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PLASTIC SOLID WASTE MANAGEMENT ASSESSMENT AMONG SELECTED SCHOOLS IN GWADABAWA LOCAL GOVERNMENT, SOKOTO, NIGERIA

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Abstract

The objective of this work was to assess the plastic solid waste management among selected schools in Gwadabawa Local Government, Sokoto, Nigeria. A descriptive survey (cross-sectional) study was employed and collected data from portions of schools and respondents. The findings indicate that, demographic characteristics of teacher respondents involved in this study are: Males are 66.7%, females are 33.3%; and the levels of education include, NCE/diploma (58.0%), BSc (26.7%), MSc (13.3%), and PhD (2.0%). Regards to students involved, 48.0% are males, 60.0% are females; 36.0% are 18-20 years old, and 64.0% are above 20 years old. The level of education of students include, 60.0% diploma students, and 40.0% certificates students. The effects are listed in the order of frequency as submitted by participants: Release of gases (20.5%), land pollution (17.0%), water pollution (15.0%), attraction of vermin (11.0%), breeding of diseases (10.5%), loss of biodiversity (7.5%), reduction of beauty of environment (7.5%), offensive odour (5.0%), flooding (5.0%), and particulates release (1.0%). Methods of waste elimination are: open disposal occurs among 37.5% schools; likewise, open disposal and burning, occur in 37.5%; while, use as fertilizer was recorded in 12.5% schools. Waste

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collection methods are either open dumping (80.0%), or use of containers (20.0%). The use of segregation of waste; therewith, only 20.0% practice segregation, the remaining 80.0% do not practice segregation, rather openly display mixtures of waste materials. The possible remedies to mitigate plastic solid waste mismanagement and effects include, education (awareness) and behavior change (53.3%) was mostly stated, funding (26.7%), improvisation (15.3%), scavenging (3.3%), and innovations (1.3%). Policy makers need to act urgently in diverse ways, and the people are supposed to be educated on ways of remediating plastic waste pollution.

Keywords: Awareness, Plastic, Solid Waste, Schools, Scavenging, Particulate, Climate Change, Respiratory Illnesses

INTRODUCTION

Plastics are synthetic or man-made materials of large molecular weight prepared through polymerization of monomers, with particular properties of being relatively inert, moldable, cheap, light weight, and providing several choices. Plastics are converted into containers, caps, tubs, trays, electrical materials, furniture, cars, writing materials, lids, packs, films, coatings, etc (Alabi et al., 2019; Gazal & Gheewala, 2020). Some of the major examples of plastics could be polyethylene, polystyrene, polyvinyl chloride, polyamides, ionomers, etc (Koushal et al., 2014; Sarkingobir etal., 2020; Sarkingobir etal., 2021; Sidi & Yahaya, 2022). Almost all walks of life are related with plastics, that is why, plastics are conspicuous in the entire human life nowadays. Therefore, after usage, the plastics definitely become a solid waste that is discarded and supposed to be handled and managed properly to avoid public or environmental health tragedy (Verma et al., 2016; Avio et al., 2020; Gazal & Gheewala, 2020).

Solid waste is useless or unwanted discarded thing that is semi-solid or solid in nature. Waste is any material or bunch of solid (alternatively semi-solid) material that exhausted it value or usage by the user. Solid waste is an abandoned, discarded material (Iwuoha et al., 2013; Hamid & Aghar, 2017; Sarkar & Bhuyan, 2018). When the source of waste is considered, institutions such as schools are major players consisting of gatherings that make waste. This waste when mishandled or mismanaged could consequently affect school actors, learning, environment, and entire society at large (ecosystem) (Ibrahim et al., 2019; Ibrahim et al., 2021; Sidi & Yahaya, 2022). The school actors especially the children or

young people may not have sufficient awareness and ability to manage school waste properly and this is a great concern to the public, as well as the environment. Issues of waste management are presently aggravated due to urbanization, increased growth rate, economic pattern, legislation, policies and funding among other things (Kaoje et al., 2017; Kaoje et al., 2018; Umar et al., 2022).

Despite the dangers of waste mismanagement there is still much to be done in terms of according appropriate treatment to waste generated in our society (Karhsima, 2016; Lovo & Rawlings, 2021). Jallo et al., (2021) in a waste assessment study in Hadejia, Jigawa, shows indiscriminate open mismanagement of waste been perpetrated by households, and resultant potential of pollution in land, water, and air; suggesting the need for awareness, safe grounds for disposal, and law enforcement. Shehu et al., (2020) in a study of views to reduce plastic bags and environmental menace in Sokoto city, Nigeria, committed that, improper plastic waste disposal in Sokoto occur in certain areas of Sokoto, due to deficient waste management system. Ibrahim et al., (2019) while assessing environmental impact of solid waste in Sokoto town, some of the areas resort to improper disposal and consequently environmental issues such as drainage impediment, creating harbor for diseases such as malaria, respiratory problems, cholera, typhoid, etc. Elsewhere, mismanagement of solid waste and its effects were reported in (Manisalidis et al., 2020).

However, plastics waste is more dangerous in the array of solid waste generated, because it is non-biodegradable, persistent, bioaccumulative, additives-laden, cheap, ubiquitous, and dissipate harmful chemicals (Magami et al., 2017; Irianti & Prasetyoputra, 2019; Malami et al., 2022; Sabo et al., 2022). Plastics are made synthetically in a polymerization process. They are many, diverse, widely utilized, and very difficult to manage comparatively (Sarkingobir et al., 2023). Sarkingobir et al., (2023) in an assessment of plastics management at nursery schools in Sokoto, decried the possible harm of plastics on children; because plastic contains additives that are harmful to health. It also poses risk to the environment by causing an ugly scene, particulates, and air pollutants. Plastic Waste create a breeding ground for diseases, and rodents; and leach chemicals to land, and water, thereby creating a polluted environment (Mbue et al., 2015; Nasir & Ibrahim, 2022; Ngeno et al., 2022). The objective of this work was to assess the plastic solid waste management among selected schools in Gwadabawa Local Government, Sokoto, Nigeria.

METHODS

Study area

The study assessing plastic solid waste management at schools in Gwadabawa was done in Gwadabawa Local Government Area, Sokoto State, Nigeria. Gwadabawa is located in-between Ilella, Gada, Kware, Tangaza, and Wurno Local Government Areas in Sokoto State. It is a semi-arid area that is northeastern Sokoto, and is about to reach Konni (the Niger Republic border).

Method of Data Collection

A descriptive survey (cross-sectional) study was used and collected data from portions of schools and respondents. A mixture of semi-structured questionnaire that was in-line with the objective of the study "assessing solid plastic waste in Gwadabawa Local Government Area schools" was utilized. Likewise, a checklist was used in collecting informations that are related to visual inspection (that is surveying the nature of waste management tips such as scenes, collection, storage, and elimination).

Sample Size and Sampling

Sample represents the whole. In this work, the samples of schools involved selected learning institutions consisting of primary, secondary, and higher tiers chosen through convenience sampling. Therewith, 40 schools were selected. In terms of respondents, 150 teachers, and 50 students were interviewed using questionnaires (self-administered, and interviewer-administered), and responses were recorded.

Data Management and Presentation

The data collected was managed using descriptive statistical implements such as frequency, percentage and Chi-square test. Thus, the results were presented in tables and relations.

RESULTS

The results for this study were revealed in Tables 1-8.

Table 1. Demographic Characteristics of Teachers

Parameter	Frequency	Percentage
Sex		
Male	100	66.7
Female	50	33.3
Level of Education		
NCE/Diploma	87	58.0
BSc	40	26.7
MSc	20	13.3
Phd	3	2.0

Table 2. Demographic Characteristics of Students

Parameter	Frequency	Percentage
Sex		
Male	20	40.0
Female	30	60.0
Level of Education		
Diploma	30	60.0
Certificate	20	40.0
Age		
18-20	18	36.0
Above 20	32	40.0

Table 3. Perceived Effects of Plastic Waste Mismanagement

Effect	Frequency	Percentage
Offensive dour	10	5.0
Breed microbes such as mosquitoes	21	10.5
Flooding	10	5.0
Loss of biodiversity	15	7.5
Water pollution	30	15.0
Land pollution	34	17.0
Release of gases (such as methane)	41	20.5
Attract vermin eg scorpion, rat, snake, scorpion	22	11.0
Reduce beautiful nature of environment	15	7.5
Particulates release	2	1.0

X^2=65.00, Df=9, Remark= Significant

Table 4. Practices of Plastic Waste Management at Schools

Method of waste disposal	Frequency	Percentage
Open disposal	15	37.5
Open disposal and burning	15	37.5
Open disposal and burying or landfilling	5	12.5
Manuring	5	12.5

X^2=10.000, Df=4, Remark= Significant

Table 5. Major Waste Collection Methods at Schools

Type of waste	Frequency	Percentage
Open dumping	32	80.0
Use of containers	8	20.0

X^2=14.400, Df=1, Remark= Significant

Table 6. Major Components of Waste at Schools

Type of waste	Frequency	Percentage
Single-use plastics (bags, bottles)	32	80.0
Others	8	20.0

X^2=14.400, Df=1, Remark= Significant

Table 7. Use of Containers and Segregation Methods of Waste Management at Schools

Use of segregation	Frequency	Percentage
Yes	8	20.0
No	32	80.0

X^2=14.400, Df=1, Remark= Significant

Table 8. Possible Solutions for Reduction of Plastic Waste at Schools

Effect	Frequency	Percentage
Awareness and behavior change	80	53.3
Proper funding	21	10.5
Improvisation	10	5.0
Scavenging	15	7.5
Innovations	30	15.0

X^2=135.267, Df=4, Remark= Significant

Figure 1: Plastic solid waste remnants from a burning side in front of Sultan Abdurrahman College of Health Technology Gwadabawa, Source: Field work, 2023

Figure 2: Plastic solid waste remnants from a burning site at a hostel of Sultan Abdurrahman College of Health Technology Gwadabawa, Source: Field work, 2023

Figure 3: Littered plastic waste at a school in Gwadabawa; Source: Field Work, 2023

Figure 4: Refuse dump at a school premises in Gwadabawa, Source: Field Work, 2023

DISCUSSION

Table 1a reveals the result of demographic characteristics of teacher respondents involved in this study. Males are 66.7%, females are 33.3%; and the levels of education are: NCE/diploma (58.0%), BSc (26.7%), MSc (13.3%), and PhD (2.0%). Regards to students characteristics involved in the study, 48.0% are males, 60.0% are females; 36.0% are 18-20% years old, and 64.0% are above 20 years old. The level of education of students include, 60.0% diploma students, and 40.0% certificates students (Table 1b).

Table 2 shows the responses on how the participants view effects of solid plastic waste mismanagement. The effects are listed in the order of frequency follows as submitted by participants: Release of gases (20.5%), land pollution (17.0%), water pollution (15.0%), attraction of vermin (11.0%), breeding of diseases (10.5%), loss of biodiversity (7.5%), reduction of beauty of environment (7.5%), offensive odour (5.0%), flooding (5.0%), and particulates release (1.0%). These effects revealed in this work are corroborated severally elsewhere. Parable, Jibatswan et al., (2022) in Borno state, Biu in particular, revealed, "spread of diseases," breeding of rodents, mosquitoes, pests, as effects of mismanaged waste. Other effects are unpleasant environment, generation of air pollution, and climate effects (Jibatswan et al., 2022).

Table 3 shows the findings indicating methods of waste elimination. The results convey that, open disposal occur among 37.5% schools, likewise, open disposal and burning, occur in 37.5%; while, use as fertilizer was recorded in 12.5% schools. These methods of waste disposal are similarly found in a Sokoto city study by Ibrahim et al., (2019); where, "dig and bury" "land filling," "burning," and "direct dumping" were reiterated. In Hadejia, Jigawa state, Nigera, Jallo et al., (2021) revealed, open dumping, burning, composting, others, as methods of waste elimination which are similar to this work's finding. Moreover, the methods of waste management revealed in this work are in tandem with the work of Raj (2017) from India, that reiterated numerous methods of waste handling.

Table 4 shows that waste collection methods are either open dumping (80.0%), or use of containers (20.0%). In Table 5, the main components of the wastes are the single-use plastics (such as bags and bottles) (80.0%), followed by "others" 10.0%. The findings of Ibrahim etal., (2019) in Sokoto city revealed similar reports to this work; therein, the plastics were conspicuously found. Jallo et al., (2011) in a northern Nigeria state, in Hadejia

of Jigawa revealed plastic waste as a major component of waste examined. Likewise, the collection methods include dumping, and use of container.

Table 6 shows the result of use of segregation of waste; therewith, only 20.0% practice segregation, the remaining 80.0% do not practice segregation, rather openly display mixtures of dump waste materials. The findings here are in consonant with what was divulged in another study in Sokoto by Ibrahim etal., (2019), that reiterated "use of direct dumping" and "use of waste bin" for waste disposal in Sokoto city. Jallo et al., (2021) shows that in Jigawa, wastes are dump in spaces, and containers. A Borno study by Jibatswan et al., (2022) shows that, segregation of water was minor among households in Biu, Borno state, Nigeria. This was also similarly corroborated by Mohammed & Elias (2017) in an Addis Ababa, Ethiopia study.

Table 7 illustrated possible remedies to mitigate plastic solid waste mismanagement and effects. Education (awareness) and behavior change (53.3%) was mostly stated, then funding (26.7%), improvisation (15.3%), scavenging (3.3%), and innovations (1.3%). In a similar vein as reported in Mohammed & Elias (2017), waste avoidance and minimization, institutional policies, and research works, are suggested to deal with the trend. Likewise, Kingsley et al., (2016) suggested provision of policies, infrastructures, integrated management, and controlled dumping as ways to prevent water mismanagement in Delta, Nigeria. In this vein, a related work from Kano, Nigeria, alluded the need for health or environmental education, more funds, etc to reverse waste mismanagement (Gujiba & Ali, 2020). Moreover, Gokaru (2020) in Bauchi, Nigeria, advocates the needs for more awareness, more positive behaviors, among other tips to address solid waste issues.

Plastic solid waste is persistent (can stay from twenty-five years to hundreds), release chemicals to the environment or organisms, and elicit concerns, especially at schools because students at primary and secondary schools can be negatively affected, teachers (adults) can also have adverse health because of intake of chemicals from burning or contacting plastic waste. People who are sick cannot learn properly (Sarkingobir et al., 2023). Certainly, due to low cost, availability, several uses plastic waste proliferates (Washam, 2010). And consequently, is likely overwhelmed the waste generated, and arousing mismanagement at places, let alone schools. Many people or policy makers treat plastic issues with disdain because of poor knowledge or awareness (Bas & Nzewi, 2018; Center for International Environmental Law, 2019). As submitted in this work, plastic

water in soils affect environment through diverse ways such as giving a fertile ground for animals such as rodents, infectious diseases such as malaria. The beauty of places is being eroded due to plastic waste pollution, releasing particulates, and gases, that cause respiratory problems, visibility problems, reduces beauty of buildings and feed plants with gaseous pollutants. Land plastic waste serve as the major source of pollution to air, and water. They are transported to water to be ingested by animals or plants in water thereby affecting food chain and biodiversity (Pavani & Rajeswari, 2013; GESAMP, 2015; Reza & Yousuf, 2016; Olugbemiga et al., 2017). Many soil properties are affected by land waste, many plants take in waste chemicals, many animals in soils are killed by waste materials; therefore, food and biodiversity are similarly affected on land by plastic waste pollution (Malami et al., 2022; Sabo et al., 2022; Alabi et al., 2019).

Solid waste management involves processes of steps that followed before ensuring successes or otherwise; and during the trend many people (actors) are involved (Jambeck et al., 2015; Hayes, 2019). The people who make, collect, gather, store, and manage waste are involved and make appreciable contribution of making or destroying the processes of waste management. However, the people are influenced by factors or determinants to actions (GSEAMP, 2015; Singh et al., 2018; Soumiya et al., 2018; Adekomaya, 2020; Shehu et al., 2020; Rasaul et al., 2021). If we consider “socioecological model" it can be seen that the intrapersonal factors such as knowledge, belief, affect the way a person handle waste. Since the respondents here are either students, teachers or relations, they are expected to have appreciable knowledge, and this study results demonstrated that, the respondents have an appreciable awareness about plastic solid waste mismanagement consequences. Therefore, this should be a recipe for rationale acts that ensure proper handling of water materials at schools or homes, if other factors or determinants are positive (Libroin, 2015; Prakash, 2017; National Institute of Environmental Sciences, 2019; Obebe & Adamu, 2020; Sripada et al., 2022; Musa et al., 2023). Then, the institutional factors, that is the school, and public (government factors) should provide a fertile ground for proper plastic solid waste management in-line with the sociological model of sociology or environmental promotion (Park et al., 2013; Simpson, 2015; UNEP, 2018; Tait et al., 2020); that is why the suggested solutions involved "more funding" and "behavior change" as well as awareness creation (Sarkingobir et al., 2023).

Therefore, if frantic efforts or results shall be seen people (school actors) should be aroused through awareness creation using teaching environmental education to students

(via curriculum), and the public (via media or social marketing and the likes) supposed to be gingered to feel that they are susceptible to plastic waste harms (such as diseases, consumption of poisoned foods through food chain, plasticized food ingestion, etc) at severe level. And they should be gingered to feel waste management is beneficial, and they can overcome the barriers to actions (Rasul et al., 2021; Sarkingobir et al., 2023). Parable, school actors easily break barriers to plastic waste management, by participation in waste management, participation in waste cleaning, participate in improvisation (using plastic waste things as teaching/learning aids), and engaging in 5Rs (reducing use of plastics; refusing plastics as ably as possible; recycling plastics as ably as possible; re-using plastics such as in the case of bottles, bags, food containers; restricting using plastics when becoming policy makers and at personal liberty (Wagner et al., 2014; Ryan, 2015; Avio et al., 2016; Simpson, 2016; Salau et al., 2022; Waheed et al., 2022).

CONCLUSION

This work was done to assess plastic solid waste in Gwadabawa Local Government Area, schools. The outcome of this work identified that, there is appreciable awareness among respondents, but there is also conspicuous mismanagement of solid waste in most of the areas. This could be re-addressed by making people aware, providing funds, and related policies; in order to prevent environment and health effects.

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