Nigeria[7]. Diesel oil spills on agricultural land generally reduce plant growth, inhibit photosynthetic process of plant and reduces nutrient uptake of plants[8]. Wyszkowski et al.[3], reported that diesel oil pollution led to a significant reduction of organic carbon content, total nitrogen and available phosphorous in the soil. Ogbo *et al.*[6], reported that diesel oil contamination of the soil caused a reduction in the proximate composition of *Vignaunguiculata* and *Zea mays.* Hydrocarbon pollution significantly reduced percentage germination, plant height, leaf production and biomass of *Telfairiaoccidentalis*[10]. Diesel oil pollution affect plant adversely by creating conditions which make essential nutrients like nitrogen, potassium, phosphorous and magnessium needed by plant growth unavailable to them[6]. Crude oil polluted soil has been found to reduce mineral and proximate composition of bitter leaf *(Vernoniaamydalina)*[11]. Researchers have studies the effects of individual hydrocarbon products on germination percentage and growth performance of plants[12-13]. Little research has focused on the effect of diesel oil pollution on proximate compositions and mineral elements of indigenous vegetables in which the rural people used as a source of protein, fat and carbohydrate. Therefore the aim of this study

is to determine the effect of diesel oil pollution on proximate composition and mineral nutrients in scent leaves *(Occimumgratissimum).*

**Botany of the Plant:** *Ocimumgratissimum*belong to the family Labiatae andgrows mostly in south eastern Nigeria and coastal communities of Niger Delta region, Nigeria. The plant is known by various names in different parts of the world. In Efik it is called "Nton", in Yoruba it is called "efinirinajase", in Hausa it is known as "Aaidoya ta gida"[14]. *Ocimumgratissimum* is a perennial plant which is widely distributed in the tropics of Africa and Asia. In Nigeria it is a widely used as spice and vegetable in the coastal communities of Niger Delta. The plant is used in traditional medicine for the treatment of several ailments such as urinary tract, wound, skin and gastrointestinal infections[15]. The pleasant smell of the plant gives it the common name scent leaf plant (*Ocimumgratissimum).*

## Material and Methods

The research was cocducted as pot experiment in the Green House at Botanical Garden, AkwaIbom State University, Ikot Akpaden, Mkpat Enin, AkwaIbom State, Nigeria. The seeds of *Occimumgratissimum* used were collected from AkwaIbom State Agricultural Development Programme (AKADEP). The soil sample used for the study was collected from bush fallow in the Botanical garden, AkwaIbom State University. The soil was sieved with 2mm mesh size before use. A total of fifteen (15) plastic buckets perforated at the base for easy drainage were used. Each treatment consists of 5kg of soil thoroughly mixed with different levels (0ml, 75ml, 150ml, 225ml, and 300ml) of diesel oil. The mixture was allowed to stay for two weeks (14 days) before the seeds of *Ocimumgratissimum* were planted. This was to allow free mixture of diesel oil and soil sample to maintain a uniform component mixture. The experiments were watered daily for 4 months (16 weeks).At the end of 4 months, the leaves were harvested for proximate composition and mineral elements analyses.

**Processing of leave Materials:** The fresh leaves of *Occimumgratissimum,* were air dried at 28$^{o}$C for 24hours. The leaves samples were grounded into fine powder using an electric blender and stored in a cool dry container for both proximate and mineral analysis. The fresh leaves were used for moisture and dry matter content determination.

**Proximate Analysis:** The proximate analysis of the leaves of *Occimumgratissimum* for crude fibre, total ash, crude protein, crude fibre, and fat contents were determined using themethods described by Pearson[16]. Totalash content was determined by furnaceincineration using the method of James (1995)[17]. Moisture and carbohydrate contents were determined using the method described by AOAC[18].

**Elemental analysis:** Mineral contents of processed samples were determined following the dry ash extraction methods[17] and[19]. Calcium and magnesium were determined by Versanate EDTA titrimetric method [20]. Phosphorus in test sample was determined by Molybdo vanadate colorimetric method[17]. Sodium and potassium was determined by flame photometry. Microminerals(Zinc and Iron) were determined using atomic absorption spectrophotometer AAS 969 Model[17].

**Data Analysis**: Data were generated in triplicates and expressed as mean (±) standard deviation and was determined according to the method of (Steel and Torrie 1980)[21].

## Results and Discussion

The effects of diesel oil pollutionon moisture contents on Occimum*gratissimum* leaves is presented in figure 1. The result shows a decrease in moisture content in the leaves of *Occimumgratissimum* with increased levels of diesel oil pollution. Treatment of soil with300ml and 225ml of diesel oil pollution showed a significant reduction ($p<0.05$) of moisture content of the leave samples. The control treatment (0ml) zero diesel oil treatment in the soil showed a significant increase in moisture content of the leaves *Occimumgratissimum.* Moisture contents were observed to decrease in the leave samples as the levels of diesel oil increased in the soil. The decreased in the moisture and dry matter contents of the leave samples treated with diesel oil may be due to influence of physiological stress occasioned by application of diesel oil in the soil that affect the water and minerals uptake of the plant. Also, the lower values of moisture content observed in 300ml, 225ml, 150ml and 75ml in diesel oil pollution were (15%, 27%, 31% and 43%) respectively. This may be attributed to the effect of diesel oil pollution in soil which affect the physical and chemical properties of the soil and inhibit water and nutrients uptake by plants[22]. The values of crude protein in the diesel oil polluted soil were (1.57±0.02, 2.19±0.01, 4.16±0.20 and 7.21±0.05) in the 300ml, 225ml, 150ml and 75ml treatment of soil with diesel oil respectively. The control treatment had the highest values of crude protein in the leaves of *Occimumgratissimum.* The crude fat, total ash, crude fibre and carbohydrate contentof the plants grown in control experiment (0ml) of diesel oil polluted soil recorded the following values 22.17±0.13, 12.05±0.07, 9.16±0.15 and 47.01±0.04 respectively (table-1). These values were significantly different from the treatments with diesel oil. However, leave samples of *Occimumgratissimum* plants grown in the 225ml and 300ml diesel oil pollution gave the least values of proximate compositions of the plant.

The effect of diesel oil pollution on mineral elements in the leaves of *Occimumgratissimum* is presented in table 2. The result showed that there were significant differences among the various treatments of diesel oil pollution in the soil. Phosphorous, magnesium, potassium, calcium and sodium were observed to be decreased in the leave samples of *Occimumgratissimum* as the concentration of the diesel oil pollution increases. Consequently, plant samples grown in the control experiment (0ml) showed a significant increase in all the mineral nutrients including some essential micro elements

determined (Fe and Zn). The values of iron and zincin the control experiment also recorded significant increase in the leaves of *Occimumgratissimum* when compared to 75ml, 150ml, 225ml and 300ml diesel oil treatment. The results of mineral elements in the leave of *Occimumgratissimum* revealed that diesel oil pollution in the soil affect the mineral nutrients and proximate compositions of plants.

**Discussion:** Diesel oil pollutionin the soil adversely affects the proximate compositions(crude protein, crude fat, crudefibre, total ash and carbohydrate) content of the leaves of *Occimumgratissimun* as shown in the result. This may be attributed to the reduction of macro and essential micro elementsin thesoil which areneeded for synthesis of these nutrients in the leave sampleof plants. Similar result was also reported by Ogbuehi (*et al.*, 2010) on the effect of crude oil pollution on proximate composition of *Manihotesculentus*. Also this result was in line with the work of Agbogidi (*et al.,* 2007), who reported that reduction in protein, moisture and fat contents of maize may be due to impairment of photosynthetic activities through cell injury and disruption in the activities through cell membrane or other stress imposing properties of crude oil resulting in anatomical aberration of plants. Carbohydrate content, moisture and dry matter content in the leave samples decreased progressively as the level of diesel oil pollution increases compared to the (0ml) control experiment. The low values of carbohydrate, moisture and dry matter content recorded in the leave samples of diesel oil polluted soil could be physiological response of this crop to stress. Since the diesel oil pollution prevent the uptake of water and mineral elements from the soil by the plants. However, the study was not in line with the findings of Ogbuehi*et al.*, who reported that crude oil pollution increased carbohydrate content of cassava. The low values of carbohydrate recorded in the soil treated with diesel may be attributed to the effect of oil pollution on photosynthetic processes of plant. This is because plants make used of water, sunlight and carbondioxide to manufacture its own food. Moisture content was found to decrease in the leave samples as the diesel oil pollution increased in the soil. This was due to influence of physiological stress occasioned by application of diesel oil in the soil. It was observed that the moisture content increased as the levels of dieseloil pollution increases in the soil, however at 300ml diesel oil pollution level, there was drastic reduction in moisture content of leave samples showing degree of physiological stress impacted on the leaves due to high pollution level of diesel oil. This observation is similarto that of Adenipekun*et al.,* who reported that crude oil pollution affect moisture content of *Celosia argentea.* The result of the Ash content was found to decrease in leave samples and the levels of diesel oil pollution increases in the soil. The increase in proximate compositions and mineral elements observed on the leaves of *Occimumgratissimum* in the control treatment (0ml) could be attributed to redistribution of assimilates of mineral elements from the soil to the plants.

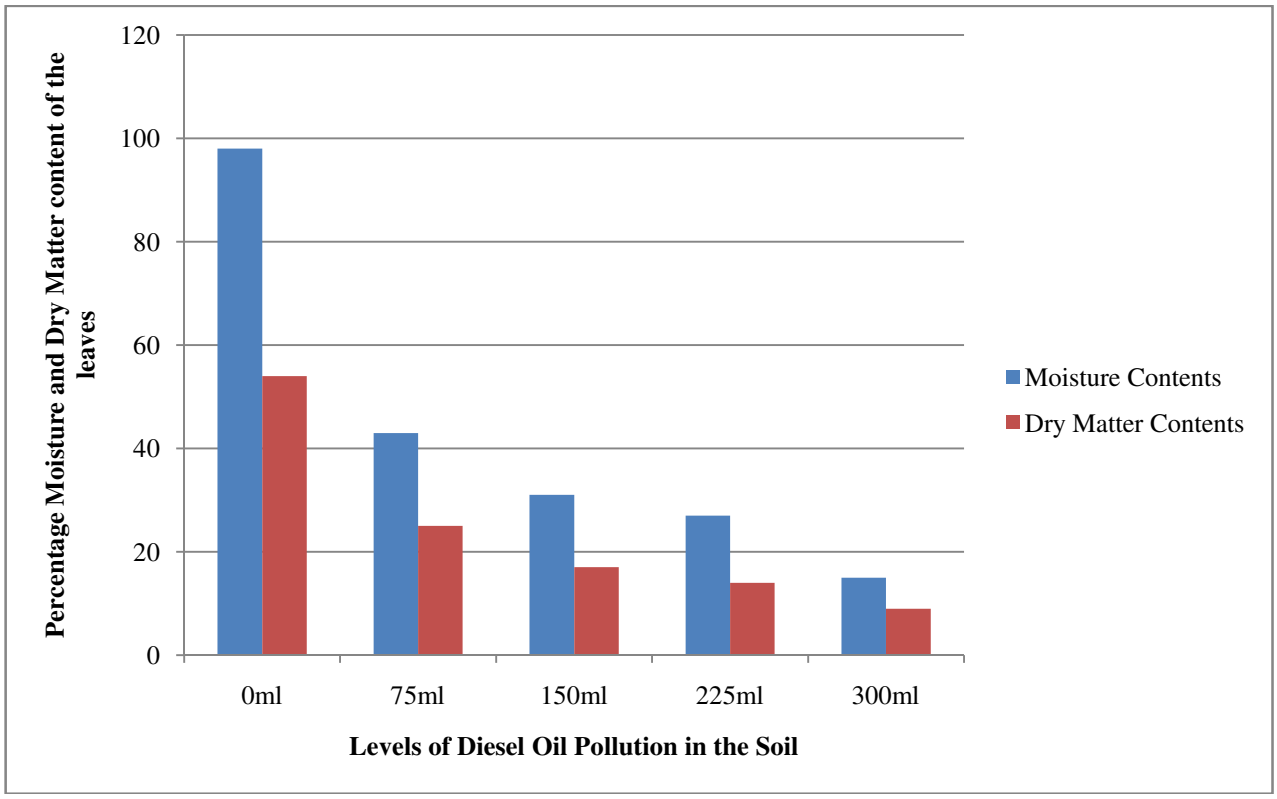


**Figure-1**
**Effect of Diesel Oil Pollution on Mosture and Dry Matter contents of the leaves**

**Table-1**
**Effect of diesel oil pollution on proximate compositions of *Occimumgratissimum* leaves**

| Diesel oil treatment | Crude protein | Crude fat | Total ash | Crude fibre | carbohydrate |
|---|---|---|---|---|---|
| 0ml (Control) | 18.30±0.01 | 22.17±0.13 | 12.05±0.07 | 9.16±0.15 | 47.01±0.04 |
| 75ml | 7.21±0.05 | 7.05±0.15 | 4.15±0.10 | 3.55±0.25 | 16.10±0.20 |
| 150ml | 4.16±0.20 | 2.08±0.01 | 2.10±0.05 | 1.95±0.30 | 12.25±0.05 |
| 225ml | 2.19±0.10 | 1.40±0.07 | 1.05±0.17 | 1.10±0.20 | 7.12±0.10 |
| 300ml | 1.57±0.02 | 0.95±0.02 | 0.74±0.25 | 1.03±0.03 | 4.15±0.25 |

The data are mean values (±) standard deviation of triplicates determination.

**Table-2**
**Effect of diesel oil pollution on the mineral elements of *Occimumgratissimum* leaves**

| Diesel oil pollution | K | P | Mg | Ca | Na | Fe | Zn |
|---|---|---|---|---|---|---|---|
| 0ml (Control) | 47.01±0.05 | 58.31±0.01 | 31.84±0.01 | 48.05±0.10 | 41.38±0.02 | 32.25±0.01 | 28.10±0.02 |
| 75ml | 22.15±0.15 | 27.13±0.20 | 13.28±0.03 | 17.10±0.03 | 12.20±0.01 | 30.10±0.20 | 22.19±0.05 |
| 150ml | 7.05±0.01 | 7.35±0.01 | 4.32±0.10 | 10.05±0.02 | 5.01±0.10 | 27.30±0.50 | 18.15±0.10 |
| 225ml | 2.57±0.05 | 4.65±0.09 | 1.20±0.01 | 4.21±0.01 | 1.10±0.01 | 27.16±0.01 | 20.18±0.20 |
| 300ml | 1.05±0.10 | 2.25±0.25 | 0.52±0.10 | 1.59±0.20 | 0.4±0.02 | 14.17±0.10 | 16.23±0.45 |

The data are mean values (±) standard deviation of triplicates determination

Comparing the results of the proximate analysis and minerals elements of leave samples of occimumgratissimum treated with various levels of diesel oil pollution with the control treatment (0ml). The results showed that control experiment gave the highest values of crude protein, crude fat, carbohydrate, total ash, moisture content. The higher values of proximate compositions recorded in leave samples in the control experiment areessential compounds for the maintenance of plant and animal life and also provide raw materials for many industries[26]. Also the high values of total fat, total ash, crude fibre and total carbohydrate of the leave samples recorded in the control (0ml) experiment it is recommended to women who have newly given birth as a tonic in Ivory Coast[27]. The leaves of *Occimumgratissimum* can be a good source of magnesium, sodium, phosphorus and potassium (table 2) planted in an environment that is free from pollution. The values of mineral elements if were found to be higher in the control experiment than those treated with various levels of diesel oil pollution The high contents of phosphorus, magnesium, sodium and potassium in the leave samples observed recorded in the control experiment further explains its usage formedicinal purposes [28]. However, leaves of *Occimumgratissimum*is a good source of phosphorus, magnesium and calcium. Other mineral elementsdetected in reasonable amounts in the control experiment were calcium, zinc and iron. According to Choudhary and Bandyopadhyay (1999), high concentration of these mineral elements in a plant isadvantageous to the consumers, since they play important roles in the maintenance of normal glucosetolerance and in the release of insulin from beta cells of islets of Langerhans

## Conclusion

The results of this study revealed that diesel oil pollution which occurred frequently in AkwaIbom State, has negative affect the proximate compositions and mineral elements of plants grown in the area.Thereby reducing its quality and nutritive contents of edible crops used by the people as vegetables and spices. The low values observed in proximate compositions and mineral elements in the leaves of the *Occimumgratissimum* in diesel oil polluted soil showed that people in the area are exposed to health hazard since they depend on vegetables as source of protein and mineral nutrients. It is therefore recommended that remediation of all diesel oil polluted site should be carried out before any agricultural activity is embark on such site and government should enact a law to prevent the dumping and indiscriminate disposal of diesel oil in agricultural land.

## References

1. Adam G., Gamoh K, Morris, D. G. and Duncan, H. Effect and Alcohol addition on the movement and petroleum hydrocarbon fuels in soils, *Sci. Total Environ*., **286 (113)**, 15-25 **(2002)**
2. Venossa A.D, Wood H.K. and Mott R., Bioremediation of an Experimental oil spill on the shore of Delaware by *Environmental Science and Technology*, **30**, 1764-1776 **(1996)**
3. Wyszokowska S. and Kucharski S., Biochemical Properties of soil contaminated by petrol, *Polish Environ Studies*, **9(6),** 476-485 **(2000)**

4. Onyeri B.A., Impact of oil industry on the Envirnment, Proceedings of Environmental Awareness Seminar on the Pertoleum Industry and the Nigerian Environment.P.T.I. Warri, Nigeria **(1998)**

**5.** Aboribe R.I., Oil politics and the Niger Delta development commission, The tussle for control and domination, *Afr. J. Environ. Stud.,* **2**, 168-175 **(2001)**

**6.** Ogbo E.M., Zibigha M. and Odogu G., Effect of crudeoil on growth of the weed (*Paspalumscrobiculalum L.)* Phytoremediation potential of the plant, *Afric Journal of Environmental Science & Technology,* **3(9)**, 229-233 **(2009)**

**7.** Nwaogu L.A., Ujowundu C.O. and Mgbemena A.I. (Studies on the nutritional and phytochemical composition of *Amaranthushybridus* leaves, *Bio–Res*., **4**, 28-31 (**2006)**

**8.** Torstensse L.O., Mikaelpell P. and Bostenberg C., Need of a strategy for evaluation of arablesoil quality, *Environ. Pollut.*, **27**, 4-7 **(1998)**

**9.** Wyszkowski M., Wyszkokwska S. and Ziochokwska A., Effect of soil contamination with diesel oil on yellowlupine, field and macro elements content plant soil environment, **50(5),** 218-226 **(2004)**

**10.** Adedokun O.M. and Ataga A.E., Effects of amendments and bioaugumentation of soil polluted with crude oil, automotive gasoline oil, and spent engine oil on the growth of cowpea (*Vignaungiculata*Walp L.), *Scientific Research and Essay*, **2(5)**, 147-149 **(2007)**

**11.** Udoekpo D, Akpan M. and Ukoh P., Effect of air pollution on carbohydrate and nutrient concentrations in some vegetables crops. In Niger Delta region, *Bulg J Plant physiol,* 2006, **22(1 2),** 53- 63 **(2010)**

**12.** Ekpo F.E. and Nya E.J., Effect of poultry manure amendments on diesel oil polluted soil on germination and growth performance of some forest tree species, *Journal of Research in Environmental Science and Toxicology*, **1(7)** 195-200 **(2012)**

**13.** Eka B.A., Effect of crude oil pollution on microorganisms and nutrient composition of Bitter leaf in the tropics, *Journal of Sustainable Tropical Agricultural Research*, **16**, 67–71 **(2012)**

**14.** Gill L.S., Ethno Medical uses of plants in Nigeria Uniben Press, University of Benin, Benin City, Edo State, Nig. 176 – 177 **(1992)**

**15.** Emeka I.N. and Elizabeth E.E., Justification for the use of *Ocimumgratissimum* L in herbal medicine and its interaction with disc antibiotics, *Journal of Pharmcolgy*, **3**, 22-29 **(2007)**

**16.** Pearson D., *The Chemical Analysis of Foods,* Chivah Livingstone Edinburgh; 3-7 **(1976)**

**17.** James C.S., Analytical Chemistry of Foods, Chapman and Hall: New York; 52–55 **(1995)**

**18.** AOAC, *Official Methods of Analysis*, Association of Official AnalyticalChemist: Washington DC **(2000)**

**19.** Kirk R.S. and Sawyer R., Pearson's composition and analysis of foods, 9th Ed. Addison Wesley Longman Ltd., England; 1998 **(1998)**

**20.** Udoh B.I. and Oguwale N.C., Mineral quantitative analysis, *J. African food chem*., **4a(11)**, 5489-5493 **(1986)**

**21.** Steel R.G and Torrie J.H., Principles and procedures of statistics- a biometrical approach, 3rdedition, McGraw-Hill Book Coy. NY, USA **(1980)**

**22.** Kyung Hwa P., Ladeji S., Okoye Z. and Ojobe T., Chemical evaluation of the nutritivevalue of leaf of fluted pumpkin (*Telferiaoccidentalis*), *Food Chem*, **53**, 353-355 **(2009)**

**23.** Ogbuehi H.C., Ezeibekwe I.O. and Agbakwuru U., Assessment of Crude Oil Pollution the proximatecomposition and macro element of cassava crop in Owerri, *Imo State Int Sci Res J,* **(2),** 62-65 **(2010)**

**24.** Agbogidi O.M., Erutor P.G., Appanbi S.O., Nagi G.U., Evaluation of crude oil contaminates oil on the mineralnutrient element of maize (*Zea mays* L.), *J Agron.,* **6(1)**, 188-193 **(2007)**

**25.** Adenipekun O., Oyetungi O.S. and Kassim C.Q. Effect ofspent engine oil on the growth parameters and chlorophyllcontent of *Corchorusolitonus*linn, *Environmentalist*, **28**, 446-450 **(2008)**

**26.** Ebun-Oluwa P.O. and Alade A.S., Nutritional potential of Berlandier Nettle spurge (*Jatrophacathatica*) seed, *Pak. J. Nutr.,* **6,** 345-348 (**2007)**

**27.** Burkill H.M. The useful plants of West Africa, Vol.1, Royal Botanical Gardens, 11-20 **(1985)**

**28.** Bouquet A. and Debray M., *Plantes Medicinales*, 146-7 **(1974)**

**29.** Choudhary K.A. and Bandyopadhyay N.G., Preliminary studies on the inorganconstituents ofsome indigenous hyperglycaemic herbs on oralglucose tolerance test, *J.Ethnopharmacol*., **64**, 179-184 **(1999)**