

STATE OF PLASTIC POLLUTION IN NIGERIA AND MEASURE TO TACKLE THEM: A REVIEW

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ABSTRACT

Marine organisms, scientists, governmental and non-governmental organizations face a significant challenge as a result of the ubiquitousness of plastic and microplastics in the aquatic environment, particularly in Nigeria where there is little or no policy put in place to address the issue of microplastic pollution. Nigeria ranks ninth globally in terms of its contribution to ocean plastic pollution and currently does not have a federal ban on the majority of single-use plastics and equipment. This paper aimed to present the status of plastic pollution in Nigeria and some policies to curb the menace. Data analysis reveals that Bayesa, Katsina, Lagos, and Oyo are the four states that generate the majority of the plastic waste in Nigeria. The number of industries, markets, and urbanization in a location affect the quantity of plastic waste that is produced there and is not dependent on the population. This paper makes some policy suggestions and recommendations such as the federal prohibition and taxation on the use of plastic, ocean clean-up, technological innovation that will support the recycling industry in Nigeria, and the need for additional plastic research. Nigeria can apply the most recent plastic waste management strategies in European and Asian nations as a model and adopt them to reduce marine plastic pollution.

INTRODUCTION

Plastic pollution is a general issue creating adverse effects in marine and coastal water bodies. One of the most widely used materials in the world, plastics are deeply ingrained in contemporary culture and play a crucial role in almost all product categories. The typical qualities that make them so practical include being resilient, light, flexible, impervious to damage, efficient, and hygienic for transporting food and other items, like plastic bags. Microplastics are increasingly being observed in all components of most aquatic ecosystems of the world and posing varying toxicological threats to virtually all aquatic biota. The adverse effects of their presence in the marine environment which include particle toxicity, chemical toxicity and microbial toxin to marine organisms and sea animals have been demonstrated and discussed in many studies (Enyoh, et al., 2019). There is no doubt that plastics have many social advantages, but there is evidence that most of these advantages could be achieved without releas-

ing plastic into the environment (Thompson, 2017). Due to these qualities and advantages, plastic waste production has increased globally without the follow up of the harm it can cause to the environment and marine world. The effects on the marine environment have also increased as a result of plastic pollution which are seen all over the marine system (Duru, et al., 2019).

A minimum of 5.25 trillion pieces of plastic weighing over 250,000 tons were found in the ocean, according to data from 24 oceanic expeditions, but more recent estimates based on the great Pacific garbage patch presume that the amount of plastic may be four to 16 times higher than previously thought (Eriskin, et al., 2014; Lebreton, et al., 2018). According to the UNEP (2017), plastic makes up about 80% of all litter, with metal, glass, and paper being much less prevalent in the environment (Galgani, et al., 2010). Microplastics are so pervasive in the environment that they pose a great challenge to scientists, the media, and governmental and non-governmental

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tal organizations. The main challenge of microplastics is the awkwardness of getting them out of the ecosystem.

The growth rate of Nigerian population from year 2000 to 2017 is at the average of 2.37 (Siddiqui, 2013), and this can be linked directly to the rate of increase in Municipal Solid Waste (MSW) generally and by extension, plastic wastes. Yearly increase in Production (10.3%) and consumption (6.5%) of plastics has intensified inevitably, which give rise to an increase in the amount of plastic waste produced per annum (Verla, et al., 2019). This may have resulted to high potential increase of microplastics pollution in Nigeria.

Generally speaking, research on plastic pollution and plastic/microplastics has been carried out in many marine environments around the world, including the South Pacific and North Atlantic the Kaliningrad region of Russia, Norderney, The Indian coast, South Africa, Mozambic According to the International Pellet Watch, IPW, there is little information on the use of plastic materials in relation to city populations, their disposal, collection, and recycling methods in Nigeria, which has a population of about 142 million. The implementation and enforcement of laws to reduce the threat of plastic pollution in Nigeria have also received little research (Law, et al., 2010; Eriksen, et al., 2013; Desforge, et al., 2014; Elena, 2017; Dekiff et al., 2011; Tiwari et al., 2019; Hirai et al., 2011).

However, controlling the amount of plastic waste produced by society and the subsequent release of litter into the ocean must be a top priority if we are to lessen the ecological and socioeconomic effects of plastic pollution. Hence, the major aim of this paper is to include:

- To make some recommendations for policies that might aid in lowering plastic pollution in Nigeria's coastal water bodies.
- Nigerian plastic pollution, production, and consumption.
- Assessing other countries' policies on plastic waste management.

Plastic Production, Consumption and Pollution in Nigeria

The buildup of plastic trash such as bottles, bags, plastic, and microbeads in the environment has a deleterious effect on humans, wildlife habitats, and aquatic life (Hammer, et al., 2012; Encyclopedia Britannica, 2013). The combined qualities of cheap prices, flexible, and chemical stability and less corrosive have increased the use of plastic materials for storage and transport purposes in priority to other materials according to (Duru, et al., 2019) review of plastics consumption, waste production, collection, and treatment in Nigeria and a few selected countries. However, such unchecked use and the ensuing rise in plastic pollution can harm wildlife, human health, and Nigeria's economy (Thompson, 2017). De-

spite laws that may address these issues already being in place in Nigeria, the problem of plastic pollution still exists and may even be getting worse (NESREA, 2009). However, these laws are either not executed or enforced inconsistently (Enyoh, et al., 2019).

Presently, the world is producing 20 times more plastic than 40 years ago. This means that each year more than 8 million tons of plastic end up in the ocean, wreaking havoc on marine wildlife, fisheries and tourism, and marine ecosystem (United Nation, 2017). UNEP, 2009 estimated 6.4 million of waste enters the world oceans every year in which Nigeria is a major donor. A report from (Jambeck, et. al., 2015) shows that Nigeria is the 9th largest contributor of oceanic plastic pollution worldwide following China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Egypt and Malaysia mainly through the river Niger, which receives bulk of the waste from inland water bodies. In addition, Nigeria along with the following countries viz China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Egypt, Malaysia and Bangladesh accounts for "90% of all the plastic that enters the world's oceans (Schmidt, et. al., 2017; Franzen, 2017).

Nigeria's plastic industry is experiencing rapid growth as a result of massive investment. However, based on the volume of plastic imports and consumption between 1990 and 2017, Nigeria was ranked second among some specific African nations (Babayemi, et al., 2019). Given that the use of packaged goods has become a part of our daily lives, the packaging industry is actually the largest consumer of plastics. According to estimates from Patel and Shah, 30% of plastics produced globally are used for packaging purposes. Humans prefer to use plastic to wrap food products rather than using bare hand to hold the food product cheaply because they believe that hand flora contains pathogens which can be harmful (Shah, et al., 2008).

LITERATURE REVIEW

Study Area

Nigeria is located between longitudes 2°2' and 14°30' East of the Greenwich meridian and latitudes 4° and 14° North of the Equator. In the western part of Africa, Nigeria is one of the Sub-Saharan nations. Republics of Niger and Chad, the Atlantic Ocean, the Republic of Cameroon, and the Republic of Benin form its northern, southern, eastern, and western borders, respectively. Over a national territory of 923,770 km², there are more than 100 million people living in an unevenly distributed manner. According to WHO/UNEP statistics from 1997, Nigeria has the eighth-largest population in the world and makes up about a quarter of the population of all the Sub-Saharan African nations.

Types of Data

The data set for this study is a secondary data; it was obtained from a paper presentation "current status of

waste management and plastic management in Nigeria, policy and industry aspects" by Federal Ministry of Environment Abuja, Nigeria (Usman, 2019). The data contain background information on volume of plastic waste generated by each state. Twenty-eight states with at least 11-year records (2007-2017) of volume of plastic waste generated were considered and the results were used to predict for the entire 36 states.

Quantity Recycled

According to (Darshan and Gururaja, 2017) plastic recycling can be defined as the process of reusing and re-processing of plastic waste into beneficial products. Reported that less than 12% of plastic waste is recycled in Nigeria, while over 80% of plastic waste goes to landfills and dump sites (Olanrewaju and Oyebade, 2019; Babayemi, et al., 2018). Quantity recycled were determined by multiplying the total plastic (T_y) with the percentage recycled. Total plastics waste generated (T_y) was calculated using the relationship:

$$T_y = \text{sum (2007-2017)}$$

$$Q_{ur} = T_y - Q_r$$

Where Q_{ur} is the quantity of plastic unrecycled, Q_r quantity recycled and T_y total quantity of plastic waste generated (Tab. 1).

Tab 1. Nigeria states based on the amount of plastic waste generated between 2007 and 2017.

States	T_y	Population	Q_r	Q_{ur}
Abia	1782241.74	3727347	213869.01	1568372.73
Abuja	764431.91	3564126	91731.83	672700.08
Adamawa	1143054.51	4248436	137166.54	1005887.97
Ak-wa-Ibom	1446412.3	5482177	173569.48	1272842.84
Anambra	1492179.68	5527809	179061.56	1313118.12
Bauchi	1724280.16	6537314	206913.62	1517366.54
Bayesa	5647247.79	2277961	677669.73	4969578.06
Benue	1538017.2	5741815	184562.06	1353455.14
Borno	1545959.6	5860183	185515.15	1360444.45
Cross-river	1040475.9	3866269	124857.11	915618.79
Delta	1505514.25	5663362	180661.71	1324852.54
Katsina	3658644.59	7831319	439037.35	3219607.24
Kebbi	1185394.71	4440050	142247.37	1043147.34

Kogi	1275650.87	4473490	153078.10	1122572.77
Kwara	775368	3192893	93044.16	682323.84
Lagos	3333110.27	12550589	399973.23	2933137.04
Nasarawa	677425.86	2523395	81292.10	596134.76
Niger	1465914.8	5556247	175909.78	1290005.02
Ogun	1381993.55	5217716	165839.23	1216154.32
Ondo	1251871.26	4671695	150224.55	1101646.71
Osun	1208419.25	4705589	145010.31	1063408.94
Oyo	1996254.36	7840864	239550.52	1756703.84
Plateau	1308794.8	4200442	157055.38	1151739.42
Rivers	1854861.17	7303924	222583.34	1632277.83
Sokoto	1339147.97	4998090	160697.76	1178450.21
Taraba	1665614.9	3066834	199873.79	1465741.11
Yobe	866681.25	3294137	104001.75	762679.5
Zamfara	1150464.22	4515427	138055.71	1012408.51
Total	46025426.87	142879500	5523052.23	40502375.66

Data source: Federal Ministry of Environment, Abuja, Nigeria.

Population source: Nigeria bureau of statistic: Distribution of population in national assembly, Nigeria 2016.

RESULTS AND DISCUSSION

Fig. 1 shows the population and the amount of plastic waste that was produced, recycled, and unrecycled. The amount of waste produced between 2007 and 2017 was highest in (Bayesa>Katsina>Lagos), along with the amount of recyclable and non-recyclable waste, but the quantity produced decreased as the population increased. This demonstrates that an increase in population does not result in an increase in the amount of waste produced. The quantity of waste produced could be attributed to industrialization because states with more industries and markets produce more plastic waste than those with fewer industries. In contrast to Bayesa and Oyo state has a large population but produces less plastic waste. The fact that Bayesa recycled a lot of waste despite producing more of it can be attributed to good management practices and government assistance for those who expressed interest in the recycling industry.

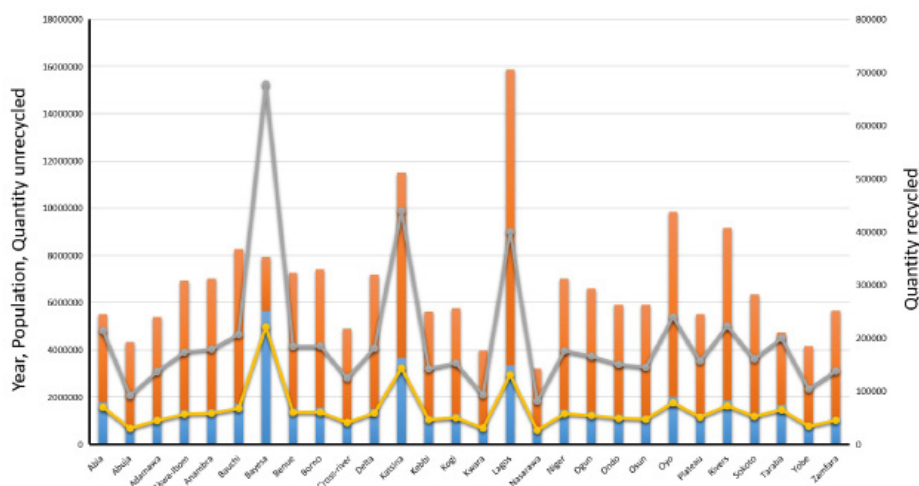


Fig. 1. Status of quantity of plastic waste generated, recycled, unrecycled and population. **Note:** (—) Year (2007-2017), (—) population, (—) Quantity Unrecycled, (—) Quantity Recycled.

Other Countries Strategy on Plastic Waste Management and Lessons Nigerian Stand to Learn

An effort has been made to combat plastic pollution, and as a result, many governmental organizations different part of the world have outlawed the use of plastic (especially single-use plastic) and are promoting plastic recycling (Verla, et al., 2019). A few notable continents are Europe (England, Italy, Wales, Scotland, Germany), Asia (India, China, Cambodia, Hong Kong, Bangladesh, Indonesia, Malaysia, and Taiwan), Australia, and America (California, specific regions in Argentina, Brazil, Chile, and Colombia), while some African nations (Kenya, Morocco, Mali, Tanzania, South Africa, Uganda, Ethiopia, Malawi, Cameroon, Rwanda, and Botswana) have also enforced laws on the use of plastic bags (Riskey, 2017).

The Californian government recently passed AB 1884, a law/policy requiring that plastic straws only be provided upon request (Iverson, 2019). Only four states either ban plastic bags or charge a fee for them (Xanthos and Walker, 2017). In contrast, other nations in Africa and Asia have begun to outright ban plastic bags and France has outlawed the use of plastic plates, cups, and utensils which took effect in 2020. Nova Scotians were forced to dispose of waste in a constrained number of plastic bags in 2014, making them more aware of their waste production and encouraging recycling (HRM, 2015; Windsor, 2015).

Smaller American cities have, however, enacted plastic bag bans or taxes (Iverson, 2019). For instance, Washington, DC, and New York City both imposed fees on plastic bags 2017 (Xanthos, et al., 2017). Seattle also prohibited polystyrene, plastic straws, and utensils, and San Francisco outlawed the sale of plastic water bottles containing less than 21 ounces.

Denmark passed legislation in 1994 requiring producers of plastic bags to levy depending on the weight of their bags. The cost of the tax can be passed on to customers by retail establishments. Consumers today pay between

37 and 65 US cents for plastic bags (Ritch, et al., 2009). Walmart in Canada started charging customers a 5% fee for all grocery bags in 2016 (Walmart Canada, 2016).

Nigeria produces more than 4 MMT of plastic waste annually as a result Tab. 1. In addition, despite the fact that there are laws in place that could address this issue, plastic pollution problems are still prevalent and may even be getting worse (NESREA, 2009). Either these laws are not abided or they are not implemented properly. To reduce the amount of plastic waste generated and protect the ocean, Nigeria should be encouraged to follow the example of the aforementioned nations. Nigeria should at least adopt some legal framework that could help reduce the generation of plastic waste, even though she may not be able to withstand a total ban of plastic due to her poor economic situation. To promote waste recycling, the government should support recycling businesses through grants or loans.

Legal Frame and Legislation that could Help Curb Plastic Waste Generation in Nigeria

Policy implementation/enforcement: To manage plastic waste in a tenable way, the Nigerian government must be fully engaged. Focusing on government and management agencies to help control the amount of plastic waste produced by society and the corresponding release of litter to the ocean is a crucial step in reducing the ecological and socioeconomic effects of plastic pollution. Government should adopt a constitution that prohibits the use of single-use plastics, or those who choose to use them should pay a fee or be subject to a tax, with the proceeds going toward cleanup. Microbead usage in the cosmetics industry should be reduced, or if it persists, fines should be imposed. Additionally, there should be a tax on people who use fishing gear, with the proceeds going toward ocean cleanup. Fishing gear that has been abandoned, lost, or thrown away can still trap, entangle, and hinder the growth, reproduction or even dead of marine mammals.

Recycling: This enables the conversion of used products into useful products. All of Nigeria's states should have recycling facilities installed by the federal government because doing so will promote waste recycling and give many young people who are unemployed employment opportunities. The government should assist those who are interested in the recycling industry because some may not be able to afford the recycling equipment. Both public and private businesses should adopt new methods to begin using recycled plastics that have been extracted from the ocean for product packaging.

Due to its affordability and ability to be recycled, plastic waste has attracted the attention of numerous researchers who have studied its potential as a source of energy (Oyake-Ombis, et al., 2015). States with high plastic waste generation rates, like Bayesa, Katsina, Lagos, and Oyo, should explore the use of plastic wastes for production of energy through techniques such as thermal and catalytic pyrolysis, fluid catalytic cracking, and microwave-assisted pyrolysis. Given that Nigeria is currently experiencing a decline in oil revenue; plastic waste can be used to produce fuel for domestic and industrial use as the country's energy needs continue to grow (Chanashetty, et al., 2015). Recycling plastic and other waste would improve Nigeria's economic condition.

Education and creation of awareness: Government officials, residents of urban and rural communities, and business owners should all attend seminars and workshops to learn the importance of starting a recycling business and the importance of disposing of waste in the proper recycling bins. Anyone who breaks this rule should be fined. They should also be made aware of how plastic pollution affects marine life, as ignorance of environmental issues is a major contributing factor to the illegal disposal of plastic. They ought to be persuaded to cook more frequently in order to eschew takeaway food and to back a fee on plastic bags. The plastic hazard can be significantly reduced at the individual level by choosing reusable shopping bags, water bottles, and cups as well as by refusing to use personal care products that contain microplastic (Patel, et al., 2000)(Fig. 2).

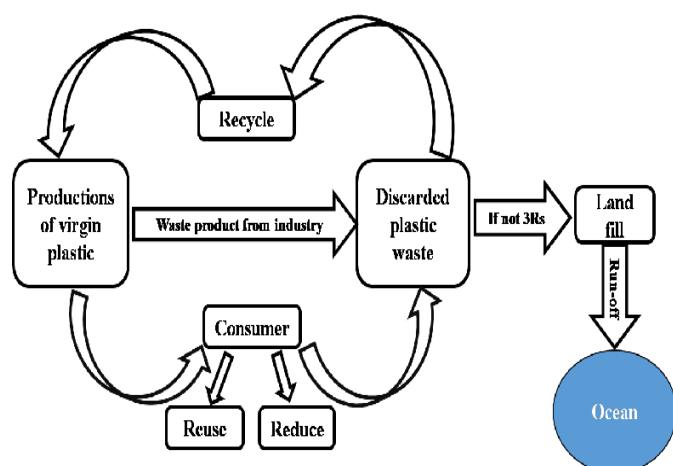


Fig. 2. Frame work for plastic waste Circulation.

CONCLUSION

Bayesa, Katsina, Lagos, and Oyo are four states in Nigeria with a reputation for producing a lot of plastic waste. It was found that the production of plastic waste was not related to population size, rather it depends on the level of urbanization and if precautions are not taken, plastic pollution is predicted to increase exponentially in the coming years. In order to lessen the threat of plastic waste generation and its effects, this paper suggested some policies and strategies. Nigeria ought to either outlaw the use of single-use plastic or impose a tax or levy. Nigeria must enact legislation modeled after that of the other nations mentioned above, with a focus on industrial regulations for single-use plastics producers and sellers. The same as the US, producers, sellers, and users of different types of fishing gear should pay taxes or even be outlawed. Recycling of plastic waste shouldn't be disregarded because it will not only help reduce plastic waste but also help Nigeria's economy.

Alternatives to plastic may also be used, despite their lack of widespread awareness. There are some raffia-based, biodegradable substitutes for plastic bags that are kind to the environment. For instance, palm-fronted wooden baskets and jute bags. Adopting policies for ocean clean-up that would assist in removing some lost gear and other litter is recommended. These policies should also be flexible. After these policies are put into place, plastic pollution should be tracked using a research approach to determine how effective the suggested policies are.

Finally, in order to frame Nigeria's approach to reducing plastic pollution, Nigeria should take lessons from other nations that have successfully done so through the implementation of policies and recycling.

REFERENCES

- Enyoh CE, Verla AW, Verla EN and Ihenetu SC. 2019. Macrodebris and microplastics pollution in Nigeria: First report on abundance, distribution and composition. *Environ Anal Health Toxicol.* 34(4):1-15
- Thompson RC. 2017. Future of the sea: Plastic pollution, a review commissioned as part of the UK government's Foresight Future of the Sea project.
- Duru RU, Ikpeama EE and Ibekwe JA. 2019. Challenges and prospect of plastic waste management in Nigeria. *Waste Dispose Sustain Energy* 1:117-126.
- Eriksen M, Lebreton LCM, Carson HS, Thiel M, Moore CJ, Borerro JC, Galgani F, Ryan PG and Reisser J. 2014. Plastic pollution in the World's Oceans: More than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. *PLoS One.* 9(12):e111913.
- Lebreton LCM, Van der Zwet J, Damsteeg JW, Slat B, Andrady A and Reisser J. 2018. River plastic emissions to the world's oceans. *Nat Commun.*8:15611.
- Galgani F, Fleet DM, Van Franeker J, Katsanevakis S, Maes T, Mouat J, Oosterbaan L, Poitou I, Hanke G,

- Thompson R, Amato E, Birkun A and Janssen C. 2010. Marine strategy framework directive, task group 10 report. *Mar Litt Pollut.*10:57.
- Siddiqui J and Pandey G. 2013. A review of plastic waste management strategies. *Int Res J Environ Sci.*13(2):12.
- Verla AW, Enyoh CE and Verla EN. 2019. The importance of micro-plastics pollution studies in water and soil of Nigeria ecosystems. *Environ Pollut.* 2 (3):89-96.
- Law KL, Moret-Ferguson S, Maximenko NA, Proskurowski G, Peacock EE, Hafner J and Reddy CM. 2010. Plastic accumulation in the North Atlantic subtropical gyre. *Science.* 329 (5996):1185-1188.
- Desforges JP, Galbraith M, Dangerfield N and Ross PS. 2014. Widespread distribution of microplastics in subsurface seawater in the NE Pacific Ocean. *Mar Pollut Bull.* 79(1-2):94-99.
- Elena E. 2017. Plastic pollution on the Baltic beaches of Kaliningrad region, Russia. *Mar Pollut Bull.* 114 (2):1072-1080.
- Dekiff JH, Remy D, Klasmeier J and Fries E. 2014. Occurrence and spatial distribution of microplastics in sediments from Norderney. *Environ Pollut.* 186:248-256.
- Tiwaria M, Rathoda TD, Ajmala PY, Bhangare RC and Saha SK. 2019. Distribution and characterization of microplastics in beach sand from three different Indian coastal environments. *Mar Pollut Bull.* 140:262-273.
- Hammer J, Kraak MHS, Parsons JR. 2012. Plastics in the marine environment: The dark side of a modern gift. *Rev Environ Contam Toxicol.* 220:1-44.
- Plastic pollution, Encyclopædia Britannica.
- United Nation Department of Public Information. 2017. Under water Plastics pose biggest threat to oceans: Global Economics Gravity Pulling Towards African. *African renewal amazine.* 31:1.
- Jambeck JR, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R and Law KL. 2015. Plastic waste inputs from land into the ocean. *Science.* 347:768-771.
- Schmidt C, Krauth T and Wagner S. 2017. Export of plastic debris by rivers into the sea. *Environ Sci Technol.* 51(21):12246-12253.
- Franzen H. 2017. Almost all plastic in the ocean comes from just 10 rivers. *Deutsche Welle.*
- Babayemi JO, Nnorom IC, Osibanjo O and Weber R. 2019. Ensuring sustainability in plastics use in Africa: Consumption, waste generation, and projections. *Environ Sci Eur.* 31:60.
- Usman AB. 2019. Current status of waste management and plastic management, policy and industry aspect. *Federal ministry of Environment.*
- Darshan R and Gururaja S. 2017. Design and fabrication of crusher machine for plastic wastes. *Int J Mech Prod Eng.* 5 (10):55-58.
- Olanrewaju OO and Oyebade AD. 2019. Environmental menace of plastic waste in Nigeria: Challenges, policies and technological efforts. *Plastic Recycling and Re-usability.*
- Babayemi JO, Ogundiran MB, Weber R and Osibanjo O. 2018. Initial inventory of plastics imports in Nigeria as a basis for more sustainable management policies. *J Health Pollut.*8 (18):6-20.
- Riskey E. 2017. Which countries have banned plastic bags?
- Iverson AR. 2019. The United States requires effective federal policy to reduce marine plastic pollution. *Conserv sci pract.* 1(6):e45.
- Xanthos D and Walker TR. 2017. International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review. *Mar Pollut Bull.* 118:17-26.
- HRM (Halifax Regional Municipality), Garbage and Recycling, Retrieved from 2015.
- Iverson AR.2019. The United States requires effective federal policy to reduce marine plastic pollution. *Conserv sci pract.* 1(6):e45.
- Jeftic L, Sheavly S and Adler E. 2009. Marine Litter: A Global Challenge.
- Walmart Canada. 2016. *Plastic shopping bag reduction.*
- NESREA. 2009. National Environmental Standards and Regulations Enforcement Agency; Laws and Regulations.
- Oyake-Ombis L, Van Vliet BJ and Mol AP. 2015. Managing plastic waste in East Africa: Niche innovations in plastic production and solid waste. *Habitat Int.* 48(0):188-197.
- Chanashetty VB and Patil BM. 2015. Fuel from plastic waste. *Int J Emerg Technol* 6(2):121-128.
- Patel M, Von Thienen N, Jochem E and Worrell. 2000. Recycling of plastics in Germany. *Resour Conserve Recycle.* 29:65-90.
- Shah AA, Hasan F, Hameed A and Ahmed S. 2008. Biological degradation of plastics: A comprehensive review. *Biotechnol Adv.* 2:246-65.