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BIODEGRADATION OF POLYTHENE AND PLASTIC USING FADAMA SOIL AMENDED WITH ORGANIC AND INORGANIC FERTILIZER

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ABSTRACT

The biodegradation of plastic and polythene was monitored using Fadama Soil (FS) amended with poultry droppings, cow dung and inorganic fertilizer (NPK). Each was seeded with the polythene and plastic sample. The degradation of polythene and plastic was examined after 2, 4, 6 and 9 months of burial in FS amended with organic and inorganic fertilizers. Physicochemical characteristics of FS, poultry dropping, cow dung and NPK were examined before and after the amendment and seeding of the polythene and plastic sample. FS amended with poultry dropping had the highest count followed by FS amended with cowdung and the least is the FS as control. But after the expiration of the experiment FS amended with cowdung had the highest bacteria count followed by FS amended with poultry droppings and least was the control soil. The bacteria species isolated from FS, organic and inorganic fertilizers before amendments include: *S. aureus, Micrococcus, S. pyogens, Psuedomonas, B. subtilis* and *B. cereus*. The fungi species include: *A. niger, A. fumigates, A. flavus, Fusarium, Mucor, Penicillium,* and *Candida*. The bacteria species isolated and characterized after nine months of seeding include: *S. aureus, Micrococcus, S. pyogenes, P. aerogenosa* and *B. subtilis*. The fungi species are: *A. niger A. flavus, A. fumigates, Mucor, Penicillium* and *Fusarium*. The percentage weight loss of polythene bags was 18.1% and plastics 6.0% after nine months.

KEYWORDS : Fadama Soil, Organic and Inorganic Fertilizer, Polythene and Plastic

Plastics are materials made up of large, organic (carbon-containing) molecules that can be formed into a variety of products.

Some of the currently available laboratory studies are rather optimistic and suggest that under optimal conditions; previously highly oxidized PE can be transformed to CO_2 from more than 50% during about one year (Chiellini et al., 2003). Other published experiments suggest that the process could be slower, but even the biodegradation of some fraction of the material is evidenced (Koutny et al., 2006). Methods used in PE biodegradation studies span from ones concerning the testing of mechanical properties, as well as those employed in the field of solid phase physics and analytical chemistry, to microbiology and biochemistry methods.

A number of microorganisms, principally fungi, have been isolated and characterized in terms of their ability to degrade polyester polyurethanes (Pathirana and Seal, 1984). The degradation was considered to be initiated by hydrolysis of ester bonds by some hydrolytic enzymes, such as esterases (Nakajima- Kambe et al., 1997). The degradation of polyester PU by fungi is thought to be caused by the enzymatic action of esterases, proteases or ureases (Pathirana and Seal, 1984). Bacteria that degrade polyester PU have been found to produce PU degrading enzymes such as polyurethanases (Koutny et al., 2006). Awide variety of fungi like Curvularia, Fusarium, Aureobasidium, Cladosporium and bacteria like Pseudomonas and Comamonas are active against polyurethane (Zheng et al., 2005).

To determine the physico-chemical properties of the Fadama Soil, poultry dropping, cowdung and inorganic fertilizer (NPK). To isolate microorganisms from fadama soil mixed with organic and inorganic fertilizers. Enumeration, isolation and identification of microorganisms involved in the biodegradation of plastic and polythene before and after biodegradation.

MATERIALS AND METHODS

Sample Collection

Fadama Soil

Six kilogram (6kg) of Fadama Soil was collected at a depth of 5cm into a new polythene bags from fadama area of Zungeru in Wushishi local government of Niger state and transported to the laboratory for analysis.

Poultry Sropping

Three kilograms (3kg) of poultry dropping was collected using new polythene bag from the poultry house of Niger State Polytechnic Zungeru, and was taken to the laboratory for physico-chemical and microbiological analysis.

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Cow dung

Three kilograms (3kg) of cow dung sample was collected to the laboratory.

Inorganic fertilizer (NPK)

Three kilograms (3kg) 0f NPK fertilizer sample was collected from the Department of Agric, Wushishi Local Government Area of Niger State.

Polythene and Plastics

Twelve (12) sachet water polythene bags were bought from Minna central market, washed using sterilized water, air dried and weighed. Likewise (twelve) 12, disposable plastic materials were collected from environment, washed using sterilized water, air dried and weighed.

Media Preparation

Nutrient agar (NA) (Biotech Brand), and Sabraud Dextrose Agar (SDA) (Biotech Brand), were used.

Determination of the physico-chemical properties of Fadama Soil pH, determination of soil particle size, Nitrogen, Organic Carbon, Calcium, Magnesium, Potassium and Sodium, available Phosphorus, Calcium, Magnesium, Potassium and Sodium and organic matter.

The experiment set-up was made of large 12 plastic containers. Three (3) for each amendments Fadama Soil mixed with poultry dropping, Fadama Soil mixed with cow dung, Fadama Soil mixed with NPK and the control.

Bacteria Enumeration And Fungal Enumeration

Nutrient agar was used for bacteria and Saboreud Dextrose Agar (SDA), was used for isolation of fungi as described by Cheesbrough, (2003) as well as Oyeleke and Manga, (2008).

After nine months the plastic and polythene materials were removed aseptically, washed using distilled water, shade dried and then weighed. Gram's staining and Motility test was also conducted.

RESULTS

All the results showed in Table 1 to 4 and Figure 1. The result of physicochemical properties of Fadama Soil mixed with organic and inorganic fertilizers after 9 months of the analysis shows an increase in pH. The total nitrogen decreases (except control) and available P increases. There

Table1: Physico-Chemical Properties of Fadama Soil, Poultry Dropping, Cow Dung And Fertilizer (NPK) Before The Analysis

Sample	pH	Organic Carbon (%)	Organic Matter (%)	Total Nitrogen (%)	Available P (ppm)	Na ($Cmolkg^{-1}$)	K ($Cmolkg^{-1}$)	Ca ($Cmolkg^{-1}$)	Mg ($Cmolkg^{-1}$)	E.A. ($Cmolkg^{-1}$)	CEC ($Cmolkg^{-1}$)	SAND (%)	SILT (%)	CLAY (%)
F/soil (cntol)	4.28	0.72	1.24	0.028	37.00	1.63	0.355	3.76	1.18	0.32	7.25	68.24	19.28	12.24
C/DR	4.3	1.32	2.28	0.68	0.016	0.94	0.09	0.15	0.21	2.22	3.61			
CD	5.8	3.89	6.69	0.06	0.19	1.58	0.09	5.80	0.37	1.54	9.38			
FRT	5.2	0.96	1.66	0.03	0.117	1.58	0.20	0.21	0.55	2.40	4.94			

KEY: E.A:ExchangeAcidity, CEC:Calcium exchange concentration, PPM: Part per million, F/soil: Fadama soil, C/DR: Chicken dropping CD: Cow dung., FRT: Fertilizer (NPK). PPM: Part per million. Cmolkg-1: Concentrated mole per kg

Table 2: Physico-Chemical Properties of Fadama Soil, Mixed With Poultry Dropping, Cow Dung, Fertilizer (NPK) And Control After The Analysis

Sample	pH	Organic Carbon (%)	Organic Matter (%)	Total Nitrogen (%)	Available P (ppm)	Na ($Cmolkg^{-1}$)	K ($Cmolkg^{-1}$)	Ca ($Cmolkg^{-1}$)	Mg ($Cmolkg^{-1}$)	E.A. ($Cmolkg^{-1}$)	CEC ($Cmolkg^{-1}$)	SAND (%)	SILT (%)	CLAY (%)
F/ptry. Drp	4.6	0.26	0.42	0.56	1.23	0.34	1.022	0.72	0.44	0.026				
F/CD	5.5	0.30	0.52	0.174	1.66	0.64	2.072	3.36	0.32	0.023				
F/FTZ	5.2	0.70	1.21	0.067	1.88	0.54	0.32	0.24	0.66	0.142				
CON	5.8	0.64	1.10	0.042	1.98	0.44	0.68	1.34	0.26	0.036				

KEY: E.A:ExchangeAcidity, CEC:Calcium exchange concentration, PPM: Part per million, F/soil: Fadama soil, C/DR: Chicken dropping CD: Cow dung., FRT: Fertilizer (NPK). PPM: Part per million. Cmolkg-1: Concentrated mole per kg

Table 3: Characterization And Identification of Bacteria Isolated From The Sample After 9 Months

SAMPLES	MICROORGANISMS	G.R	C.S	P.S	Ct	Cog	MO	G.H	S.H	N.R.	In	M.R.	U	C	V.P	OX	HS	D.G	L	S	D.M	M	A	F	X	D	SOR	SOR
F/poultry dropping	Staph. Aureus	+	Cocci	-	+	+	-	+	-	+	-	-	-	-	+	-	-	+	-	+	+	+	-	+	-	-	-	- -
“	*Psue. aerogenosa*	-	Rod	-	+	-	+	+	-	+	-	-	+	+	-	+	-	+	-	+	+	-	-	+	-	-	-	- -
	Bacillus subtilis	+	Rod	-	-	-	+	+	+	+	-	-	-	+	+	-	-	+	-	-	+	-	+	-	-	-	-	- -
	Strep payogenes	+	Cocci	-	+	+	-	-	-	-	-	+	+	-	-	-	-	+	-	+	-	+	-	+	-	-	-	- -
	Micrococcus	+	Cocci	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Staph. Aureus	+	Cocci	-	+	+	-	+	-	+	-	-	-	-	+	-	-	+	-	+	+	+	-	+	-	-	-	-
	Escherichia coli	-	Rod	-	+	-	+	-	-	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	-
	Kleb pneumonia	-	Rod	-	-	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+	+	+	+	+	-	-	-	
F/cow dung	*Psue. aerogenosa*	-	Rod	-	+	+	-	+	-	+	-	-	+	+	-	+	-	+	-	+	+	-	-	+	-	-	-	- -
	Staph. Aureus	+	Cocci	-	+	+	-	+	-	+	-	-	-	-	+	-	-	+	-	+	+	+	-	+	-	-	-	- -
	Klebsiella spp	-	Rod	-	+	-	+	-	-	-	-	+	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	- -
	Bacillus subtilis	+	Rod	-	-	-	+	+	+	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	-	- -
	Kleb pneumonia	-	Rod	-	-	+	+	-	+	+	-	+	+	-	+	-	-	+	+	+	+	+	+	+	-	-	-	
	Bacillus lentus	+	Rod	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Escherichia coli	-	Rod	-	+	-	+	-	-	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	
	Proteus vulgaris	-	Rod	-	+	-	+	+	-	+	+	+	+	-	-	+	+	-	+	-	+	-	-	+	-	-	+	
F/Fertilizer	*Micrococcus*	+	Cocci	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	- -
	Psuedomonas	-	Rod	-	+	-	+	+	-	+	-	-	+	+	-	+	-	+	-	+	+	-	-	+	-	-	-	- -
	Proteus vulgaris	-	Rod	-	+	-	+	+	-	+	+	+	+	-	-	+	+	-	+	-	+	-	-	+	-	-	+	+ +
	Bacillus lentus	+	Rod	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	- -
	Escherichia coli	-	Rod	-	+	-	+	-	-	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	- -
F/soil:control	*Micrococcus*	+	Cocci	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	- -
	Psue aerogenosa	-	Rod	-	+	-	+	+	-	+	-	-	+	+	-	+	-	+	-	+	+	-	-	+	-	-	-	- -
	Bacillus subtilis	+	Rod	-	-	-	+	+	+	+	-	-	-	+	+	-	-	+	-	-	+	-	+	-	-	-	-	- -
	Strep payogens	+	Cocci	-	+	+	-	-	-	-	-	+	+	-	-	-	-	+	-	+	-	+	-	+	-	-	-	- -
	Staph. Aureus	+	Cocci	-	+	+	-	+	-	+	-	-	-	-	+	-	-	+	-	+	+	+	-	+	-	-	-	- -

KEY: G.R: Gram reaction C.S: Cell shape P.S : Presence of spore Ct: Catalase Cog: Coagulase MO:Motility
G.H: Gelatin hydrogenase S.H: Starch hydrogenase N.R: Nitrate reaction In: Indole production M.R: Methyl red U: Urease
C: Citrate V.P: Voges prosk OX: Oxidase HS: Hydrogen sulp D.G: D.glucose L: Lactose
S: Sucrose D.M: D-Mannitol M: Maltose A: Arabinose F: Fructose X: Xylose D: Dulcitol SOR: Sorbitol

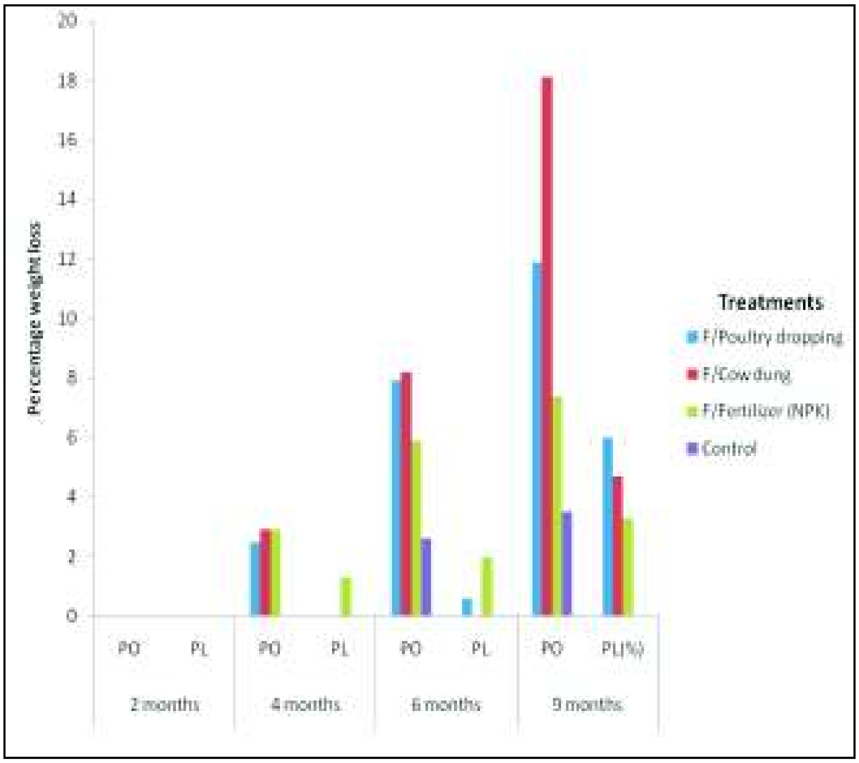

Figure 1: Percentage Weight Loss of Polythene And Plastics Seeded In Fadama Soil Amended With Organic And Inorganic Fertilizers After The Period of Nine Months

Key: F- Fadama soil. PO- Polythene. PL- Plastics

The result for the percentage weight loss of polythene and plastic bags varies between the months of seeding and also by the treatments used for the analysis. The percentage weight loss of polythene and plastic bags after nine months in Fadama Soil mixed with poultry dropping was 11.9% for polythene and 6.0% for plastics. Weight loss in Fadama Soil mixed with cow dung was 18.1% for polythene and 4.7% for plastics. Weight loss of polythene and plastic in Fadama Soil mixed with fertilizer (NPK) was 7.4% for polythene and 3.3% for plastics. While, the percentage weight loss of polythene and plastics after nine months of burial in Fadama Soil (control) was 3.5% and 0.0% respectively.

Isolation, identification and characterization of bacteria and fungi species after the period (nine months) of incubation in Fadama Soil mixed with organic and inorganic fertilizers. The bacteria species include; *Bacillus subtilis, Bacillus cereus, Bacillus lentus, Psuedomonas aeroginosa, Staphylococcus aureus, Klebseilla pneumoniae Streptococcus payogenes, Escherichia coli, Proteus vulgaris* and *Micrococcus.* Fungi species isolated are; *Aspergillus niger, Aspergillus fumigates, A. vesico Mucor, Fusarium, Penicillium, Candida krusei, flavus* spp, *Attereus, Rhizopus, Microsporum canis* and *Alternaria* spp.

DISCUSSION

The biodegradation of polythene and plastic seeded with the organic and inorganic fertilizer reveal the physico-chemical properties of Fadama Soil, poultry dropping and Cow dung. Acidic range of Fadama Soil and chicken dropping revealed that the indigenous microorganisms isolated from Fadama Soil and chicken dropping were acidophilic. Where by the slight closeness of cow dung and fertilizer pH range showed that some of the microorganisms may be basophilic. However, the differences in the pH requirement of the microorganisms, as well as variations in the soil structure are likely to influence the soil microbial counts and their distribution in the soil. Bachman and Kinzel, (1992) made a similar observation that interrelationship exist between soil type, as well as

Table 4: Morphological Characteristics And Identification of Fungi Isolated From The Sample After 9months

Sample	Color of aerial hyphae	Colour of septate hyphae	Nature of hyphae	Shape	Precence of special structure	Sporangiophore or conidiophore	Characteristics of spore head	Probable organism
F/poultry dropping	Yellow	Brown	Septum /nucleate	Oval greenish	Foot cell precence	Long erect non-septate	Multinucleate	*Aspergillus niger*
	Brown	Orange-brown	Septate	Lemispherical	Footcell absent	Longerect	Dome-like	*A flavus Aterreus*
	Grey	Brown	aseptate	Oval bladder	Footcell absent	Long erect and aseptate	Elliptical	*Mucor spp*
	Gray black	Black	Nonseptate	Oval	Foot absent	Long erect	Smooth round	*Rhizopus*
	Orange-yellow	Yellow -green	Septate	Oval deep red	Foot cell absent	Long erect	Semi elliptical	*A. versico*
Fadama soil mixed with cow dung	Alemon-yellow	A deeper - brownish	Septate	Oval green	Foot cell present	Long erect	Spindle-shape	*Microsporum canis*
	Bluish green	Brown	Septate	Oval greenish	Foot cell present	Long erect non-septate	Multinucleate green vesicles	*Aspergillus fumigates*
	Graynish	Greenish-gray	Septate	In chain	Foot cell absent	Long erect non-septate	green vesicles	*Alternaria, C. krusei*
Fadama soil mixed with fertilizer	Green	Brown	Septate	Branched	chain green found conidi	Long erect conidiaphore	Hairing conidia	*Penicillium*
	Pink	Dark brown	Nonseptate	Green concave shape conidia	Foot cell absent	NA	NA	*Fusarium*
	Bluish green	Brown	Septate	Oval greenish	Foot cell present	Long erect non-septate	Multinucleate green vesicles	*Aspergillus niger*
Fadama soil only as a control	Grey	Brown	aseptate	Oval bladder	Footcell absent	Long erect and aseptate	Elliptical	*Mucor*
	Pink	Dark brown	Nonseptate	Green concave shapeconidia	Foot cell absent	NA	NA	*Fusarium*
	Green	Brown	Septate	Branched	chain green found conidi	Long erect conidiaphore	Hairing conidia	*Penicillium*

variations in soil structure may likely influence the soil microbial counts and activities.

The pH range of the treatments increase slightly from the second month to nine months and decreases in Fadama Soil amended with poultry dropping. This may be as a result of continuous biotransformation (apparently brittle) of the polythene material to slightly acidic. Odokuma and Okara, (2005) made a similar observation and reported the biotransformation of recharge cards seeded in mangrove and rain forest soil. However, slight increase in pH may have stimulated the growth of other organism metabolized the polyethylene converting them to slightly acidic compound (Odokuma and Ibe, 2003).

Physicochemical properties of soil also revealed that nitrogen content in the Fadama Soil was quite low (0.028), compare to that of poultry dropping, cow dung and fertilizer. This corresponded with low bacteria count in Fadama Soil sample. However, the low nitrogen content in the soil samples affects the microbial population, and their distribution in the soil. The result conforms with earlier reports of soils been in similar agroecology area and in Fadama Soil else were (Shafi'u, 2009). Shafi'u, (2009) also stated that the low N, contents of Fadama Soil may be because of impeded Nitrogen mineralization under anaerobic condition; which does not pass the ammonia stage, and thus, is subsequently lost as a gas to the atmosphere. Available phosphorus in the Fadama Soil is higher compare to the content present in chicken dropping, cow dung and fertilizer. Acar et al., (1984) stated that depending on the nature of the impacted environment, nutrients such as phosphorus and nitrogen could be limited thus affecting the microbial population.

After nine months, the Magnesium, Calcium, Sodium, Phosphorus, Nitrogen as well as Organic Carbon decreases in their concentration in all the treatments which may be as a result of microorganism utilization during the biodegradation process. Similar observation was reported by (Odokuma and Okara, 2005) that nitrates, sulphates and phosphates in all the treatments showed decreases indicating utilization by microorganisms during biodegradation process. Biodegradability is a function of the overall composition including nature of chemical composition, considering abiotic factors such as weathering which might work synergistically with microbial processes (Odukuma and Ibe, 2003: Odokuma and Okara, 2005).

The heterotrophic bacteria isolated, identified and characterized from the fadama soil samples mixed with organic and inorganic fertilizers include; *Bacillus subtilis, Bacillus cereus, Psuedomonas aeroginosa, Staphylococcus aureus, Streptococcus payogenes, Proteus vulgaris, Bacillus lentus, Escherichia coli* and *Micrococcu,.* and the fungal species include; *Aspergillus niger, Aspergillus fumigates, Mucor spp, Fusarium spp, Penicillium spp Candida krusei,.* However, the predominant bacteria and fungi species isolated from the film surfaces of polythene and plastic bags were: *Staphylococcus aureus, micrococcus, Streptococcus payogenes* (G^{+ve}), *Psuedomonas* (G^{-ve}) and three species of fungi *Aspergillus niger, Aspergillus fumigates,* and *A flavus.* respectively. Kathiresan, (2003), reported similar species of organisms associated with polythene and plastics buried in the mangrove soil, and emphasized that these microbes are associated with degradation of plastic materials up to 28.8% within a month. Microorganisms utilize polythene films as a sole source of carbon resulting in partial degradation of polythene and plastics. They colonize the surface of the polyethylene films or plastics forming biofilm (Vijaya and Mallikarjuna, 2007).

The growth profile of the organisms observed within the period of six to nine months indicated a decline in microbial counts. The decline in these counts may be due to nutrient exhaustion with possible release of toxic metabolites. This may also be as a result of polythene and plastic been actively metabolized. Odukuma and Okara, (2005) reported a decline in microbial count from 21 to 28 days, and stated that is an indicator of actively metabolized of recharged card seeded in mangrove and rain forest soil. Further explain that it may be as a result of toxic metabolites and exhaustion of nutrient.

The result of weight loss of polythene and plastic bags when seeded in fadama soil mixed with organic and inorganic fertilizer is an indicator of biodegradation of polythene and plastics. Weight loss of polythene and plastic was observed to commence between the periods of third to fourth months in all the treatment. However, the loss in weight of polythene and plastic bags increases with period of incubation as the research progresses for a period of nine months (final weight). The first to the third months of seeding weight loss was not observed in the either in that of polythene or plastic, this could be attributed to the delay by microorganism in their adaptation to the available nutrients and new environment. This agrees with the observation of (Orhan et al, 2004), that the lag period of four months observed in polythene and plastic could be attributed to the delay in the formation of biofilm by the microorganisms as a result of change in the environment.

The weight loss of polythene and plastics when seeded for nine months in fadama soil mixed with cow dung was 18.1% and Fadama Soil mixed with poultry dropping was 6.0%. This may be as a result of differences in the chemical structure of polythene (low-density polyethylene) and plastic (high-density polyethylene). This finding is in conformity with the findings of Orhan et al., (2004), who reported that the weight loss of high-density polyethylene (HDPE) was 3.68% and that of low-density polyethylene (LDPE) was 11.01% after twelve months of incubation in solid waste, and attributed it to their differences in chemical composition. Kathiresan and Bingham (2001) made similar observation that the biodegradation of polythene is relatively faster than that of the plastic and attributed it to the thickness of the polythene that is five times thinner than the plastics. Therefore, using statistical analysis of the data generated with analysis of variance (ANOVA) at 5% level of significant, shows that there is a significant differences ($p>0.05$) at the rate to which polythene and plastics were degraded.

It has been observed that seeding of polythene and plastics in the Fadama Soil causes significant reduction in the weight of polythene and plastics irrespective of the amendments, because weight loss of polythene in Fadama

Soil use as control recorded (3.5%) after nine months of incubation. Similar observation was made by Bollag et al., (2000), who reported that composting of plastic films in the soil (Fadama and Mangrove Soil) causes biodegradation of plastics, that the soils maintains moisture by tidal water flood during exothermic reaction of biological compounds in the soil.

The result of gravimetric analysis shows that the cumulative carbondioxide evolution for treatment (A), (Fadama Soil mixed with poultry dropping) is higher; 240.86dm^3 compared to Fadama Soil mixed with cowdung (B), 210.14dm^3. Fadama Soil mixed with fertilizer (C), had 209.58dm^3 and Fadama Soil (D) as control had 188.97dm^3. However, analysis of variance shows that there is no significant differences ($P<0.05$) between the treatments. The high rate of CO_2 evolution observed in treatment A and B, compare to treatment C and D, may be as a result of amendment of the Fadama Soil with organic matter which lead to the increase of microbial population as well as increased in carbon source. Mohee and Umar, (2006) made a similar observations by determining the biodegradability of plastic materials under controlled and natural composting environment, reported that CO_2 evolution of plastics under controlled atmosphere showed a higher level of biodegradation in terms of CO_2 evolution than plastics under natural environment, which they attributed as a result of higher microbial count and biostimulation of the controlled soil. Chiellini et al., (2003) reported that current available laboratory studies are rather optimistic and suggest that under optimal conditions highly oxidized polyethylene can be transformed to CO_2 by more than 50% in one year.

The analysis of variance (ANOVA) at 5% level of significant indicated that there was a significant ($p>0.05$) differences between the treatments. However, all treatments have some level of effect on the degradation of polythene and plastics.

The microbial degradation rate of polythene and plastic films in amended Fadama Soil appeared to be dependent on the microbial population distribution and pH, as well as the degrading ability of microorganisms to colonize the surface of the polythene and plastics.

CONCLUSIONS

The result of this study indicated that plastic materials can be degraded in the Fadama Soil irrespective of whether the soil is amended or not. Predominant bacteria and fungi identified include; *Staphylococcus aureus, Micrococcus, Streptococcus pyogenes, Psuedomonas* and three species of fungi *Aspergillus niger, Aspergillus fumigates,* and *A flavus*. Period of composting have a significant impact on the rate at which polythene and plastics are degraded. However, polythene and plastics seeded in Fadama Soil amended with cow dung and poultry dropping had the highest rate of weight loss compared to Fadama Soil amended with inorganic fertilizer (NPK) and control. This signified that amendment of Fadama Soil with organic manure contain potent microorganisms that has the potential to aid biodegradation of polythene and plastics.

Based on the results of the study, the following recommendations are made:

(a) A consortium of the bacteria and fungi species isolated could be used for further studies of their individual ability to degrade polythene and plastics.

(b) Genetically modified microorganisms could be tested if they biodegrade the materials faster.

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