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ENVIRONMENTAL PROBLEMS OF SACHET WATER PRODUCTION IN NIGERIA

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ABSTRACT
Water sachet litter is a major environmental problem in Nigeria and has therefore become a topical issue of heated debate with no fruitful outcome and desired solution. This paper therefore x-rays the environmental problems associated with sachet water production, traces its evolution and attendant problems, and suggests appropriate solutions accordingly. The environmental problems are identified, pictured, and then analyzed descriptively. The major factors found to be aggravating the problems are the lax environmental regulations and poor waste management in the country. Deposit-refund system is thus recommended as an appropriate and sustainable economic instrument that would achieve the desired solution to the environmental problems in the country.
Keywords: Deposit-refund system; Environmental problems; Sachet water production; Water-sachet litter; waste disposal practices.

1. INTRODUCTION

The importance of water to man and his environment is obvious, and hence cannot be over emphasized. Man needs water to grow, sustain and maintain healthy life. Therefore, water is undeniably an essential commodity and one of the world's greatest needs that cannot be dispensed with. It is the duty of every government to provide its citizens with water. However, due to many years of neglect on the part of the government, the country has been bedeviled by dearth of publicly provided potable water. Consequently, this neglect, coupled with the inability of the Nigerian government to persistently provide adequate potable water for the growing population and the resultant quest by the public for a solution to the dearth of water, has led to the emergence and proliferation of sachet water (Akunyili, 2003; Babatunde and Biala, 2010), the packaged water popularly called *pure water*, and which typically comes in

50-cl thermoplastic sachets.

Although the so-called pure water has undoubtedly been a boon to the consumers, packaging the plastic sachet has social costs or environmental repercussions. While individual sachet-water consumers derive the benefit of convenience from the use of the plastic sachets, the country at large bears the social costs of emptied sachets littered across the country. Littering of water-sachets constitutes an environmental externality problem, the form which Kahn (1966) describes as *the tyranny of small decisions*, which arises when a consumer fails to recognize that his consumption activity or behavior (e.g., littering) could lead to a much larger problem (e.g., flooding, pollution). A sachet water consumer may regard his contribution to total litter as insignificant, but the problem becomes severe as other consumers follow suit. Consequently, over 560 million of water-sachets are consumed and discarded daily as waste across the country (Idiata, 2012).

The end result of sachet water production and consumption is non-biodegradable waste sachets, which generate a number of negative environmental externalities or problems, which include flooding, pollution, death of livestock, soil degradation, and public health problems. In order to tackle these problems from the root cause, this paper therefore seeks to pictorially analyze the problems and trace the evolution of sachet water production and its attendant problems so as to suggest appropriate solutions. To achieve these objectives, the rest of this paper is divided into three sections. Section 2 provides the literature review of background information on the genesis and evolution of sachet water production and its attendant problems in the country, while Section 3 contains the methodology. The last section provides the conclusions derived from the study.

2. LITERATURE REVIEW

This section reviews background information on the evolution of sachet water production and its attendant problems. It provides background information on environmental regulations and policies. It also discusses the current solid waste management practices and the structure of sachet water market.

2.1 The Genesis and Evolution of Sachet Water and Its Environmental Problems in Nigeria

The Ministry of Water Resources and state water corporations in Nigeria are charged with the responsibility of providing water to the populace.

However, as the population grew and industries increased, the supply of water by the public utilities became inadequate in quality and quantity. Between 1992 and 1996, the years that sachet water production began to sprout, the rate of increase of the country's total water supply for industrial, agricultural and domestic uses was 1.0 percent, while the population growth rate was 2.84 percent (Gbadegesin and Olorunfemi, 2007). The implication of this, is that water demand was larger than the available water supply, the result of which was scarcity or inadequacy of water supply. It was this situation in which water demand outstripped supply that led to the emergence and proliferation of private water enterprises/individuals who thought they could profit by packaging and selling water to the needy (Onemano and Otun, 2003). Thus, the inability of the government to persistently provide adequate potable water for the growing population and the resultant quest for a solution led to the emergence and proliferation of sachet water. As a significant response to the dearth of drinking water supplies, the advent of sachet water has, thenceforth, successfully expanded potable water supply coverage in the country

At the initial stage, the private enterprises came in with the introduction of *iced water*, primitive 'packaged' water sold in hand-filled, hand-tied plastic bags. Iced water, which was then sold for 1 naira per wrap, was very popular and patronized by Nigerians who could not afford bottled water. Iced water production started in the 1970s in Aba town and continued to reign until about three decades ago when sachet water typically packaged in 50-cl plastic sachets and heat-sealed on one end (Fig.1)was introduced in 1990 also in Aba town (Eze and Anakwe, 2005). Consequently, people who hitherto patronized iced water switched to sachet water to minimize the incidence of water-related diseases. Because sachet water is relatively affordable (being sold for 5 or 10 naira per sachet depending on the location or state), there were increases in demand for it, which gave many people impetus to venture into the business. Subsequently, increasing number of private firms were getting involved in the business in virtually every city and town. This brought about a lot of health and environmental concerns, which prompted the National Food and Drugs Administration and Control (NAFDAC) in 2001 to clamp down on unhygienic production of sachet water.

Although the introduction of this type of packaged water was intended to solve the problem of inadequate potable water in the country, it has created such other problems as litter/pollution, localized flooding, degradation of the quality of the soil and water sources, entanglement, ingestion, suffocation, and eventual death of both wildlife and livestock (Biala, 2014). These problems

arise because water sachets are made of nonbiodegradable, synthetic polyethylene (a type of plastics), which does not decay, decompose or corrode, and which when burnt, produces toxic gases which can harm people and the environment (Aziegbe, 2007; Nwachukwu, Obidi and Odocha, 2010; Hati and Dimari, 2010; Ezue, 2011).

Figure 1: Sample of Sachet Water



Source: Biala (2017)

Since its introduction, sachet water has succeeded in creating a new type of wastes *sachet waste*. Used water-sachets are the most ubiquitous and a highly visible form of litter. They litter open spaces and float around. They can be blown away by the wind and can travel long distances because they are a light form of plastics. They contribute largely to solid waste management problems in the country. The poor drinking habit, personal attitudes of individuals, social norms concerning waste disposal, lack of concerted effort to recycle, and lack of proper mechanisms for the disposal of used packaging all work together to aggravate the situation. Table 1 shows the quantities of this type of waste generated daily across the country. Overall, about 560 million of sachets are generated daily across the country.

Water sachets clog gutters and thus cause localized flooding, as evidenced by Figure 2, where gutters are clogged up with sachets and other waste items. Several studies (for example, Aderogba, 2012a; 2012b; Selby, 2012; Oriola, 1994; Folorunsho and Awosika, 2001; Ologunorisa, 2004) have attributed the perennial incidence of flooding in the country to blockage of water channels by water sachets and other non-biodegradable wastes. They have found that blockage of the drainage system by water sachets assists the

magnitude or severity of flooding and the length of time that floods last.

Table 1: Estimated Water-Sachet Waste Generated Daily across the Country

S/N	State	Sachets Generated	S/N	State	Sachets Generated
1	Abia	11,335,996	20	Katsina	23,170,312
2	Adamawa	12,672,404	21	Kebbi	12,954,512
3	AkwaIbom	15,680,832	22	Kogi	13,113,948
4	Anambra	16,728,128	23	Kwara	9,484,356
5	Bauchi	18,705,860	24	Lagos	36,054,136
6	Bayelsa	6,813,432	25	Nasarawa	7,453,100
7	Benue	16,876,976	26	Niger	15,800,972
8	Borno	16,604,772	27	Ogun	14,912,392
9	C/River	11,555,864	28	Ondo	13,764,096
10	Delta	1 6,393,564	29	Osun	13,694,140
11	Ebonyi	8,694,004	30	Oyo	22,366,356
12	Edo	12,873,328	31	Plateau	12,714,848
13	Ekiti	9,536,848	32	Rivers	20,741,600
14	Enugu	13,029,192	33	Sokoto	14,787,996
15	Gombe	9,415,516	34	Taraba	9,202,944
16	Imo	15,739,596	35	Yobe	9,286,364
17	Jigawa	17,394,596	36	Zamfara	13,039,384
18	Kaduna	24,266,248	37	FCT	5,620,804
19	Kano	37,534,728			
Total sachets generated across the country					**560,014,144**

Source: Adapted from Idiata (2012)

Plastic sachets damage the soil. If sachets are buried or land filled, they can affect the soil structure, composition and the level of microbial activities in the soil (Nwachukwu, 2010; Hati and Dimari, 2010). Landfilled sachets have the potential to leach their chemical components into soil and water sources, and thereby constitute health dangers and contribute to greenhouse effect. The greenhouse effect is caused by methane, one of the major greenhouse gases produced by landfills. Stagnant water caused by clogged gutters are an ideal habitat for mosquitoes and other parasites that affect public health.

Furthermore, a backlog of used sachets constitutes a threat to flora and fauna, especially the aquatic life. As shown in Figure 3, some wildlife and livestock mistake them for food and thus ingest them, thereby causing blockage of digestive tracts and eventual death. A study by Dee (2002) found that 143 species were injured and killed by plastic wastes through suffocation,

ingestion, and entanglement. In addition, if stepped upon, carelessly disposed sachets can also cause domestic accidents, such as sliding and falling.

Figure 2: Drains Clogged Up by Water-Sachets at Various Locations



Figure 3: A Ram Eating an Emptied Sachet of Water



Source: Biala (2017)

Aesthetically, the plastic sachets disrupt the visual beauty of the environment and tourist spots. Accumulation of emptied sachets constitutes an eyesore and has an adverse impact on tourism (see Fig. 4). The visible mountains of waste sachets, clogged drains, and unsightly beaches give the tourists the impression that the country is a filthy one. Furthermore, litter can cause psychological stress and decrease in property value, owing to dirty and unsanitary environment (Rathana, 2009; Mangizvo, 2010).

Apart from these effects, litter imposes some other social costs on society. Litter cleanup is very costly, in that it costs governments a huge amount of money. A study by Adenuga, Ogujiuba and Ohuche (2005) highlights loss of revenue and declining health-care as some of the economic implications of environmental degradations caused by pollution. Litter pollution, where it is managed or controlled, is a drain on revenue through government recurrent expenditure on general environmental management. Where it is not controlled, litter pollution is also a drain on revenue and/or foreign exchange expended on the importation of drugs to combat health hazards and disasters that may result from pollution.

Figure 4: Samples of the Environments Littered with Water Sachets in Ilorin



Source: Biala (2017)

2.2 Environmental Regulations and Policies in Nigeria

The evolution of environmental regulation in Nigeria dates back to 1914 when the *Minerals Ordinance* was enacted by the colonial administration. The main objective of the ordinance was to prohibit the pollution of watercourses in the process of mining and prospecting for any mineral resources (Orubu, Odusola and Ehwarieme, 2004). Some years after independence, several efforts were made further towards environmental protection. These efforts led to, inter alia, the enactment of the Mineral Oils (Safety) Regulations (1963), Petroleum Regulation (1967), Oil Navigable Waters Act (1968), the Petroleum Act (1969), Harmful Waste Decree (1988), Effluent Limitations Regulations (1991), the Pollution Abatement in Industries and Facilities Generating Wastes (1991), and the Environmental Impact Assessment Act (1992).

The petroleum-related regulations or acts stipulated that oil firms should take precaution and control to prevent the pollution of inland water, rivers watercourses by oil spillage and/or other fluids/substance that might contaminate the water. In November 1988, *Harmful Waste Decree* (decree 42 of 1988) was promulgated following the discovery of the dumping of toxic waste by an Italian firm in 1987 in Koko, a seaport near Warri, Delta State. The country was before this incident ill-equipped to manage such environmental crisis, as there were no institutional capacity and legislations to address such matters. The decree adopted direct regulation approach and prohibited the sale, purchase, importation, transportation and storage of harmful waste in the country. In the decree, life imprisonment was prescribed as the sanction for any violators of its provisions.

In December 1988, another decree establishing Federal Environmental Protection Agency (FEPA) was prompted by the environmental crisis. The decree was promulgated to further address the problem of environmental degradation, especially pollution. Most state governments later took a leaf from the federal government's book and established their respective state environmental protection agencies, such as Kwara State Environmental Protection Agency (KWEPA), Lagos Environmental Protection Agency (LASEPA), etc. FEPA came up with guidelines and standards for environmental pollution control (FEPA, 1991). The guidelines and standards relate to five areas of environmental pollution control: (1) effects limitations, (2) water quality for industrial water uses at point of intake, (3) industrial emissions limitations, (4) management of social and hazardous wastes, and (5) pollution abatement in industries. A major effort initiated by FEPA to tackle the

problem of solid waste management was a blueprint on *National Waste Management Strategy,* anchored on waste minimization, recycling, waste-to-wealth campaign; guidelines for sorting, collection, treatment, transportation, and disposal of waste; penalties for contravention of waste management laws, collection of fines, and disbursement of incentives to state and local governments for effective implementation (Umoh, 1997).

In June 1999, FEPA was transformed into the Federal Ministry of Environment and its state counterparts were consequently subsumed under state ministries of environment. The Ministry incorporated other relevant agencies and departments in other ministries that were involved in environmental protection activities. The Ministry of Environment was created without an appropriate enabling law on enforcement issues, the situation that created a vacuum in the effective enforcement of environmental laws, standards, and regulations in the country. Consequently, the Federal Government in line with section 20 of the 1999 Constitution established the National Environmental Standards and Regulations Enforcement Agency (NESREA) in 2007 as a parastatal of the Federal Ministry of Environment, Housing and Urban Development. NESREA is currently the institutional mechanism for environmental protection and sustainable development in the country. Established by NESREA Act No. 25 of 2007, the agency is charged with the responsibility for the protection and development of the environment and related matters.

NESREA came up with the National Environmental (Sanitation and Wastes Control) Regulations in 2009, whose purpose is to adopt sustainable and environment-friendly practices in environmental sanitation and waste management. The regulations stipulate as follows:

(i) No person is to discard any litter or similar refuse register except in designated litter bins.
(ii) No owner, operator, occupant or person in care, management or control of premises is to allow the release of litter into the environment.
(iii) No passenger of any vehicle is to throw or drop any litter onto the streets, roads, highways, and public places.
(iv) No person shall sweep out or throw out any litter into any drain, public place, private lands, vacant plot, streets, lanes, walkways, and beaches.
(v) All food vendors shall ensure that litter and other wastes do not pollute the environment by collecting and disposing of all wastes generated in the course of business to a designated collection point.

Despite these regulations and the fact that littering of water sachets is a criminal offence, the country is still heavily littered, gutters are choked up with wastes, and the environment is avoidably degraded. The regulations are just lax and weak. All these are symptoms of ailments of already "gasping" Nigerian cities (Egunjobi, 2009)

2.3 Solid Waste Management Practices in Nigeria

Solid waste management (SWM) has been one of the environmental challenges facing the country. Increasing human population as well as production and consumption activities coupled with weak regulation and legislation have contributed greatly to poor waste management and ultimately, environmental degradation. The country has witnessed a significant rise in both the total tonnage of waste generated and the kilogram per capita, though accurate data on these indicators are virtually nonexistent. Therefore, private individuals, corporate bodies and governments are finding it extremely difficult to manage municipal solid waste.

Solid waste constitutes one of the most crucial health and environmental problems facing local, state and federal governments. The passiveness, negligence and underestimation of the significance of proper municipal solid waste management by all levels of government have made solid waste management an intractable environmental and public health problem.

Although solid waste management is a statutory function of the local governments, state and federal governments intervention has become necessary due to the fact that the local governments are not properly, technically and financially equipped to perform the function effectively and efficiently (Longe, Longe and Ukpebor, 2009; Olanrewaju and Ilemobade, 2009; Remigios, 2010).

Generally, the inability of the government to effectively manage wastes created a vacuum in the collection and disposal of solid wastes in the country. The vacuum are being filled by both the formal and the informal private sectors. The formal sector consists of registered and mechanized enterprises that have the financial strength and the technical know-how to convert recovered waste materials, such as papers, aluminium, plastics, and metals into more useful products and raw materials for other products. The informal sector is composed of itinerant *cart pushers*, who are involved in house-to-house waste collection recovery and disposal; *scavengers*, who are involved in the on-site waste recovery; *resource merchants* whose business is

to purchase all recovered recyclable and reusable waste materials; and *small-scale recyclers*.

There also exist in the informal sector, the itinerant waste buyers who walk around towns and cities to buy waste materials like old or broken plastics, "rubber" slippers, flask, glass bottles, aluminum wares, and metal cans. In Kwara State, for example, besides free scavenging, scavengers in the state do their business by using a "barter system" to get worn-out slippers. They exchange a product such as matches or a plastic container for two pairs of worn-out rubber slippers. This system is popularly called *bata-meji rubber-kan* (two old/worn-out rubber slippers in exchange for a plastic container). This buy-back system has worked very well, because hardly can one see any rubber slippers littered round the streets. The scavengers and other informal sector recyclers sell their recovered materials to middle men, (resource merchants) who in turn sell them to processing and manufacturing firms. The cart pushers go from house to house, collect waste at a fee, sort and recover reusable and recyclable materials from the waste before disposing the residues. The recyclers convert paper materials into such products as tissue papers, exercise books, while plastic materials are converted into bags, hangers, toys, plastic hose and a host of others.

The current solid waste management system is still very crude, inefficient, and unsustainable. Although the informal recycling sector is very active in waste management, statutory measures for achieving improved recycling rates and formal resource recovery programmes are nonexistent. As a result, households and businesses are not compelled to recycle their waste. Household wastes are multifarious and co-disposed without sorting, since there is no public awareness about the need for source separation. House-to-house collection of waste is not well established. Industrial wastes (some of which require special handling, treatment, and disposal) and municipal wastes are mingled, collected together and co-disposed. Collection and disposal of wastes are a major urban environmental problem (Egunjobi, 2009). This places governments in a difficult situation especially as they have to develop new strategies to deal with increasing volumes as well as strange varieties of wastes. Wastes are disposed of virtually free of charge in most states. Major disposal options include tossing (throw-away), open burning, dumpsites, and dumping in drainages (see Fig. 5). Some people, especially those in the market places, intentionally dump their sweepings in the gutters. Despite the existence of both the formal and informal waste management sectors, very negligible proportion of the municipal solid waste (MSW) is recycled and/or reused. Incineration and

sanitary landfill are nonexistent in most cities. As a result, wastes dumped at dumpsites find their way to waterways and water bodies, thereby contributing to flooding and contamination of water courses.

Figure 5: Waste Disposal Practices at Various Locations in Nigeria



Source: Ezeah (2010), Abah and Ohimain (2010), and Biala (2017)

Open burning, open dump of solid waste especially by the road sides, the use of streams or runoffs to transport solid wastes are all common practices. In some parts of the country, refuse is generally buried. Several Nigerians consider *burning* a cheap way of disposing of their solid wastes; they simply set wastes on fire in a corner in their backyard or in an open place (Babayemi and Dauda, 2009). Mountains of solid wastes in some designated places are set on fire, and thereby cause serious environmental pollution. Lots of stray sachets are illegally disposed of at any available space (Fig. 6). Water sachets and other wastes are often dumped anywhere at the convenience of the trekking population since there is virtually no mechanism that allows proper disposal of these materials after consumption. This gives rise to indiscriminate dumping of the plastic sachets. Consumers use and discard millions of water sachets. While only few is recycled, negligible proportion is re-used.

Figure 6a: Waste Dump Consisting of Water-Sachets



Figure 6b: Wastes Disposal Practices in Nigeria



Source: Biala (2017)

2.4 Structure of the Sachet Water Market

Sachet water is a ubiquitous source of drinking water for low and middle-income Nigerians. After bottled water, it is the second most important drinking water. The sachet water market is regulated by the National Food and

Drugs Administration and Control (NAFDAC). Sachet water business is a lucrative venture with many people involved in its production and marketing. It has revenues in the multimillion naira range, primarily from its sales. From Table 1, the daily sachet water trade is estimated to be over ₦2.8 billion (₦5 560,014,144 sachets consumed daily nationwide). Sachet water production has many inputs, ranging from raw water itself to polythene sachets to sealing machines and energy products.

There exist small and large scale enterprises that package this type of drinking water. While the small-scale firms package and sell only sachet water, the large-scale firms package and sell both bottled and sachet water. The distribution chain for the product starts from the producers to the final consumers (households), with wholesalers and retailers in between. The prevailing average wholesale price per bag, which contains 20 sachets, ranges from ₦100 to ₦150. Currently, the prevailing average retail price (per-sachet price) is ₦10. The market price is not volatile as evidenced in the stability of the price since it was introduced.

The market for sachet water is characterized by a large but limited number of sellers and buyers of a somewhat differentiated product, which makes it monopolistically competitive. The market is characterized by several middlemen (retailers and wholesalers) and producers. There are thousands of producers and millions of retailers and consumers. The producers are so many that it is difficult for any firm to dominate the market. The market enjoys relatively free entry and free exit, though there seems to be such barriers to entry as (1) getting certified by NAFDAC, which takes a very short while to overcome by meeting its stringent-but-surmountable requirements, and (2) becoming a member of the union of sachet water producers, which is equally surmountable in no time.

Although different brands of sachet water exist in the market, product differentiation is not real since the content (water) is perceived by consumers to be homogeneous (Babatunde and Biala, 2010). Consumers do not show preferences for certain brands; all brands are assumed to be of the same quality since they are regulated by the same agency. Thus, product differentiation is only *notional* or *fancied*. The effect of this is that each sachet-water producer has little or no discretion in the determination of the price. Each, therefore, faces the keen competition of close substitutes offered by other firms. As regards the nature of the demand, water-sachets have a derived demand whose primary autonomous demand is for water content. The price elasticity of demand for sachet water is low because it is a necessity whose price takes

infinitesimal or negligible proportion of consumers' income. Factors that determine the quantity demanded of sachet water include season, weather, and NAFDAC certification. More sachet water is consumed in the dry season than in the raining season because the hotter the weather the more water is consumed.

3. METHODOLOGY

This paper x-rays the environmental problems that are associated with sachet-water production in Nigeria by carrying out a survey of the existing literature on sachet water. It employed a descriptive design in which the environmental problems were identified, pictured and then analyzed. While some of the problems were personally identified and pictured by the author at different locations across the country, some were sourced from the literature consulted. The pictorial description was employed owing to the nature of the problem.

4. CONCLUSIONS

Environmental problems associated with water sachets are due to poor waste management practices in the country, which in turn, is due to ignorance, weak regulation and legislation. The existing policies, strategies, and regulations on waste management are not effective, and there are no economic instruments, such as deposit-refund and advance disposal fee, which are universally acclaimed as effective measures of litter management. Despite the various environmental regulations and the fact that littering of water sachets is a criminal offence, the country is still heavily littered, gutters are choked up with wastes, and the environment is avoidably degraded. Effective recycling regulations are practically nonexistent. Anti-littering laws are not enforced. Waste recycling in the country is at the nascent stage and has not received adequate attention from the governments and the waste management authorities.

Since the environmental problems caused by water sachets are aggravated by the lax environmental regulations and poor waste management in the country, the government should implement deposit-refund system (DRS) as an alternative to the command and control measures. The DRS is a market-based method of controlling littering whereby consumers of a litter-generating product pay a surcharge but later refunded when used-packaging of the product is returned to point of purchase or designated collection site. It has been found by the author that, even with weak government regulations in the country,

deposit-refund system can still provide consumers of sachet water with incentive to return sachets after consumption, and thereby reduce the attendant problems (Biala, 2017). With DRS in place, the wholesalers or retailers would end up having large piles of used sachets awaiting recycling. The government should, therefore, set up recycling plants and/or encourage sachet water producers and other interested private firms to engage in recycling business by subsidizing the requisite recycling machinery and equipment.

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