2025; 1-2 | pp.39-47

Academians Journal of Natural and Biosciences Studies

Volume 1, Issue 2, October-December, 2025
(An Academians Publishers of Research & Academic Resources)

ISSN: 3121-6374

Original Research Article

Received: 25-09-2025 Accepted: 15-10-2025 Published: 03-12-2025

Assessment of Solid Waste Management Practices adopted by Zaria Industries Estates

Ogbole I. E.
Department of Geography and Environmental Management Faculty of Physical Science, Ahmadu Bello University,Zaria

Abstract: The key finding presented in this paper is that industrial waste management practices in Zaria Industries mainly involve hazardous by-products, posing significant environmental and health risks. This study targets two core objectives: first, it examines the types of waste produced and their specific properties; second, it evaluates the waste management practices employed and the reasoning behind their adoption. Data collection focused on Sunseed Nigeria Limited, Olam Nigeria Limited, Premier Seed Nigeria Limited, and Nelmaco Limited, providing comprehensive insight into waste generation and handling methods. Predominantly, hazardous wastes such as boiling ash, spent earth, organic waste, soap stock, and ETP sludge are produced. The industries manage their waste primarily through source reduction (44.0%) and recycling (30.8%). Furthermore, community sensitization (49.0%) plays a crucial role in communicating waste management impacts to the public. To address these findings, the recommendation is made for governmental intervention to establish waste management agencies to function as business corporations, thereby enforcing stricter regulations. Additionally, it is suggested that scientific techniques be advanced to promote industrial ecology, where waste from one activity is repurposed as raw material for another.

Keywords: *Solid Waste Management; Adopted by Industrial Estate in Zaria*

1. Introduction

Zaria faces a pressing environmental challenge with pollution levels reportedly exceeding safety thresholds by a significant margin. This dramatic level of environmental degradation has been brought into sharper focus due to the global increase in awareness of the environment's value as a resource. The consequences of mismanaging environmental assets through misuse pose significant threats to both nature and human health. Industries are notable contributors to this problem, generating hazardous wastes. When these hazardous wastes are improperly disposed of within the environment, they contribute to the growing issue of environmental pollution. This situation is exacerbated by inadequate monitoring and supervision from relevant authorities, as noted by Onibokun et al. (1998). In the past, before the implementation of state and federal waste regulations in the late 1970s, industrial waste was often improperly disposed of in landfills, stored in surface impoundments like lagoons or pits, discharged into surface waters without adequate treatment, or incinerated. Such waste management practices have led to the contamination of groundwater, streams, lakes, and rivers, as well as harm to wildlife and vegetation. Additionally, noise pollution presents another significant environmental concern in the study area. This intensity of environmental pollution caused by industrial wastes has captured the attention of authorities worldwide.

Corresponding Author: Ogbole I. E.

Although many studies in the past focused on the impact of industries on the environment, many of them looked at it from the resident‟s safety and health perspective (Olatunbosun 2009, Okoanegbete 2009 and Iriruaga 2012). Increase in amount of solid waste due to industrial development and rapid growth in population and consequently increase in amount consumed materials, has caused serious crisis in human societies. Improper Transfer and disposal of industrial waste that contain some hazardous materials, create serious problems for human and the safe environment. Therefore, this study evaluates solid industrial waste management option and the impact on the state of environment and human in two industry estate to select the best scenario in terms of technical and environmental waste management. The management option includes the combination of waste reduction, recycling, reuse, recovery of energy, reporting and various disposal options (Magrinho and Semiao, 2008). Waste recycling, energy generation and employment opportunities from waste management also have immense potential (Kassim and Ali, 2006).

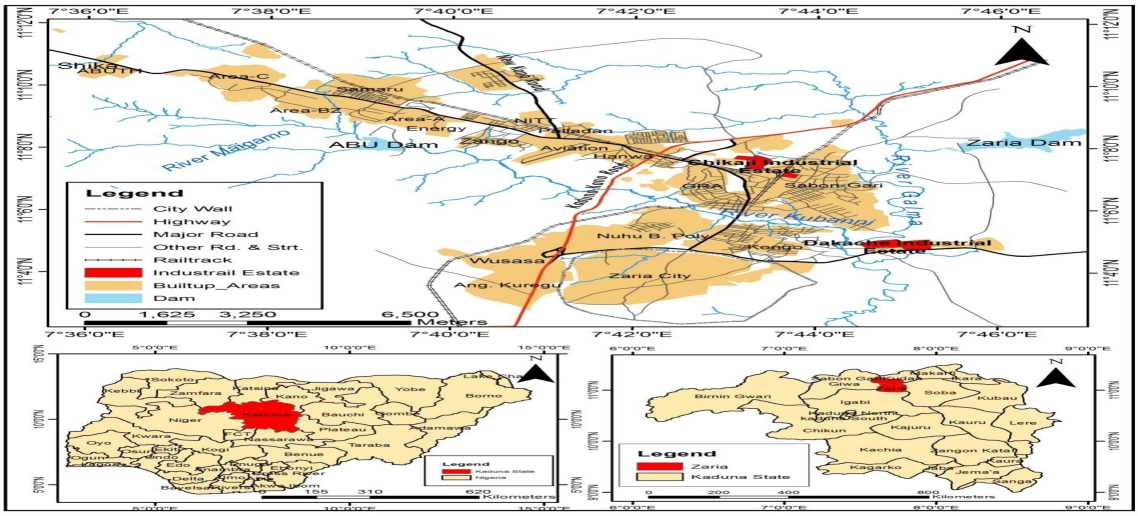
The application of recycling, reuse, composting, waste-to-energy or other processes in order to recover materials and energy provides a substantial alternative supply of raw materials and reduces the dependence on virgin feedstock. The recovered products must meet the fundamentals of market resource security, meaning they should meet the requirements of reliable quality, quantity and price (Cheremisinoff, 2003). Over the past few decades, particular attention has been paid to the reduction of solid waste generation via implementation of appropriate recycling programmes as a response to the increase in the cost of both waste collection and disposal (Alavi Moghadam et al., 2008; Damghani et al., 2007). Reporting waste effects on the environment and the health of the worker has a positive relationship with waste reduction (Ogbole, 2018). The industries in the industrial estate which produce significant amount of harzadous wastes in Zaria metropolis include the sunseed Nigeria limited, olam Nigeria limited, Nelmaco Company, premier seed and so on. These are industries which discharge their effluent into environment and some solid wastes together with air emissions of significant components.

2. Study Area

Zaria is located on a plateau at a height of about 670.6 meters above sea level in the center of Northern Nigeria and more than 643.7 km away from the sea. The city, lying on latitude 11° 3'N and longitude 7°42'E, experiences a tropical continental climate characterized by distinct wet and dry seasons. Zaria is a dissected segment of the Zaria-Kano plains, an extensive crystalline metamorphic rock formation that is part of the Nigerian basement complex. Its landscape is marked by the dramatic granite inselbergs, notably the majestic Kufena Hill, which punctuates the horizon. Low quartzite ridges stretch across the western parts of this region. Zaria is primarily drained by the River Galma, a major tributary of the Kaduna River, while the Kubanni River is the main tributary of Galma. The red-dust skyline often adds a picturesque backdrop to this culturally rich and historically significant area.

The population of the study area is 695,069. In the rural areas major ethnic group is the Hausa while the establishment of several educational institutions gives the cosmopolitan outlook. Moreover, Zaria is one of the foremost traditional settlements in Nigeria in which the increasing economic prosperity has diversified the socio-economic aspect and thus attracting large population. This, like any other primate city in Nigeria, has led to the increase in industrial waste generation, especially in the urban centres.

Figure 1.1: Zaria Showing the Industrial Estates



Source: Modified from the Administrative Map of Kaduna State, 2012

3. Materials and Methods

The research conducted covers two industrial estate. This comprises of Dakace and Chikaji industrial estate. The Dakace industrial estate has two industries which are Olam Nigeria limited and Sunseed limited. While Premier Seed Nigeria limited and Nelmaco Nigeria limited are the industries within the Chikaji industrial estate.

Data for the study were collected by pre-coded questionnaires, structured interview and direct observation. A total population of 335 industrial staff participated in this study. 65 copies of questionnaire were randomly distributed to worker in premier Seed Nigeria limited, while 35 workers participated in the study. In Sunseed Nigeria limited, 215 copies of questionnaire were distributed, while Olam had 20 workers who participated as shown in Table1. The structure questionnaire provided information of the solid waste types the industries generates and the management practices the industries adopted. The industrial respondents are required to outline the solid waste type the industries generated and also to provide detailed information on the waste management option the industries used. This management practice ranges from reuse, source reduction, recycling, energy recovery and reporting.

Table 1: Population Size of Industry

S/N	NAME OF INDUSTRY	INDUSTRIAL POPULATION IN 2016
1	PREMIER SEED NIG. LTD	65
2	NELMACO NIG. LTD.	35
3	SUNSEED NIG. LTD.	215
4	OLAM NIG. LTD	20
	TOTAL	335

Source: Field survey, 2016

Oral interview with heads of industrial waste management department of each industry was also conducted to supports the data gotten from the questionnaire. This enabled the researcher to obtain data on the industrial solid waste and its management practices. In order to determine the industrial waste management practice, the data were subjected to inferential analysis.

4. Results and Discussion

4.1 Type of Waste Generated by the Industries

However, it was noted that Premier Seed Nigeria Limited generates chemical waters which if not properly managed could make the water in the area unfit when discharged into water bodies. Olam Nigeria limited was observed to only produce plastics, woods, glass, metal, cotton wick and seeds which combine to the 300kg total wastes generated by the industry in the area. This is an indication that waste generation by industries is a function of materials produced and scale of production and bye product/waste involved at the different stages of production. In support interview with the Head of Waste Management Unit Sunseed Nigeria Ltd revealed that:

"during the production of vegetable oil and poultry feeds some hazardous wastes like sludge, spent earth, soap stock and carbon (II) Oxide are produced which contain harmful chemicals"

Table1.2: Type of wastes generated by the industries

Name of Industry	Type of Waste
Premier Seed Nig. Ltd	Impurities
	Chemical water
	Chemical containers, empty bags and dust
Olam Nig. Ltd	Trash
	Mote
Nalmaco Nig. Ltd	Chaff, and
	dust,
	stones,
	empty containers
	broken kennels
Sunseed Nig. Ltd	Boiling ash
	Refuse
	Spent earth
	Organic waste
	Soap stock
	ETP Sludge
	Gaseous emission
	Firewood scales

Source: Field survey, 2016

4.2 Properties of the Industries' Waste

Table1.3: Estimates of Hazardous and Non- hazardous Industrial waste generation

Category	Sunseed Nig Ltd	Olam Nig. Ltd.	Premier Seed Ltd.	Nelmaco Nig. Ltd	Total Quanty(ton)	%
Hazardous Waste	Boiling ash , Spent Earth, Soap Stock, ETP Sludge, Gaseous emission	Nil	Chemical water, Chemical dye Container	Nil	9837	78.15
Non Hazardous	Refuse, Organic waste, Firewood scale	Trash , Mote	Empty bags, dust, impurities	Chaff, Dust, Stone, Empty container, Broken kernels	2750	21.85
Total					**12587**	**100**

Source: Field survey, 2016

Result from Table 1.3 shows that most of the industries in Zaria produce hazardous waste (78.15%). This indicates a need for special treatment and disposal techniques. Sunseed Nigeria Limited generates more hazardous wastes such as boiling ash, ETP sludge, gaseous emissions, spent earth, and soap stock than any other industry, affecting both agricultural activities and the environment. To provide readers with a clearer understanding of the risks, it is estimated that Sunseed Nigeria's hazardous waste output consists of approximately 1,500 tonnes annually, contributing to the region's pollution levels significantly. In contrast, Olam Nig Ltd and Nelmaco, along with other industries, produce non-hazardous waste (21.85%), which is more manageable.

However, it was noted that Premier Seed Nigeria Limited generates chemical waters which if not properly managed could make the water in the area unfit for drinking and for other domestics' purposes. While the waste generated by Olam Nigeria limited and Nalmaco limited composed of less hazardous chemicals which are easily biodegradable and does not affect the environment. This is an indication that waste generation by industries is a function of materials produced and scale of production and bye product/waste involved at the different stages of production. This study is in line with Sharma (2010) who noted that depending on the type of materials used.

4.3 Solid Waste Management Practices of the Industries

Table 1.4 shows the management practices used by the industries in managing their waste.

Company name	Reduction Freq.	%	Reuse Freq.	%	Recycling Freq.	%	Recovery Freq.	%	Total Freq.	%
Premier Seed Nig. Ltd	30	9.0	10	3.0	20	6.0	5	1.5	65	19.2
Olam Nig. Ltd	4	1.2	10	3.0	4	1.2	2	1.0	20	6.5
Nelmaco Ltd	5	1.5	18	5.4	10	3.0	2	1.0	35	11.0
Sunseed Nig. Ltd	108	32.3	29	8.7	69	20.6	9	2.7	215	64.3
Total	**147**	**44.0**	**67**	**20.1**	**103**	**30.8**	**18**	**6.2**	**335**	**100**

Source: Field survey, 2016.

However, the data obtained shows that almost all the industries employed one form of waste management practice ranging from reduction, reuse and recycling, and they do mainly for economic purposes. As indicated in Table 1.4, Sunseed Nigeria Limited adopts waste reduction (32.3%) followed by recycling (20.6%), a strategy often carried out more frequently than reuse and recovery. They pointed out that reducing waste at the point of production is cost-effective and if that is not achieved, recycling the waste they produce becomes economical. For example, by implementing source reduction, Sunseed Nigeria Limited estimates an annual cost saving of approximately 10%, which is significant when considering their operational scale. In Olam Ginnery Limited, reuse (3.0%) of their waste is more prevalent because it is less tedious and can easily be carried out. They sometimes implement source reduction (1.2%) and recycling (1.2%) to complement their reuse strategy. Premier Seed Nigeria Limited adopts source reduction (9.0%) and recycling (6.0%) methods for their waste, while Nelmaco, on the other hand, also manages their waste through reuse (5.4%) methods and sometimes uses recycling (3.0%). From the above, we can see that most of the selected industries adopt waste management strategies such as source reduction (44.0%) and recycling (30.8%) to manage their

industrial solid waste. Linking these strategies to numeric benefits, industries highlight both environmental responsibility and substantial cost savings, making such practices appealing from both an ecological and financial standpoint.

To support these findings, interviews were conducted with the Head of Waste Management Department in the selected industries. Information obtained from the Head of Waste Management Department in Sunseed Nigeria limited, who stated that their major strategy in managing waste is source reduction and this is done in order to conserve environmental resources. According to him the company ensures full production process to minimize waste to the barest minimum and this is achieved through improvements in design, production, use, reuse, recycling, improvements in operations and maintenance. He pointed out that the waste generated by the industry is hazardous which affect both human and the environment; but nothing was done by the industry to reduce the effect of these waste.

Also as revealed from Olam Nigeria limited much of their wastes were reuse and recycle. They produce plastic, wood and cotton. These are sorted out into their category and for the plastics waste; they are use in the storage of seeds and chemicals. The mote is processed by

separating the cotton from its seed. The cotton is further processed into wool, while the seed is sold out to other industry.

In addition, the discussion with Premier Seed Nigeria Limited revealed that their main strategy in managing waste is use of source reduction. According to him, this method is aims at reducing the amount of waste produced and is more effective way to handle waste from its generating point. The industry is involved in the production of genetically improved seed and seed preservation.According to him, he said that chemical is used in an appropriate amount and we ensured that it did not leached out to pollute the soil and environment. They also revealed that the empty bags the industries produce is sorted out and clean by washing them. This is use to package broken kernels and chaff. This is the waste the industry carried recycling on.

In addition, Nelmaco Industries employed reuse and recycling strategies in managing its waste. The empty containers produced by the industries are used for the storage of other materials, and broken kernels are used as organic manure to increase soil fertility. Therefore, from the above discussion, we can understand that most of the industries employ reduction and recycling waste management strategies. However, it is essential to position these practices in relation to global standards. International benchmarks indicate that best-practice recycling rates can exceed 60% in many developed nations, highlighting a significant opportunity for industries in Zaria to enhance their waste management efforts further. By aligning more closely with these global figures, local industries could not only reduce their environmental impact but also gain economic benefits through more efficient resource use.

5. Discussion

Table 1.5 shows the medium the selected industries use in reporting the harmful effect of waste generated to the public. The result showed that from the total sampled Olam Nigeria Limited uses community sensitization 3.0%, techniques to report the effects of waste. They pointed out that these techniques are cost effective.

Table 1.5 Technique of Reporting Effects of Waste to the Public

	Premier Seed Nig. Ltd		Nelmaco Ltd		Sunseed Nig. Ltd		Olam Nig. Ltd		Total	
Items	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Leaflet/Handbills	10	3.0	5	1.5	20	6.0	3	1.0	38	11.

Internet	25	7.5	5	1.5	40	12.0	2	0.6	72	4 21. 5
Radiobroadcast	8	3.4	8	3.4	30	9.0	3	1.0	49	14. 7
TV announcement	0	0.0	5	1.5	5	1.5	2	0.6	12	3.6
Community sensitization	22	6.6	12	3.6	120	35.9	10	3.0	164	49. 0
Total	**65**	**20.5**	**35**	**11.5**	**215**	**64.4**	**20**	**7.0**	**335**	**100**

Source; Field survey, 2016

While Sunseed Nigeria limited (64.2%), Nelmaco(11.5%) and Premier seed Nigeria limited (20.5%) used community sensitization in reporting the harmful effects of their waste, the reason being that it has a wider coverage than any other techniques. The findings draw a conclusion on the procedures of environmental disclosure on waste management strategy by the industries giving more priority to community sensitization (49.0%). To illustrate the effectiveness of community engagement, Sunseed Nigeria Limited reported a 15% reduction in community complaints regarding waste management issues after implementing their sensitization programs. This result highlights the potential of community involvement to decrease environmental harm and alleviate public concerns.

5. Conclusion and Recommendations

To convey the significance of the findings, it is imperative to highlight that the bulk of waste generated by the industries in Zaria is hazardous, demanding immediate and effective management solutions. This paper examines the type of wastes generated by the industries and identifies those that are hazardous and those that are not. Based on the findings, Sunseed Nigeria Limited generates boiling ash, spent earth, organic waste, soap stock, and ETP sludge, resulting in waste production twice that of the other industries. Premier Seed generates chemical water and chemical containers. Olam Nigeria Limited and Nelmaco Limited both generate waste that is organic in nature and biodegradable. Overall, 78.15% of the waste generated is hazardous, predominantly from Sunseed Nigeria Limited and Premier Seed Limited, while 21.85% is non-hazardous. These findings underscore the dangerous nature of waste produced and the need for proper management. A tentative conclusion is that source reduction and recycling are the major waste management practices adopted by Zaria industries. Additionally, all industries use community sensitization to report the harmful effects of waste as a way of information disclosure.

Based on the findings of this research, some recommendations are proffered towards ensuring sustainable management of waste to promote human and environmental health. Firstly, it is advisable that the Government must provide congenial enabling legislations and edicts that will establish waste management agencies as Independent Waste Management Authorities which will function like private business corporations to checkmate the industrial waste department. This will enhance its transparency and efficiency because it will aspire to break even and at the same time try to live up to expectations. In addition, it will help to sustain a cardinal point in Vision 2020 of the government, which is maintaining the health of Nigerians and the Nigerian environment.

To translate these recommendations into actionable steps, a phased roadmap is essential:

Short-term actions (1-2 years):

- Establish a task force to draft the enabling legislations and edicts required to create Independent Waste Management Authorities.

- Initiate pilot programs in select industrial areas to test and refine waste management strategies, focusing on source reduction and recycling.

- Conduct awareness campaigns to educate industry stakeholders and the community about new waste management practices and their benefits.

Medium-term actions (3-5 years):

- Implement the drafted legislations and fully operationalize Independent Waste Management Authorities across all industrial areas.

- Expand waste management pilot programs based on initial successes and integrate them into broader government policies.

- Develop partnerships with local research institutions to foster innovation in industrial ecology practices and technology development.

Long-term actions (6-10 years):

- Achieve full compliance with WHO standards for landfill design and operations nationwide.

- Ensure continuous improvement of waste management technologies and practices, driven by ongoing research and international collaboration.

- Monitor and evaluate the impact of waste management strategies on human and environmental health, adjusting policies as needed.

Secondly, efforts should be geared towards the use of scientific techniques to develop appropriate technologies for dealing with solid waste management, such as encouraging the emergence and development of industrial ecology where wastes from one activity are input as raw materials for another activity. Landfill sites should be designed and operated in accordance with W.H.O standards. Thirdly, there should be sufficient health and safety provisions for workers at all stages of waste handling.

Reference

Ogbole, I. E. (2018). *Assessment of industrial solid waste management in Zaria Industrial Estate, Nigeria* [Master's thesis, Ahmadu Bello University]. ARIADNE. http://hdl.handle.net/123456789/4376

Okoanegbete, J. F. (2009). *Appraisal of effect of land acquisition, oil exploration and housing development on escavours region of delta state* [Unpublished master's dissertation]. University of Ibadan.

Olatunbosun, G. B. (2009). *Impacts of West African Portland Cement on the housing environment of Ewekoro*. University of Ibadan.

Iriruaga, E. T. (2012). *Solid waste management in Nigeria*. D-Waste Management for Everyone. http://www.d-waste.com

Kassim, S. M., & Ali, M. (2006). Solid waste collection by the private sector: Households' perspective—Findings from a study in Dar es Salaam, Tanzania. *Habitat International*, 30(4), 769–780. https://doi.org/10.1016/j.habitatint.2005.05.002

Sharma, B. K. (2005). *Solid, toxic and hazardous waste*. In *Environmental chemistry*. Goel Publishing House.

Alavi Moghadam, M. R., Mokhtarani, N., & Mokhtarani, B. (2008). Municipal solid waste management in Rasht City, Iran. *Waste Management*, 28(5), 885–889. https://doi.org/10.1016/j.wasman.2007.05.010

Cheremisinoff, N. P. (2003). *Handbook of solid waste management and waste minimization technologies*. Butterworth-Heinemann.

Abdoli, M. A., Falahnezhad, M., & Behboudian, S. (2007). Multivariate analysis of Tehran's municipal solid waste. *Journal of Environmental Health Science & Engineering*,

4(4), 265–271. https://journals.tums.ac.ir/article/28300.html

Kassim, S. M., & Ali, M. (2006). Solid waste collection by the private sector: Households' perspective—Findings from a study in Dar es Salaam, Tanzania. *Habitat International*, 30(4), 769–780. https://doi.org/10.1016/j.habitatint.2005.05.002

Magrinho, A., & Semião, V. (2008). Estimation of residual MSW heating value as a function of waste component recycling. *Waste Management*, 28(12), 2675–2683.