e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 12, December 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

© 2024 IJMRSET | Volume 7, Issue 12, December 2024| DOI: 10.15680/IJMRSET.2024.0712221

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

State of Plastic Waste Pollution in Port Harcourt and Public Health Implications: A Review

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ABSTRACT: In many direct and indirect ways, plastic, one of the most popular materials in today's industrial world, is a major threat to the environment and the health of consumers. Cancers, birth defects, weakened immunity, endocrine disruption, developmental and reproductive effects, and other serious negative health outcomes are associated with exposure to hazardous chemicals during manufacturing, leaching in food items stored in plastic packaging, and children chewing plastic toys and tethers. With an estimated 80 million tons of plastic-related debris being dumped into the ocean each year, plastic pollution is one of the main problems affecting the status quo in the universe. The level of plastic pollution in Port Harcourt and its effects on public health were determined by this study. It also found that different towns and institutions in Port Harcourt needed to educate people about plastic pollution. Along with other creative techniques, the study suggested using poetry, music, and educational blogs to teach about plastic waste and promote sustainable development in Port Harcourt. The clear request for more thorough research on the effects of plastic waste on public health in Rivers State came at the end.

KEYWORDS: Plastic pollution, public health, waste management, sustainable development, education.

I. INTRODUCTION

Approximately 80 million tons of plastic-related debris are dumped into the ocean each year, making plastic pollution one of the biggest problems affecting the status quo in the cosmos (Awuchi & Awuchi, 2019). Ocean warming, overfishing, ocean acidification, eutrophication, deoxygenation, shipping and undersea noise, invasive species, habitat destruction and fragmentation, and other types of chemical pollution are some of the man-made environmental hazards, and plastic pollution is just one of them. Globally, the amount of plastic garbage has skyrocketed due to economic development and shifting consumer and industry habits (Chow et al., 2017). A dangerous cocktail is created when plastic pollution is combined with other dangers to marine life. Plastic's impact on marine ecosystems shouldn't be seen in a vacuum. Plastic is now present in human diets and can travel all the way up the marine food chain when consumed. Field and lab research have shown that plastics and the chemical contaminants they contain can go up the marine food chain when consumed by marine creatures. The amount of plastic pollution in the world's oceans has increased dramatically.

According to data from 24 oceanic expeditions, at least 5.25 trillion pieces of plastic weighing more than 250,000 tons were discovered in the ocean; however, more recent estimates based on the Great Pacific Garbage Patch suggest that the amount of plastic may be four to sixteen times greater than previously believed (Lebreton et al., 2018). Metal, glass, and paper are far less common in the environment than plastic, which accounts for almost 80% of all litter (Galgani et al., 2010). Because microplastics are so common in the environment, scientists, the media, and governmental and non-governmental organizations face significant challenges as a result. The primary obstacle to removing microplastics from the environment is their discomfort. According to Siddiqui and Pandey (2013), the average population growth rate in Nigeria between 2000 and 2017 was 2.37. This growth rate is strongly related to the rate of increase in Municipal Solid garbage (MSW) in general and, therefore, plastic garbage (Enyoh et al., 2019). The annual rise in plastics production (10.3%) and consumption (6.5%) has unavoidably increased, leading to a rise in the quantity of plastic garbage generated annually (Verla et al., 2019). This might have led to a significant rise in Nigeria's microplastic contamination.

© 2024 IJMRSET | Volume 7, Issue 12, December 2024| DOI: 10.15680/IJMRSET.2024.0712221

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It was dubbed a "planetary crisis" by the United Nations (UN) (MacLeod, Arp, Tekman, & Jahnke, 2021), although Daltry, Merone, and Tait (2021) called it a "plastic pandemic." The issue of marine plastic pollution has spread rapidly from the poles to the most isolated islands, from the sea's surface to the deepest ocean trench. Even if present government and corporate commitments are fulfilled, plastic pollution is expected to continue to rise (Borrelle et al., 2020). In response, urgent global and systemic measures are required (Elhacham, Ben-Uri, Grozovski, Bar-On, & Milo, 2020). The startling statistics about how plastic waste affects life are alarming. Around 380 million tonnes of plastic are manufactured annually worldwide as of 2018. Over 7.8 billion tons of plastic were produced worldwide between the 1950s and 2018. Nine percent has been recycled, while an estimated twelve percent has been burned (The Economist, 2018). Over 23,400,000 tons of plastics were imported into Nigeria's technology sector between 1996 and 2014, yet less than 12% of the resulting waste was recycled.

Given the risks this volume causes to human health and local and global environments, effective management of this important waste and resource category is required (Ugochukwu et al., 2018; Ogboeli et al 2024). Significant efforts have been made in some areas to reduce plastic pollution through encouraging recycling and lowering plastic usage (Walker, Tony, and Xanthos, 2018). According to several academics, the weight of plastic debris in the world's oceans may surpass that of fish by 2050 (Sutter, 2016). Over the past 50 years, plastic output has steadily increased worldwide, rising from 2 million metric tons in 1950 to 381 million metric tons in 2015, and is predicted to reach 100% growth in 2020 (Envis and Hub, 2018).

According to Royer et al. (2018), 8,300 million metric tons of plastic were produced worldwide between the year 2000 and 2018. Over 60% of all municipal solid trash worldwide is made up of plastic waste, of which 78% is disposed of and 22% is recovered (Ogwo et al., 2013; Ayo et al., 2018). With a production rate of almost 12 tonnes of plastic garbage every second, an estimated 367 million tonnes of plastic were produced in 2020 (Sogbanmu, 2022). Every year, more than 280 million tons of plastic are manufactured, with the four main industries of packaging, construction, automotive, and electrical and electronics accounting for over 75% of the demand. Oliver and Thevenon (2014).

According to Hahladakis (2018) and Van et al. (2020), plastic is a general term for polymeric materials that may incorporate other compounds (additives) to increase efficiency, lower costs, and achieve desired color. Plastic materials are made from a variety of polymers, including seven different kinds of polymer resins (Bashir, 2013). Among these are polyethylene terephthalate (PETE), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), and other polymers, including nylon, acrylic, and polycarbonate (PC) (Seaman, 2020). However, if we want to reduce the ecological and economical repercussions of plastic pollution, we must prioritize reducing the amount of plastic trash generated in Port Harcourt and the subsequent discharge of litter into the environment and water. Therefore, this paper's main goal is to assess Port Harcourt's plastic waste pollution and its effects on health.

II. METHODOLOGY

This study used an existing literature review to investigate "the impacts of plastic pollution on public health in Nigeria." Surveying theoretical underpinnings and prior research on the topic was the primary goal of this study. It also looked at Nigeria's present efforts to lessen the negative effects of plastic pollution on public health.

Waste management and plastic pollution

In sub-Saharan Africa, waste management is a significant issue. Mostly due to the absence of a skilled staff, a recycling infrastructure, and other relevant considerations (Asase et al., 2009). According to Jambeck et al. (2018), 4.4 million tons of solid waste were thought to be "mismanaged" on the continent in 2010. However, Nnaji (2014) notes that waste management encompasses a number of phases, including "generation and storage, collection and transfer, sorting, treatment, material recovery, and disposal." For these stages, Nigeria lacks the necessary infrastructure, skilled workforce, and willpower. Nigeria lacks sufficient operational facilities for the collection and recycling of both plastic and nonplastic garbage (Salami, 2018).

Because of the insufficiency and inefficiency of the waste management system, Kofoworola (2007) claims that "more than half of the waste in Lagos is left uncollected from the streets and the various locations." This is consistent with the

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findings of Ogwueleka (2009), who estimated that between 30 and 60 percent of the nation's solid trash is not collected. As a result, there is a greater chance that macroplastic trash will break down into microplastics as part of this uncollected garbage. Nnaji (2014) pointed out that 80% of people in other Nigerian cities, towns, and villages do not receive the services of waste collectors and instead dispose of their waste themselves. In Abuja, the DFID (2004) estimated that the waste collection agency serves roughly 56% of people living in the Federal Capital Territory. The majority of waste management organizations and infrastructure are in a dysfunctional state, which makes it difficult for them to collect waste efficiently and on time. This, in turn, affects the amount of plastic pollution (Nnaji, 2014).

The fact that trash management and collection are not privatized is another important component in Nigeria's pollution problem (Ogboeli et al 2024). Instead, it is almost entirely controlled by government organizations with undertrained employees and antiquated or subpar waste management infrastructure (Ike et al. 2018). This makes the nation's plastic (and other types of) pollution problem worse. Lack of funding, inadequate waste collection staff, and a shortage of waste collection vehicles were among the issues the Northeastern Polytechnic's waste management department faced, according to a study by Akeh and Shehu (2018) that looked at solid waste disposal and management in the institution.

Once more, the few waste collectors that are available must limit their services to areas that their vehicles can easily access due to the general lack of the necessary infrastructure, such as a dependable road network in Nigeria (Nnaji 2014), which leaves the great majority of households unattended. As a result, locals who might like to utilize their services turn to unlawful open disposal sites. Furthermore, there is a problem with people not knowing that waste management services exist, which results in their not using the limited places where they could be accessible (Babayemi & Dauda, 2009).

Understanding plastic pollution

One of the most popular materials in today's industrial world, plastic poses a major risk to consumer health and the environment in a number of direct and indirect ways. According to Rustagi, Pradhan, and Singh (2011), exposure to hazardous chemicals during production, leaching in food items stored in plastic packaging, or children chewing plastic toys and tethers is associated with a number of serious negative health outcomes, including cancer, birth defects, weakened immunity, endocrine disruption, and effects on development and reproduction. According to Laura (2018), plastic pollution is the accumulation of plastic particles in the environment that negatively impacts humans, wildlife, and wildlife habitat. Examples of these particles include plastic bottles, plastic bags, and many more. Plastic pollutants are classified as macro-, meso-, or micro-debris according to their size (Hammer et al., 2012). Because plastics are affordable and long-lasting, humans produce a lot of them (Hester and Harrison, 2011).

However, some plastics decay slowly because of their chemical makeup, which renders them resistant to several natural degradation processes (Le Guern, 2018). Together, these two elements have contributed to the world's extremely high level of plastic pollution. Fisheries, tourism, ecosystems, drainage systems, and wildlife are all being negatively impacted by plastic waste. Part of the solution to the global climate change crisis is addressing the issue of plastic pollution. Innovation will be required to find solutions for plastic waste and alternatives (Ogboeli et al 2024).

The development of mechanisms that allow communities to transform waste into wealth—a notion that helps to consider waste management of all kinds as a resource rather than a waste product—and long-lasting solutions to plastic pollution can be achieved with the aid of new skills, knowledge, and education (Sosale et al., 2021).

The need for plastic pollution education in Nigeria

One effective strategy to combat the expanding plastic pollution epidemic is plastic pollution education. Creating educational programs at all educational levels promises to advance a comprehensive awareness of the issues and provide individuals with the skills and knowledge necessary to address the plastic pollution challenges that are wreaking havoc on our planet. To reduce the amount of plastic garbage that contaminates the land, enters rivers, and ends up in the ocean, immediate action is required (Sosale, Shepardson, Aedo & Jha, 2021). Innovative solutions can be fueled by knowledge and abilities. First, human behavior can be changed through education. Good environmental habits and behaviors can be instilled in parents and communities through well-designed educational programs and creative instructional toolkits for plastic waste management (Anabaraonye, Nji, Hope, 2018).

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Second, education can provide young people the tools they need to create creative solutions to the climate crisis. For such answers, tertiary education is essential. In addition to creating educational paths between the technological environment, climate jobs, and higher education, training on climate change issues and university-industry links can boost innovation and increase possibilities. Third, education may foster creativity to broaden solutions and provide people the know-how to construct using renewable resources and eco-friendly, energy-efficient, and climate-resilient materials. According to Anabaraonye, Okafor, and Hope (2018), curriculum content that emphasizes climate change adaptation and mitigation has the potential to alter behavior and cultivate knowledge that can result in climate action. Fourth and lastly, the education sector can generate the knowledge and skills necessary for adaptation, mitigation, and the formulation of suitable policy solutions to address the shift to a fully decarbonized economy by conducting climate change research and development in higher education. Furthermore, the education sector can provide answers for group initiatives centered on innovation, such as increasing investments in all types of capital.

The public health implications of plastic pollution in Nigeria

Plastics include untreated monomers and other hazardous materials that were long thought to be inert. Because they absorb and transmit other pollutants, or because they are directly poisonous, certain plastics may be chemically hazardous (Rochman et al., 2013). According to Sharma and Chatterjee (2017), chemical reactions can cause injury to the heart, brain system, reproductive system, and possibly even cancer. The effects of estrogen in live things can be mimicked by monomers and other chemicals found in plastics. Plastic particles contain dangerously high levels of pesticides and organic toxins—100 times more than sediments and a million times more than seawater (Rochman et al., 2013). The main ways that people consume microplastics are through seafood, alcohol, and plastic-bottled water (Coxet al., 2019).

Although research on the harmful effects of microplastics in food webs is complicated and still in progress (Seltenrich, 2015), there is evidence that ingesting these microplastics may cause infertility, obesity, and possible endocrine dysfunction, including oestrogen mimicking, which has been linked to breast cancer in women. Although it can be challenging to distinguish between exposure through food packaging and exposure from pollutants and food webs, it could be argued that this distinction is immaterial if serious consequences for human health start to materialize (Seltenrich, 2015). Plastics pose a concern to human health because they include additives like plasticizers, monomers like bisphenol A (BPA), or both (Halden, 2010).

Although little is known about the long-term health consequences of plastics on humans, studies have shown that women and newborns have high amounts of BPA (Rolland et al., 2020), which may change children's white matter (Ellahi & Rashid, 2017). Longer-term studies are needed to confirm these findings. BPA is an addition to various types of plastic as well as a component of plastic monomers. The most frequent way that plastic packaging exposes people is by ingestion, especially reusable plastic packaging where frequent washing and storage causes the polymer to break down. Approximately 95% of people have measurable levels of BPA in their serum and urine, according to studies. Since BPA is known to bind to oestrogen receptors, it is currently categorized as an endocrine disruptor and an oestrogen mimic, although its overall health consequences are still up for debate and not entirely understood.

Increased postnatal development, early sexual maturation in females, sex hormone abnormalities in both males and females, lower fertility in males, prostatic hyperplasia, immune system changes, hyperactivity, and more are among the effects of BPA that have been observed in animal research. Research on safe substitutes for BPA is necessary since replacement phenols can be equally detrimental to human health (Moon, 2019). Due to their low cost of production and single-use sterility, plastics are widely used in Nigeria's healthcare system (Halden, 2010). Phthalates are found in medical equipment used in dialysis, blood transfusion, and extra-corporeal membrane oxygenation (ECMO). Food tainted by plastic wrapping can also contain these substances. Animal male reproductive system abnormalities and endocrine disturbance are among the health issues linked to phthalates, despite their quick metabolism. Serum phthalate levels, a larger waist circumference, and insulin resistance have also been linked in human investigations (Halden, 2010). Although there is still some scientific disagreement regarding the risks of phthalates to human health, longitudinal birth cohort studies in animals have shown that phthalate exposure during pregnancy can affect brain development, and there is growing evidence that phthalate exposure raises the risk of learning and attention problems in children (Engel et al., 2021).

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In order to reduce potential hazards, more comprehensive and integrated safe recycling and disposal of plastics must be greatly expanded globally, even though the dangers and effects of exposure to plastic-related toxins require additional research. In addition to their chemical impacts, plastics have an indirect impact on human health by upsetting ocean ecosystems. For example, plastic pollution is directly affecting coral reefs in addition to rising oceans brought on by climate change. Corals consume microplastics through their diet of zooplankton and related tiny organisms. Coral reefs are crucial coastal structures that serve as natural physical barriers against storms and cyclones in addition to being important parts of food webs and ecosystems. According to Jones et al. (2018), 87% of coral reefs globally have some degree of degradation, which exacerbates the consequences of greenhouse gas emissions and other human-caused effects on the oceans. Coral reefs' deteriorating health in an already hostile environment is exacerbated by plastic-related harm.

RECOMMENDATIONS

1. It is important to incorporate instruction on plastic pollution into Rivers State curricula at all levels in order to firmly establish positive attitudes about reducing plastic pollution. Rivers indigens urgently need to be educated on the five "R" strategies for managing plastic waste.
2. Reduce, refuse, reuse, repurpose, and recycle is a motto that addresses preventing plastic pollution to some extent. This focuses on the actions that people can take to prevent environmental contamination. There are comparatively simple ways to address other sources of microplastics, like clothes and cosmetic beads, but they also call for consumer education and regulatory changes. Discussion, policy creation, and choices about production, consumption, and waste management are all need to address the more complicated problem of our societies' reliance on plastic (Daltry et al., 2021).
3. Effective plastic waste management in Rivers' major businesses and infrastructure requires long-term planning. We must put in a lot of effort to stop the spread of plastic pollution. Cleaning up after plastic pollution is significantly less effective than addressing its causes before it occurs (Tekman, Walther, Peter, Gutow, & Bergmann, 2022).
4. The problem of plastic pollution impacts the entire planet, much like the climate crisis. Global cooperation and structural solutions will be successful in responding to the steadily rising amounts of plastic pollution. The issue is currently receiving encouraging public attention, and there are increasing calls for swift international action to reverse the trend before plastic pollution compromises the resilience of a significant number of marine species and ecosystems (Walther, 2015).
5. Simply preventing plastic waste from ever entering the environment is a significantly more essential strategy, which also entails a significant decrease in the manufacture of primary plastics. Additional advantages of this strategy would include lower pollution and resource consumption from plastic trash disposal, transportation, and manufacture.
6. As effective means of educating people, communities, and institutions throughout Rivers State about climate change challenges and plastic pollution prevention for sustainable development, poetry, music, and educational blogs are suggested (Anabaraonye, Nji & Hope, 2018).
7. To help eliminate plastic pollution in Port Harcourt, the Rivers State government should give talented and driven young people enough money to understand and take advantage of green business opportunities in recycling plastic waste (Anabaraonye, Nwobu, Nwagbo, Ewa & Okonkwo, 2022).
8. More work needs to be done to raise public understanding of bio-based and biodegradable goods, their characteristics, applications, and the effects they have on the environment and human health (Filho, Barbir, Abubakar, et al. 2022).

III. CONCLUSION

In order to implement sustainable solutions, the widespread problem of plastic pollution in Port Harcourt, Rivers State, Nigeria, requires rapid attention and coordinated efforts from multiple stakeholders. The review's conclusions highlight the pressing need for improved waste management facilities, public education initiatives, and legislative measures to address the growing issue of plastic trash accumulation. To protect the environment and advance public health in Port Harcourt, it is imperative to address the obstacles to efficient plastic waste management, such as insufficient infrastructure, ignorance, and inappropriate disposal methods. It is imperative that committed citizens, educators, and professionals from a variety of communities, cities, and institutions in Port Harcourt, Rivers State, take up the critical duty of educating people about plastic pollution. Policymakers may strive toward a cleaner and more sustainable future for Port Harcourt by utilizing cutting-edge technologies and encouraging community involvement, which will lessen the negative effects of plastic trash on ecosystems and public health. In order to promote good change and build a more resilient and ecologically conscious society in Port Harcourt, Rivers State, cooperative projects, research projects, and

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policy interventions are crucial going forward. We can work together to create a healthier and greener environment for present and future generations.

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ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

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