ANALYSIS OF PHYSIO-CHEMICAL PROPERTIES OF WASTE FROM URBAN INFORMAL ENTERPRISES IN IBADAN, NIGERIA

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ABSTRACT

Against the background of persistent, widespread of informal activities and its appalling environmental negativities, this paper analyzed the physiochemical characteristics of waste discharged by urban informal enterprises in Ibadan Region. Through the use of Global Positioning System, sampling locations were determined. A total of twenty one samples were successfully utilized for the laboratory analysis. The samples comprise liquid and solid waste generated by urban informal enterprises in randomly selected four local government areas. The physiochemical characteristics of samples and the pollutants (cadmium, chromium, lead) were analyzed in two laboratories (The Science laboratory of Obafemi Awolowo University and Department of Agronomy University of Ibadan) for comparative purpose. The result of analysis for concentration of Lead for liquid wastes and Cadmium test for soil samples reveals that waste from most of UIEs in tertiary services recorded significant values that exceeded permissible levels. The result of physiochemical properties (Alkalinity, Acidity and Chloride) of liquid waste from virtually all the categories of UIEs in almost all the four sampled Local Government Areas

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exceeded maximum permissible limit (600mg/l). The study recommends the reinstatement and use of the services of sanitary officers to curb some of the behavioural attitudes of operators that poses threat to the environment The haphazard locations of UIEs should be controlled while their activities, particularly waste discharges should be monitored by relevant environmental agencies at all tiers of government. These will provide a sustainable and comprehensive approach that will guide against its negative impacts on the environment.

Introduction and Background to the Study

Several scholars (Sethuraman, 1992, Perera et al 1996, Harts 1973 Oni 2001, Ijaiya 2002, Menyah 2009, Adedibu et al 2005, Abumere, 1995 Akinbinu, 2001 Karl 2000, Amin, 2002, Lubell,1991 Cataya,1994) have examined the impacts of urban informal enterprises on the growth, productivity, and provisions of employment opportunity as well as its recognition as the platform and nurturing grounds for domestic entrepreneurial capacities, technical skills, technological innovations and managerial competencies (Blackman 2000). In addition, its impacts on poverty alleviation, income generation and reduction in crime and violence have been established by scholars (Ijaiya and Umar, 2004 Igbinedhor 1987). However, as informed by Onyechere, (2011) Onyebueke, (2000) Sethuraman (1997) its impacts on the environment in which they operate is yet to be given adequate investigation empirically. This should be a major concern to environmentalist including planners most especially its implication on the environmental sustainability. Consequently, this paper focused extensively on this pertinent but neglected subject.

One of the major problems in urban areas of developing nations in Africa is the ever increasing environmental degradation. Amongst these problems, is the accelerating growth of municipal waste disposal emanating from various human activities, particularly waste from informal enterprises. According to Onyenchere, (2011), waste disposal, most especially from informal enterprises, is now one of the most conspicuous environmental problems of Africa's urban areas. The generation of wastes from discarded pure water bottles and sachets by hawkers/vendors from informal enterprises is growing steadily. This increase is not only in terms of quantity (Yantson, 2000 Abolade, 2012) but also in its variety and components which include its changing biodegradability and toxicity Onyenchere, (2011). The complexity of this problem is hinged on unorganized and indiscriminate location of informal enterprises which often pose a

great difficulty of dissatisfaction and stress to the entire environment. Consequently, the spontaneous and proliferation of urban informal enterprises in most developing nations has continued to pose serious threat to the ecosystem.

According to Nwaka (2005), informal sector follows closely the pattern of urban development in Nigeria and that the areas of informality in cities are very extensive. The infiltration of informal sector has turned out to be an environmental tragedy and its land use implications present a considerable challenge to urban land use planning in Nigeria, even though it contributes to poverty alleviation (Okeke, 2000). He established further that the operation of informal enterprises has defied urban land use planning and consequently defaced the urban landscape. This often results to health hazards, environmental pollution and filthy or unsanitary condition of the environment, and sometimes contributes to outbreak of diseases thus constituting serious threat to human life (Fasinmirin et al 2009, Muvbani 1992). This occurrence is predominant in urban environment of less developed countries where waste management techniques is very poor. This becomes worsened as the widespread of the unplanned and poorly accommodated informal enterprises in most parts of African cities increases and consequently, the collection, transportation, and proper treatment of municipal wastes becomes extremely difficult. This becomes worsened with the general problems of lack of control over waste minimization, lack of appropriate landfill site and inadequacy of financial resources (Onyenchere, 2011).

According to Nwaka, (2005), the appalling environmental negativities associated with the informal sector activities and settlements constitute a major threat to the health and wellbeing of urban life. It has brought a serious challenge to land use development thus stressing virtually all residential densities and posing a great threat to the environment and quality of life of urban dwellers. Yantson (2000) also remarked that as the urban informal enterprises expand, there is bound to be a proliferation of workshops and work sites as well as intensification in the use of informal economic locations. This, he noted, could breed and exacerbate environmental problems and health hazards.

However, given the well-known haphazard development pattern, (as locations pay no regard to any planning regulations) and associated insanitary environmental condition, the environmental impact of informal enterprises is obscene. The infiltration of such services and enterprises is not necessarily the problem but the haphazard location and its poor management

through inappropriate policy measures as well as poor implementation of such policies to control and regulate the siting of such activities. This is a major characteristic of Ibadan Metropolis which is the home of several informal enterprises. Such findings will provide insight for policy formulation environmental impact and land use regulation. This is the major thrust of this paper.

Material and Methods

Physiochemical Characteristics of Liquid Waste

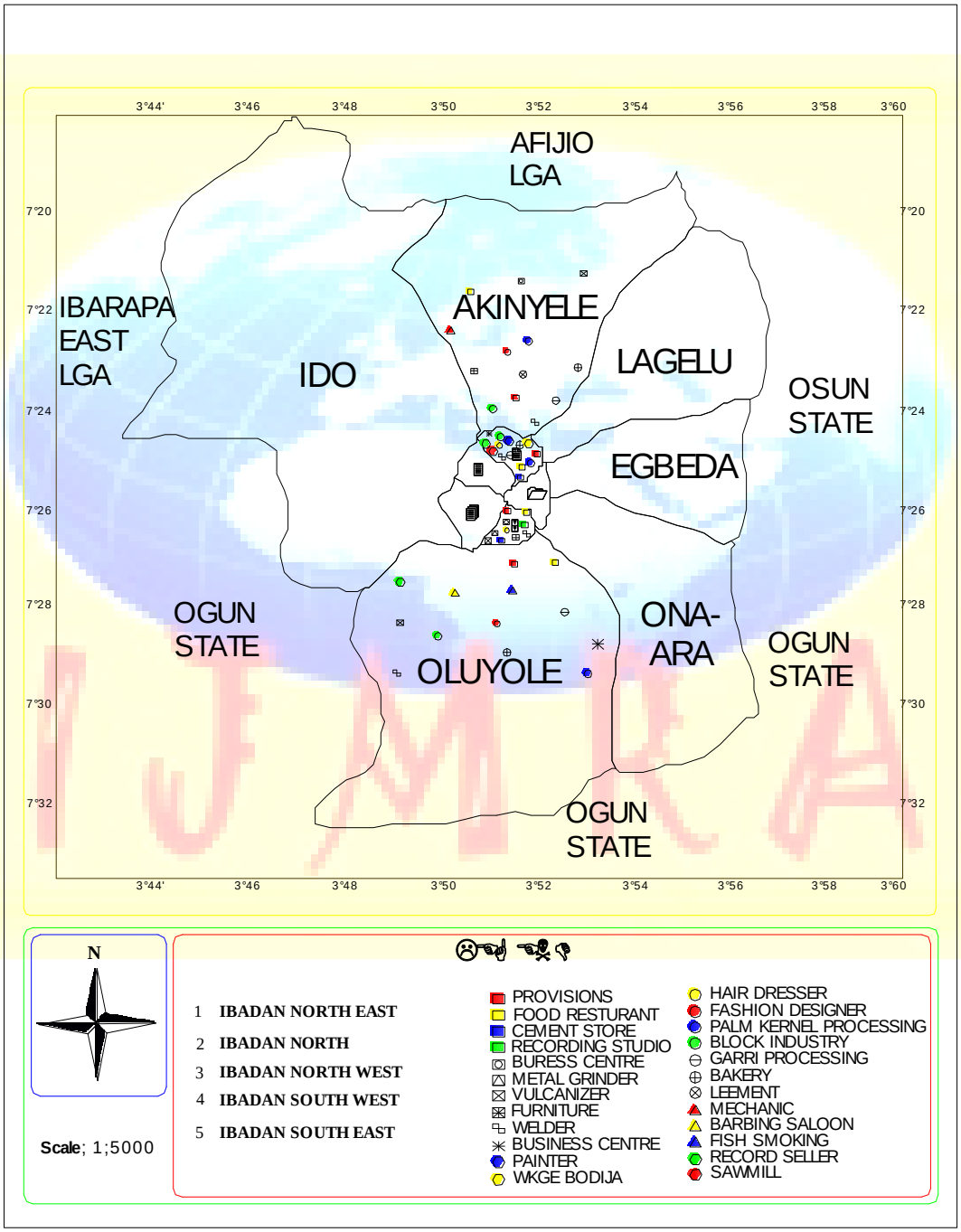
A total of twenty one samples of different categories of urban informal enterprises from same location were collected in clean water bottle without any air bubbles. The samples are limited to these number: this is premised on the fact that not all informal enterprises generates waste in liquid and solid form, some are in gaseous form and coupled with the uncooperative attitude of operators in taking samples from there workshops. This is premised on fear of insecurity due to African culture. However, twenty one samples were successfully collected and kept inside rinsed bottles before use. Samples were collected, tightly sealed and labeled in the field for identification 10ml of the sample was poured in a small tube and 2 drops of indicators and 2.2 volume of titrates were added to determine the physio-chemical characteristic of waste from selected urban informal enterprises. Laboratory analysis for cadmium (Cd) and Lead (Pb) was carried out in Science Central Laboratory of Obafemi Awolowo University Ile Ife. Although, not all the sampled urban informal enterprises generate liquid waste. Therefore, only those activities that generate liquid waste and only those who were willing to release their waste were sampled in all the location considered as some operators were vehemently opposed to collection of their samples. The liquid waste sampled includes battery liquid waste, hair dressing liquid waste, waste water from restaurant and food vendor, art work ,cassava processing, engine oil metal grinding waste.

Physiochemical Characteristics of Soil Samples

Through the Global Positioning System (GPS) the sampling locations for samples were determined (Figure 1). The samples were collected in a clean polythene bags. The polythene bags were tightly tied and labeled in the field. The collected solid wastes were taken to central laboratory Obafemi Awolowo University for proper digestion. The digested samples were taken to science central laboratory Obafemi Awolowo University Ile Ife and Department of Agronomy, University of Ibadan for analysis. The two laboratories were employed to ascertain the validity

of the results. The soil samples of urban informal enterprises considered for analysis include soil with liquid waste from battery, hair dressing liquid waste, waste water from restaurant and food vendor, art work, cassava processing, engine oil, palm kernel and metal grinding waste, cambered from panel beating.

Figure1: Sampling Location for Urban and Informal Enterprises



SOURCE: AUTHOR'S FIELD WORK, 2012

The results of physiochemical characteristics of liquid waste from Urban Informal Enterprises are presented in Table 1

Result and Discussion

Alkalinity

Alkalinity is referred to the capability of water to neutralize acid. It is often related to hardness because its main source is usually from carbonate. The standard desirable unit of alkalinity is 200mg/l while the maximum permissible level is 600mg/l. Virtually all the urban informal enterprises sampled recorded different concentration in the level of alkalinity. This ranges from 60-6000mg/l. The highest (6000mg/l) concentration of alkalinity was recorded for battery charging, this is followed by palm kernel (5600mg/l). The least concentration was observed for cassava processing (IBSE, AKY 100 mg/l) food processing (IBSE 80mg/l) metal grinding (AKY 60mg/L). Comparison of these results with standard desirable limit (200mg/l) and maximum permissible level of 600mg/ in almost all the sampling locations showed it exceeded the desirable limit. The discharge of any of these parameters with high concentration either into water body will undoubtedly increase the alkalinity of the medium in which it is discharged and consequently pollutes the ecosystem.

Acidity

The result of concentration of acidity for all the sampled urban informal enterprises showed a high concentration in their level of acidity except engine oil that did not reflect any concentration of acidity. The highest concentration of acidity was recorded for battery effluent (450000mg/l). This is expected since the fluid contained in the battery is highly acidic. The unfortunate underlying issue is that when the liquid has been fully utilized the waste is usually discharged on bare land. These undoubtedly pollute the ecosystem. The least concentration was observed for food restaurant (2500mg/l) located at Ibadan North East.

Chloride

Chlorides are important in detecting the contamination of ground water by waste water. The permissible limit for chloride is between 250-600mg/l. The concentration of chloride observed for palm kernel at two sampling locations (17994.42mg/l, 872.07mg/l), art work (3099.92mg/l) food restaurant (399.88mg/l) cassava processing (449.86 mg/l) and hair dressing (299mg/l) were above the recommended permissible limit. However, chloride value observed for hair dressing at

AKY, IBN, and Palm kernel processing at IBN, cassava processing at AKY, IBSE, and food restaurant at AKY IBN recorded a lower concentration.

Result of Laboratory Analysis of Pollutants (Cadmium and Lead)

The result of laboratory analysis to examine concentration of lead and cadmium in soil sample and waste water from Urban Informal Enterprises from central laboratory Obafemi Awolowo University and Agronomy Department University of Ibadan is presented in Table 2. It reveals that the concentration of cadmium is not significant for liquid waste even though significant values of lead were observed for battery charging (0.34mg/l) and metal grinding (0.27mg/l). However, the concentration of lead is significant for soil sample from battery charging (0.633mg/l-0.779mg/l), painting (0.606mg/l-0.727mg/l) and metal grinding (0.264mg/l). The concentration lead for palm kernel is not significant (-0.138). The result of cadmium test is significant for palm kernel (0.040-0.481mg/l), cassava processing (0.063-1.055mg/l), and metal grinding (0.0481mg/l).

Table 1: Result of Physiochemical Properties of Waste from Selected urban Informal Enterprises

LOCATION	PARAMETER	Acidity (mg/L)	Alkalinity (mg/L)	Chloride (mg/L)
IBN	Battery Charging	450000	6000	N/A
AKY	Food Restaurant	5000	80	149.95
AKY	Palm Kernel	10000	380	872.07
IBN	Palm Kernel	10000	220	148.95
IBN	Palm Kernel	10000	100	17994.42
AKY	Cassava processing	12500	100	149.95
IBSE	Cassava processing	2500	260	199.94
IBSE	Food Restaurant	5000	1360	399.88
AKY	Food Restaurant	35000	1160	249.92
IBSE	Hair Dressing	67500	320	299.9
AKY	Hair Dressing	5000	340	149.95
AKY	Metal Grinding	32500	500	249.92
AKY	Art Work	35000	160	3099.04

IBN	Hair Dressing	7500	660	99.97
IBN	Hair Dressing	5000	1240	99.97
IBN	Food Restaurant	5000	5600	0.0
IBN	Food Restaurant	5000	80	149.95
IBN	Food Restaurant	10000	60	199.94
IBN	Cassava processing	N/A	1160	449.86
IBN	Engine Oil	N/A	N/A	N/A
IBN	Engine Oil	N/A	N/A	N/A

Source Author's Field Survey 2011)

Table 2: Result of Laboratory Analysis on Pollutants

S/N	Samples	Liquid		Soil	
		Lead $(mg/l)_1$	Cadmium $(mg/l)_1$	Lead $(mg/l)_1$	Cadmium $(mg/l)_2$
1	Food Restaurant (AKY)	0.00	0.00	0.00	0.00
2	Food Restaurant (IBSE)	0.00	0.00	0.00	0.00
3	Food Restaurant (AKY)	0.00	0.00	0.00	0.00
4	Food Restaurant (IBN)	0.00	0.00	0.00	0.00
5	Food Restaurant (IBN)	0.00	0.00	0.633	0.00
6	Battery Charging (IBN)	0.00	0.00	0.779	0.00
7	Battery Charging (IBN)	0.34	0.00	0.683	0.00
8	Battery Charging (IBN)	0.00	0.00	0.679	0.00
9	Art Work (Paint AKY)	0.00	0.00	0.606	0.00
10	Art Work (Paint AKY)	0.00	0.00	0.727	0.00
11	Art Work (Paint AKY)	0.00	0.00	0.264	0.00
12	Palm Kernel (AKY)	0.00	0.00	-0.138	0.040
13	Metal Grinding (AKY)	0.27	0.00	0.00	0.048
14	Cassava processing (1BSE)	0.00	0.00	0.00	1.055
15	Palm Kernel (IBN)	0.00	0.00	0.00	0.481
16	Cassava processing (IBN)	0.00	0.00	0.00	0.063
17	Engine oil (IBN)	0.00	0.00	0.00	0.00
18	Hair Dressing (IBSE)	0.00	0.00	0.00	0.00
19	Hair Dressing (AKY)	0.00	0.00	0.00	0.00
20	Hair Dressing (IBN)	0.00	0.00	0.00	0.00
21	Hair Dressing (IBN)	0.00	0.00	0.00	0.00

Source Author's Field Survey (2011)

[1] Central Laboratory, OAU

[2] Agronomy Department, UI

Conclusion and Recommendation

In the course of this paper, the environmental impact of urban informal enterprises has been critically examined. This is with a view that its associated negativities will contribute significantly to the deplorable state of the environment. The laboratory analysis of waste generated by this subject and indiscriminately disposed has been examined to establish its impact on environment.

The result of physiochemical properties (Alkalinity, Acidity and Chloride) of liquid waste from virtually all the categories of UIEs in almost all the four sampled Local Government Areas exceeded maximum permissible limit (600mg/l). The discharge of this liquid waste into any components of the environment will consequently increase the physiochemical characteristic of the medium in which it is discharge and this will consequently affects the environment.

The result of laboratory analysis to examine the concentration of cadmium and lead in soil sample and waste water reveals the concentration of cadmium is not significant for liquid waste except for battery charging (0.34mg/l) and metal grinding (0.27mg/l). On the other hand, the result of lead for selected soil sample like battery charging and art work at various locations was significant while the result of cadmium was also significant for palm kernel (0.040mg/l-0.481mg/l), metal grinding (1.055mg/l), and cassava processing (0.63mg/l-0.481mg/l). Conclusively, if any plant containing this metal is consumed, the effect on human health is inevitable.

The study recommends formulation and implementation of new policies and legislations that will accommodate the operational procedures of UIEs should be formulated with realistic plans this will accommodate and regulate the activities of informal enterprises. The legislation should incorporate policies on environmental ethics that will guide behavioural attitude of operators specifically on method of waste disposal including human waste, operational

procedures most especially the ones that have significant consequences on environment like environmental pollution. The locations of UIEs that use gasoline fuel should be controlled while their activities, particularly waste discharges should be monitored by relevant environmental agencies at all tiers of government. This will ensure proper control and use of harmful chemicals, emission of pollutants and indiscriminate dumping of wastes generated. The study also recommends the reinstatement and use of the services of sanitary officers to curb some of the behavioural attitudes of operators that pose threat to the environment. This will provide a sustainable and comprehensive approach that will guide against its haphazard development and negative impact on the environment. The attitude of building and location of business on road setbacks and open spaces should be discouraged through appropriate sanctions for any operators that violate the rules that guide land use e.g. zoning. Where applicable such illegal structures on road setbacks and those that are either in bad condition or contradicts the acceptable design should be demolished by town planning officer.

The concept of environmental planning and management should be employed in the management of a sustainable environment. It is the panacea to urban environmental problems. Its attribute as holistic, flexible and interactive approach to sustainable urban planning and management justify its capability for addressing all environmental problems in most urban centers. Effective environmental planning must involve both the operators and environmental managers. This will enhance proper management and alleviate the threat posed into the ambient environment. Proper management of waste emanating from these enterprises through environmental education and awareness particularly to the operators and patrons as well as appropriate management strategies will further enhance environmental sustainability.

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