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ASSESSMENT OF THE EFFECT OF SACHET WATER WASTE ON THE ENVIRONMENT IN WUSHISHI, NIGER STATE

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Abstract

This study aimed to assess the environmental effects of sachet water waste on the environment and to isolate and possibly identify bacteria that are likely connected to the sachet's biodegradation from degraded soil. Sachet water is packaged in polyethylene bags that are not biodegradable or decay, and when burned, produces oxides of carbon, nitrogen, and sulphur. It can also be found on streets, in drainage systems, and even in our water bodies, leading to pollution and ecological damage. The accumulation of sachet water waste blocks drainage system, increasing the risk of flooding during the rainy season. Questionnaire was used for data collection. This study have been able to establish that sachet water wastes have consumed 70% of the land in the study area, hinting at the possibility of the sachet water wastes in the study area affecting the ecological footprint of the town on one hand and causing health and safety challenges on the other; although safety was found 5th in ranking to be the least consideration by the residents of Wushishi in the choice of sachet water that they consume. Similarly, the sachet water waste disposal methods in the study area were largely environmentally unfriendly and unsustainable. The study therefore recommends serious enlightenment on the need for adequate water consumption in line with established global standards; and a public-private partnership network aimed at creating sustainable waste disposal and management system for the town; creating designated waste collection/disposal and management spot which should be subjected to periodic fumigation to curb the development and spread of disease pathogens.

Keywords: Environment, Effect, Sachet water waste

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1.0 INTRODUCTION

Solid Waste disposal is a major issue not just for less developed countries but also for the developed countries. The most pressing issue is how to manage the enormous amount of waste that is produced all over the world in order to preserve the environment and ensure humanity's continued existence. The issues confronting less developed countries in the treatment of Metropolitan Solid waste are not difficult to solve however they need deliberate exertion from all parts of society. Any meaningful and long-lasting solution requires an all-encompassing approach (Orji, 2006). According to Akunyili (2003), the proliferation of so-called "pure water" producers in Nigeria is largely attributable to the government's inability to consistently provide sufficient potable water to the increasing population. Therefore, the solution for the shortage of potable water prompted the development of sachet.

Sachet water entails the packaging of drinking water in a non-biodegradable synthetic polyethylene (polythene). Sachet water, popularly called pure water in Nigeria has become an everyday intake for an average Nigerian. The evidence of this is seen in the amount of disposed sachets littering the streets and also the increased number of drainages blocked by ‘blocks’ of sachet water waste. Sachet water was introduced to the Nigerian markets around 1990 but its regulation by the National Agency for Food and Drug Administration and Control (NAFDAC). Sachet water gained much popularity in Nigeria because the product is convenient for use, affordable and economically viable. It brought ‘potable’ water to the doorsteps of many Nigerians (Akunyili, 2003).

The venture has also given employment to Nigerians which enables them to put food on their table. Notwithstanding the benefits accruing from sachet water production and consumption, the indiscriminate disposal of the waste in various undesired sites such as along the streets, gutters, motor parks, schools, markets, homes, and venues of social functions etc. poses a lot of threat on the environment. The sachets are made of non-biodegradable synthetic polyethylene (polythene) which does not decompose in the soil even after many years. The polythene even when subjected to burning produces carbon monoxide, nitrogen oxide, methane and sulphur. Sachet water waste disposal is a vast problem that needs to be tackled because of the implications it has on environment such as soil, vegetation air and water (Adenuga, 2006). According to Idiata and Iyasele (2014), several environmental impacts from sachet water waste includes obstruction of waterways, animals choking and soils and litters of pure water sachet on the landscape requires immediate attention. The effects include, Increase disease transmission, contamination of ground and surface water, generation of Greenhouse gas emissions and other air pollutants, damage to ecosystems, injury to people and properties.

Therefore no detailed study on the environmental problems of sachet water waste disposal on the environment in the study area; this is a research gap this study sets to fill.

Specifically, the study aims to assess the environmental problems associated with sachet water wastes disposal in the study areawith a view to finding solutions to improve on the environmental quality.

1.1 Study Area

Wushishi local government area is domiciled in Niger state, North-central geopolitical zone of Nigeria. The headquarters of the LGA are in the town of Wushishi.

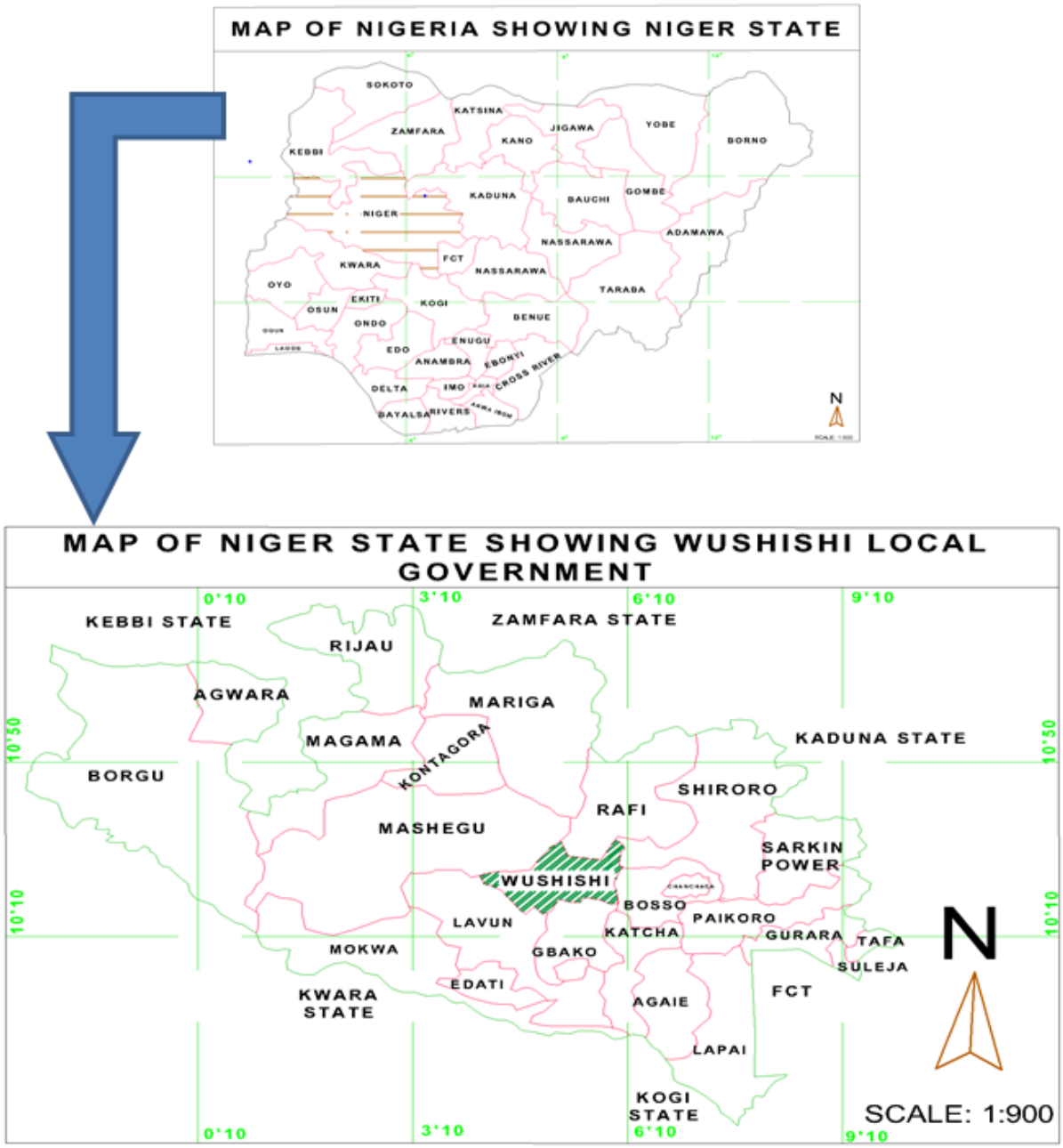

Figure 1: Location of Wushishi in Nigeria

Source: Nigeria Galleria (2023)

2.0 LITERATURE REVIEW

Sustainability of the environment is an important factor influencing sustainable socioeconomic development of any community. However, anthropogenic practices have contaminated the environment to such an extent that managing and maintaining healthy environmental conditions has become a worldwide problem. Rapid urbanization and population growth in the last half century have outpaced government efforts to maintain and expand potable water infrastructure in Nigeria, and the private sector has responded with an easy but environmentally threatening solution. Stoler, *et al.* (2015) in their study asserted that, Sachet water, known colloquially as *"pure water"* has out-competed nearly all alternatives to the unreliable government water infrastructure to become the country's cheap, mobile, and omnipresent answer to the country's urban water crisis.

Sachet bag is made from polyethene Sachet material which is non-biodegradable; it belongs to single-use Sachet (Temitope, *et al.,* 2015). Sachet bags can be recycled by crafting it to another thing, but unfortunately it mostly ends up on landfills or littering the ground after use. In Nigeria, the name of the producing company and the NAFDAC registration number will be printed on the bag. This number is what people (consumers) always look out for before buying the water as they have strong belief that sucha company has passed all the NAFDAC specification. Any company with sachet bag that has no NAFDAC number can be reported and get charged to court. However, the creation and commercialization of sachet bags which are lesscontrolled resulting into so many unregistered factory in the businesses. Some are filled up with tap water, untreated or from illicit drilling. In addition, serious hygiene issues occur because of the storage of the bag (unsanitary premises). Other noticeable problem is that, they are often left littering the ground and blocking the waterways which can lead to flooding (Akunyili, 2003).

The packaging of this sachet water is made of non-biodegradable synthetic polyethylene (polythene), which does not decay, decompose or corrode, and which when burnt, produces oxides of carbon, nitrogen and sulphur. However, the use of sachet water has become a menace, due to its negative long-term environmental consequences, namely the vast increase in polythene waste that needs to be degraded. When one walks around large metropolitan areas in Nigeria, the polythene wastes that constitute the majority of litter is unavoidable and also the used sachet water bags constitute an alarming portion (Tiwary, 2015).

Sachet water packaging, typically made of low-grade plastics, poses a severe threat to our environment. The lightweight nature of these sachets makes them prone to being carried by wind and water, resulting in widespread littering. Sachet water waste can be found on streets, in drainage systems, and even in our water bodies, leading to pollution and ecological damage. The accumulation of sachet water waste blocks drainage systems, increasing the risk of flooding during the rainy season. Moreover, the Sachet materials used in sachet water packaging take years to decompose, exacerbating the environmental impact (Orji, 2006).

The problem of solid waste disposal is alarming in urban centres of the country and is a major concern to the government. This problem of waste generation and disposal is worrisome in Borno state, where it is always on the increase because of increasing population pressure and socioeconomic factors. Several environmental impacts including blockage of waterways and choking of animals, soils and mosaic litters of pure water sachet in the landscape requires urgent attention. The effects include increase disease transmission, contamination of ground and surface water, generation of Greenhouse gas emissions and other air pollutants, damage to ecosystems, injury to people and properties (Idiata and Iyasele, 2014)**.** Rapid urbanization, rural-urban migration, little or no town planning efforts coupled with attitudinal irresponsibility, lack of political will, ineptitude and graft have independently and collectively created environmental challenges in Nigeria resulting to human or solid waste decorating streets and public spaces everywhere in the country (Oyeniyi, 2011).

3.0 METHODOLOGY

This study used both primary and secondary data. The primary data were used to estimate the rate of sachet water consumption in the study area, the perception of the residents on the effects of sachet water wastes, the reasons for sachet water consumption and the methods of sachet water waste disposal in Wushishi. The primary data were collected with the aid of a structured questionnaire. Wushishi has a population of 140,200. Systematic random sampling technique was used to administer questionnaire to 280 residents of the study area after

calculating the representative sample of the population using the Krejcie and Morgan's (1970) sampling size determination table.

The secondary data used for this study were obtained from published sources (journal articles, reports and online sources). Studies suggest that man requires between 1.89litres to 3.0litres of water for drinking daily (WHO, 2004; Tiwary, 2015; USEPA, 2016; Apeh, 2018). However, this figure is a little bit lesser in Wushishi where the average daily sachet water consumption stood at five sachets per capita as presented in Table 1. Thus, daily average of five sachet water per capita will be adopted for this study to capture this peculiarity. In addition, it has been discovered that at least 70% of Nigerians depend on sachet water for their daily drinking water need (Edoga *et al.*, 2008). So, in conformity with established threshold, 70% sachet water dependency rate will be maintained. With regard to the average area covered by sachet water packs, Ibrahim *et al.* (2015) reported that each pack covers approximately 0.0211m^2, which is adopted for this study.

Descriptive statistics was used for the analysis of data collected and the data are presented in frequency tables. Microsoft Excel was used for the analysis of the data.

4.0 RESULTS AND DISCUSSION

4.1 Sachet Water Use

Sachet water usage in the study area is presented in Table 1. The result shows that all the respondents consume sachet water, thus qualifying them for inclusion in this study. Regarding the number of sachet water consumed daily, more than 7% and 19% reportedly consumed 1-2 and 3-4 sachets respectively. However, about 62% reportedly consumed 5-6 sachets daily; while more than 5% and 6% consumed 7-8 and more than 8 sachets of water respectively per day. Importantly, the mean daily water consumption in Wushishi is 5 sachets (or 2500ml) daily. This is a little below the 6 sachets or 3000ml reported for Liberia by Apeh (2018). This means that the daily drinking water requirement pegged at between 2.7litres and 3.7litres for adult men and women respectively by Sawka (2005) is not met in the study area, although it meets the WHO requirement of 1.89litres to 3.0litres (WHO, 2004). In addition, the residents reported seasonal variations in the rate of sachet water consumption, with most consumption occurring in hot season; while the greatest proportion of the residents preferred cold water for consumption.

Table 1: Sachet water use

Variable		Frequency	Percentage	Mean	Standard deviation
Sachet water consumption	Yes	280	100.0		
	No	0	0.0		
Number of sachet water consumed daily (50cl of 500ml)	1-2 sachets	21	7.5	5.0	67.31
	3-4 sachets	54	19.3		
	5-6 sachets	173	61.8		
	7-8 sachets	15	5.4		
	> 8 sachets	17	6.1		
Seasonal variations in daily sachet water intake	Yes	280	100.0		
	No	0	0.0		
Season with higher intake	Wet season	0	0.0		
	Hot season	280	100.0		

Preferred sachet water temperature for consumption	Normal	18	6.4		
	Mild	92	32.9		
	Cold	170	60.7		

Source: Authors' Field Survey (2024)

4.2 Sachet Water Generation in Wushishi

The rate of sachet water waste generation in Wushishi is presented in Table 2. As the result shows, the expected volume of sachet water consumption in the study area per day is 701,000. However, after adopting the 70% threshold of minimum number of sachet water consumers in Nigeria as reported by Edoga *et al.* (2008) on the one hand and adopting the five sachets mean found for this study as presented in Table 1, the observed number of sachet water consumption stood at 490,700. Therefore, considering the standard area of each sachet water pack which is approximately 0.0211m^2 (Ibrahim *et al.*, 2015), the average area covered by sachet water wastes in Wushishi is 10,353.77m^2. It is worrisome to note that if this trend is not curtailed, this will translate to sachet water wastes alone capable of affecting the ecological footprint of the town, and ultimately affecting its environmental sustainability.

Table 2: Sachet water waste generation in Wushishi

Population of Wushishi population	**Population**	**Expected volume of sachet water consumption (population x sachet water consumption per capita per day)**	**Observed sachet water consumption per day (70% of the population x five sachet waters per capita per day)**	**Average area of sachet water wastes (0.0211m^2 x 70% of the population x five)**
140,200		701,000	490,700	10,353.77

Source: Authors' Estimate (2024)

4.3 Residents' Perception of the Environmental Effects of Sachet Water Waste Disposal

Residents' perception of their environment is a very important step towards environmental stewardship. The perception of the residents of Wushishi on the environmental effects of sachet water waste disposal is presented in Table 3. The result suggests that blocking of drainage systems and littering of the environment ranked 1st and 2nd among the perceived effects of sachet water waste disposal with mean scores of 4.88 and 4.61 respectively. Clogging of drainage systems is a precursor to flood disaster. The perception of the residents that sachet water wastes constitutes possible toxins when used as play toys by children on the one hand, and causes soil pollution on the other ranked 3rd and 4th with mean scores of 4.09 and 4.01 respectively. Furthermore, ranking 5th and 6th on the list of the perceived effects of sachet water waste disposal in Wushishi are the perceptions that they create breeding ground for mosquitoes and create soil pollution. Mosquitoes are the primary cause of malaria which is responsible for millions of deaths in sub-Saharan Africa. Thus, sachet water wastes constitute health challenge to the residents of the study area. It was also reported that sachet water wastes constitute offensive odour when burnt, ranking 6th on Table 3 with a mean score of 3.82. This is in addition to the reports of causing accidental falls (ranking 7th with a mean score of 3.30). All of these are pointers to the need to address the issue of sachet water wastes in order to achieve a safe, aesthetically pleasing and sustainable urban environment.

Table 3: Residents' perception of the effects of sachet water waste disposal

	Effects	Strongly Agree		Agree		Disagree		Strongly Disagree		MEAN	Standard Deviation	Rank
		F	P	F	P	F	P	F	P			
A1	Blocking of drainages	108	38.6	152	54.3	14	5.0	6	2.1	4.88*	1.93	1st
A2	Environmental littering	120	42.9	158	56.4	2	0.7	0	0.0	4.61*	1.40	2nd
A3	Possible toxins when used as play toys	105	37.5	166	59.3	9	3.2	0	0.0	4.09*	1.91	3rd
A4	Causes soil pollution	79	28.2	181	64.6	19	6.8	1	0.4	4.01*	1.26	4th
A5	Helps breed mosquitoes	105	37.5	174	62.1	1	0.4	0	0.0	3.90*	1.29	5th
A6	Offensive odour when burnt	244	87.1	36	12.9	0	0.0	0	0.0	3.82*	1.42	6th
A7	Contributes to accidental falls	208	74.3	61	21.8	11	3.9	0	0.0	3.30*	1.30	7th
A8	Visual pollution	98	35.0	167	59.6	4	1.4	1	0.4	2.97	1.48	8th
A9	Pollution of ponds	65	23.2	119	45.5	96	34.3	0	0.0	2.95	1.50	9th
A10	Visual impairment for motorists	96	34.3	169	60.4	5	1.8	0	0.0	2.45	1.22	10th

NB: F = Frequency; P = Percentage
Source: Authors' Field Survey (2024)

4.4 Reasons for the Consumption of Sachet Water

The reasons for the consumption of sachet water in the study area are presented in Table 4. The highest ranking reason for the consumption of sachet water in the study area is its availability with a mean score or 4.11. Similar result was reported in the studies of sachet water consumption in urban areas of Nigeria and Liberia by Omalu *et al.* (2010) and Apeh (2018). This was closely followed by affordability as the second most important reason for sachet water consumption with a mean score of 3.93. In a similar study in Ogbomosho, Olaniyan *et al.* (2016) reported that people choose to consume sachet water because it is cheaper compared to other packaged potable water sources. Surprisingly, safety ranked 5th and lowest in the ranking of the reasons for the consumption of sachet water in the study area, implying that safety considerations played insignificant role in the choice of sachet water for the consumers.

Table 4: Reasons for the consumption of sachet water

Reason	Rank	Mean ()	Standard deviation
Availability	1st	4.11*	0.83
Affordability	4th	3.93*	1.22
Quality	3rd	3.78*	1.82
Accessibility	2nd	3.59*	1.60
Safety	5th	2.97	0.94

Source: Authors' Field Survey (2024)

4.5 Methods of Sachet Water Disposal Adopted

Owing to its considerable non-biodegradable nature, sachet water waste disposal methods are of utmost importance. The methods of sachet water waste disposal adopted in Wushishi is presented in Table 5. The result shows that the sachet water waste disposal methods Adopted in the study area are largely unsustainable because of their environmentally unfriendly nature. For instance, open dumping ranked 1st among the methods used in disposing sachet water wastes in the study area with a mean score of 4.12; dumping in waste bins ranked 2nd with a mean score of 3.99; open burning ranked 3rd with a mean score of 3.90; throwing inside bushed ranked 4th with a mean score of 3.43; dumping in gutters ranked 5th with a mean score of 3.08, and other dumping methods ranked 6th with a mean score of 3.05. Similar results were reported by Audu and Nuhu (2019) in their study of Potiskum, Nigeria. Sadly, all of these disposal methods are proven to be environmentally unfriendly and unsustainable.

Table 5: Methods of sachet water disposal adopted

Method	Rank	Mean	Standard deviation
Open dumping	1st	4.12*	1.34
Dumping in waste bins	2nd	3.99*	1.46
Open burning	3rd	3.90*	1.38
Throwing inside bushes	4th	3.43*	1.30
Dumping in gutters	5th	3.08*	1.40
Other dumping methods	6th	3.05*	1.28
Controlled incineration	7th	2.82	1.54
Burying in refuse pits	8th	2.61	1.57

Source: Authors' Field Survey (2024)

5.0 CONCLUSION AND RECOMMENDATIONS

Sachet water wastes constitute a considerable proportion of the total solid wastes generated in urban areas. Yet, studies that specifically address the issue of sachet water was in urban and suburban areas in North-Central Nigeria in general and Niger State in Particular are relatively scarce. This is particularly so in Wushishi where this study was conducted.

This study shows that, unlike elsewhere, the average sachet water consumption per capita per day in Wushishi is five sachets. This study have been able to establish that sachet water wastes have consumed a vast mass of land in the study area, and will continue to spread its limit if the problem of sachet water waste generation and management is not adequately addressed. In addition, the study hints at the possibility of the sachet water wastes in the study area affecting the ecological footprint of the town. Furthermore, the study shows that the residents of the town perceived sachet water wastes in the study area as capable of causing

health and safety challenges. Surprisingly, the study shows that safety was the least reason considered by the residents of Wushishi in the choice of sachet water that they consume. Finally, the sachet water waste disposal methods in the study area were largely environmentally unfriendly and unsustainable.

The study therefore recommends that the residents should be enlightened on the need for adequate water consumption in line with established global standards and the effects of inadequate water consumption. Similarly, the study suggests that the local government authority, non-governmental organisations in the town and well-meaning individuals should form a public-private partnership network in order to create a sustainable waste disposal and management system for the town. The wastes in this designated location can be recycled in line with the waste to wealth and zero waste principles. In addition, the designated waste collection/disposal and management spot should be subjected to periodic fumigation to curb the development and spread of disease pathogens. Lastly, this study examined the effects of sachet water wastes on the environment. Further studies are required to establish the economic and social impacts of sachet water production on the one hand, and its waste on the other.

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