

Save Environment, Save Life in Dhaka City: A case study in Eden Mohila College

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Abstract: Plastic pollution is a persistent challenge worldwide with the first reports evidencing its impact on the living and nonliving components of the environment dating back more than half a century. The rising concerns regarding the immediate and long-term consequences of plastic matter entrainment into foods and water cannot be overemphasized in light of our pursuit of sustainability (in terms of food, water, environment, and our health).Plastics are persistent and pervasive throughout the environment and have now been reported from the deepest parts of the ocean to the tops of the highest and most remote mountains. There is a body of information on the sources, degradation, and transport of plastics as well as a variety of research investigating the Eco toxicological and wider ecological consequences of plastic ingestion and accumulation. Such knowledge has been obtained with developments in field and laboratory methods for plastic identification and then well-publicized in the media and wider public communications. However, although there has been a small focus on plastic pollution within the past decade, there is plenty that we do not yet know. Even within the past five years, sources of micro plastics (1µm–5 mm) to the environment have been confirmed that had not previously been considered, for example, road paints and tire wear particles. Research focused on the monthly average value observed that the maximum plastic wastes of 3kg345gm in accounting department and a minimum plastic wastes of 1kg798gm in statistics department. Plastic in the environment, but understanding on the accumulation and impacts in terrestrial and freshwater environments is growing. There is a substantial lack of basic science focused on the efficiency of solutions aimed at mitigating plastic pollution. On average, every month about 3kg of plastic waste comes from each department in our institution. Green Voice team in Eden Mohali College is serious about mitigating the plastic pollution. Our students are preparing various reusable plastic products for eco-friendly purpose. They are also trying to implement 3Rs principal (Reduce, Reuse, Recycle) and suggested the city corporation to Recycle the plastic wastes.

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We can also inspire other affiliated colleges of Dhaka University with our innovative ideas and practices for a better eco-friendly environment.

Keywords : Plastic, Micro Plastic, Polymer, Contamination, Pollutant, Chemical.

Introduction

The past two decades have seen a significant increase in plastic debris research seeking to understand the sources, characteristic properties, transportation mechanisms, accumulation, and impacts of the material within the environment. Every day, the equivalent of 2,000 garbage trucks full of plastic are dumped into the world's oceans, rivers, and lakes^{1,3}. Plastic pollution is a global problem. Every year 19-23 million tons of plastic waste leaks into aquatic ecosystems, polluting lakes, rivers and seas. Plastic pollution can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people's livelihoods, food production capabilities and social well-being. UNEP's body of work demonstrates that the problem of plastic pollution doesn't exist in a vacuum⁵⁻⁷. The environmental, social, and economic and health risks of plastics need to be assessed alongside other environmental stressors, like climate change, ecosystem degradation and resource use. Even if you don't see discarded plastic in your community, tiny pieces of plastic have been found everywhere around the world, from the highest mountain peaks to the deepest ocean trenches. Plastic is found in the water we drink, the food we eat, the air we breathe, the soil below us, and even inside of our bodies. Plastic pollution is a human health, social justice, environmental, climate, and wildlife issue. People and communities across the world are finally waking up to the fact that plastic pollution impacts everything. We invite you to learn the facts about plastic pollution and to join us in changing the system away from single-use plastics and toward just, equitable solutions that benefit the health of humans, animals, waterways, oceans, and our environment. Plastic contamination of the marine environment has been increasingly documented since the 1970s, which is roughly 20 years after the start of mass production. There is now growing evidence of plastic contamination in terrestrial, aquatic, estuarine, and atmospheric environments. Quantifying the abundance of plastic is influenced by the sampling method chosen, and this can vary by environment type and debris size. At present, most methods depend on some degree of visual identification of items or particles. However, there continue to be updates to technological advances and laboratory techniques such as the application of gas chromatography--mass spectrometry^{4,6}.

1. Objectives:

1. Identifying the quantity of plastic wastes.
2. The implementation of 3Rs principle (Reduce, Reuse, Recycle)

2. Methodology:

2.1 Research Sites:

The study was carried out in Eden Mohila College, Dhaka (23 departments: Bangla, English, History, Islamic History& Culture, Islamic Studies, Philosophy, Economics, Political Science, Sociology, Social Work, Physics, Chemistry, Mathematics, Botany, Zoology, Geography & Environment, Psychology, Statistics, Home Economics, Accounting, Management, Marketing, Finance& Banking), college canteen, pond, playground and 6 halls (Hasna Begum, Khadija Khatun, Jabunnesa, Rajiya Begum, Bangamata).

2.2 Research design:

The research design was descriptive survey with both qualitative and quantitative methods of data collection in order to attain the comprehensive results. Qualitative method was appropriate to this investigation as it produced detailed data from a big group of participants, while exploring feelings, impressions and judgments. On the other hand, quantitative method made the use of questionnaires, surveys and experiment to gather data that is revised and tabulated in numbers, which allows the data to be characterized by use of statistical analysis. About 25000 of female students are studying in Eden Mohila College. My target they will contribute a vital role to mitigate the plastic pollution. I feel it's an opportunity as a teacher of Eden Mohila College. Green Voice team in Eden Mohali College (About 1500 students) is serious about mitigating the plastic pollution. Our students are preparing various reusable plastic products for eco-friendly purpose. They are also trying to implement 3Rs principal (Reduce, Reuse, Recycle)and suggested the city corporation to Recycle the plastic wastes.

On an average, every month about 3kg of plastic waste comes from each department in our institution. How about we try to apply 3Rs (Reduce, Reuse and Recycling) within our own campus with the help of the students and workers? We can also inspire other affiliated colleges of Dhaka University with our innovative ideas and practices for a better eco-friendly environment.

2.3 Type of Plastic Wastes:

Plastic bottle, Pen, Plastic bottle cap, Food Wrappers, Food box, Cup, Packet of chips, Ice-cream cup, Plastic glass, Polythene beg, Straws, One time spoon, One time plate, Cosmetic Packet, Shampoo Packet, Plastic glass etc.

3. Results and Discussion:

Table 3.1: Quantity of Plastic Wastes (gm.) of 23 Departments.

Name of the department	Daily (gm.) (Approximate)	Weekly (gm.) (Approximate)	Monthly (gm.) (Approximate)
Bangla	180	500	2685
English	120	620	2945
History	190	529	3198
Islamic History & Culture	210	490	2934
Islamic Studies	110	418	2796
Philosophy	170	500	2190
Economics	190	523	2498
Political Science	212	512	2945
Sociology	170	610	2579
Social Work	210	510	2684
Physics	170	419	2265
Chemistry	130	514	2187
Mathematics,	150	490	2243
Botany	180	619	2795
Zoology	160	618	2512
Geography & Environment	110	390	2198
Psychology	120	498	2154
Statistics	90	320	1798
Home Economics	110	512	2196
Accounting	210	690	3345
Management	190	714	2956
Marketing	230	689	3015
Finance & Banking	222	719	3220
Total	3834	12404	60192

Source: Field Survey, 2024.

According to the survey the weekly average value observed that the maximum plastic wastes of 690gm in accounting department and a minimum plastic wastes of 320gm in statistics department because these departments comprises of the most and least students in our respective institution. If each student from their respective department try to mitigate plastic waste and implement reuse and reduce we will get a healthy environment.

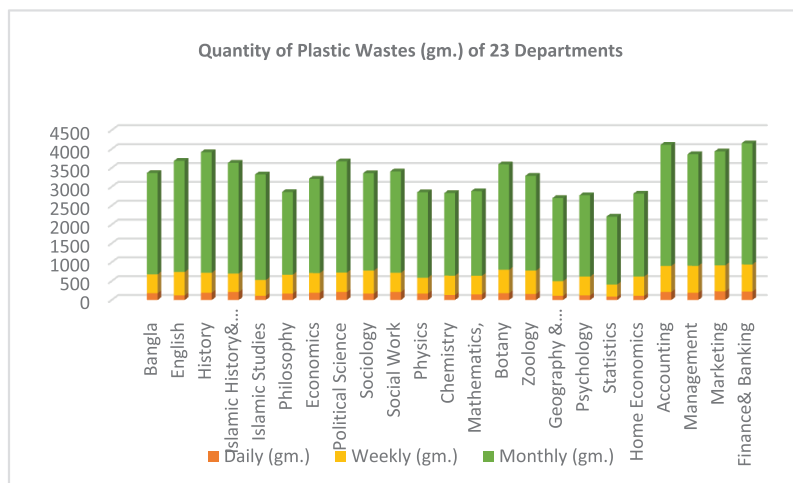


Fig 3.1: Quantity of Plastic Wastes (gm.) of 23 Departments.

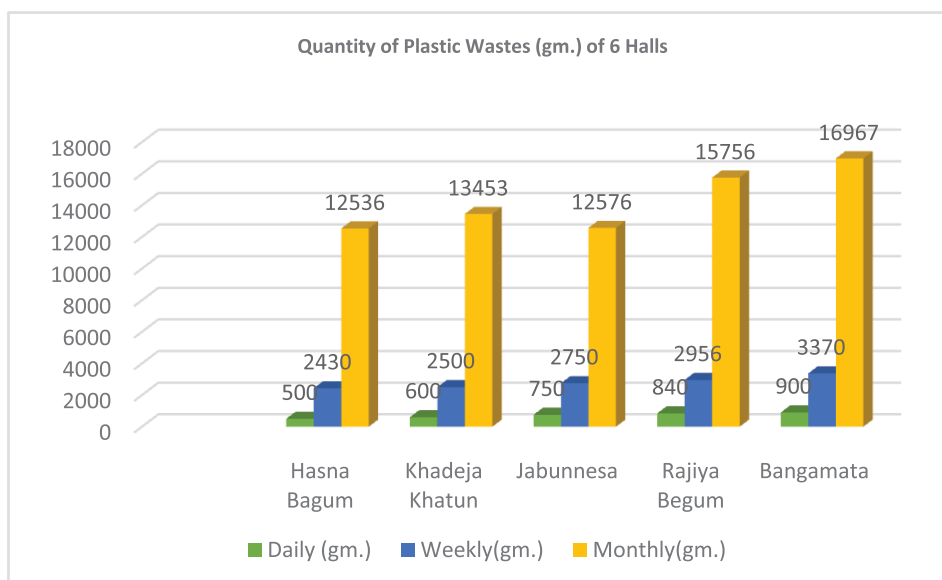
According to the survey the monthly average value observed that the maximum plastic wastes of 3kg 345gm in accounting department and a minimum plastic wastes of 1kg 798gm in statistics department. The distribution of plastic debris (macro, micro, and Nano plastics) in the environment and its entrainment into biological systems have become a serious issue. Various health conditions such as thyroid dysfunction, obesity, diabetes, and reproductive impairment have been attributed to plastic pollution. For example, it has been shown that Nano plastics impact negatively the composition and diversity of microbial communities in the human gut, which, considering emerging research evidencing the strong relationship between the gut and neural networks in the brain, could negatively impact the endocrine, immune, and nervous systems¹¹.

Table 3.2: Quantity of Plastic Wastes (gm.) of 6 Halls

Name of the hall	Daily (gm.) (Approximate)	Weekly(gm.) (Approximate)	Monthly(gm.) (Approximate)
HasnaBagum	500	2430	12536
KhadejaKhatun	600	2500	13453
Jabunnesa	750	2750	12576
Rajiya Begum	840	2956	15756
Bangamata	900	3370	16967
Total	3590	4006	71288

Source: Field survey, 2024.

According to the table 3.2, it can be observed that the weekly maximum plastic wastes of 3kg 370gm in Bangamata hall followed by Rajia Begum, Jabunnesa, Khadeja Khatun, Hasna Bagum hall. If each student from their respective hall try to mitigate plastic waste and implement reuse and reduce we will get a healthy environment.

**Fig3.2:Quantity of Plastic Wastes (gm.) of 6 Halls.**

According to the survey the monthly average value observed that the maximum plastic wastes of 16kg 967gm in Bangamata hall and a minimum plastic wastes of 12kg 536gm in Hasna Begum hall. A significantly high amount plastic pollution can causes health issues and also impact the environment. The accumulation of plastic debris (macro, micro, and nano plastics) in the environment is associated with a range of impacts. Impacts can largely be split into three main categories: (a) impacts to fauna and flora

within the environment, (b) economic consequences, and (c) impacts to health and well-being.

Table 3.3: Quantity of Plastic Wastes (gm.) of College Areas

Name of College areas	Daily(gm.) (Approximate)	Weekly(gm.) (Approximate)	Monthly(gm.) (Approximate)
College Canteen	300	2500	6845
Pond and surrounding	500	3200	9487
Play ground	250	1700	7346
Total	1050	7400	23678

Source: Field survey, 2024.

According to the table 3.3, it can be observed that the weekly maximum plastic wastes of 3kg 200gm in Pond and surrounding followed by college canteen 2kg 500gm, play-ground 1kg 700gm.

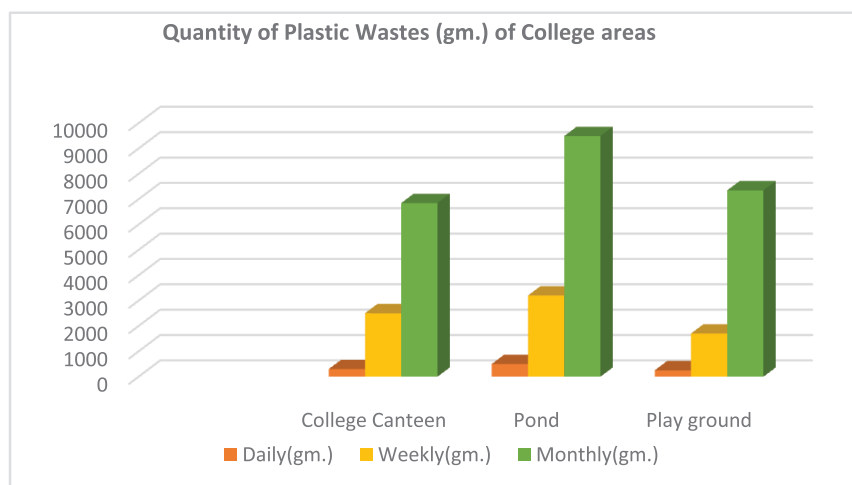


Fig3.3: Quantity of Plastic Wastes (gm.) of College Areas

According to the survey the monthly average value observed that the highest value is 9kg 487gm plastic wastes were found in surrounding pond area then play ground 7kg 346gm, college canteen 6kg 845gm. A significantly high amount plastic pollution can impacts to fauna and flora within the environment, economic consequences and

impacts to health and well-being. We should not rely on cleanup technology to fix the problem; there is no single solution that fixes all. There is a firm understanding that the rate of plastic pollution entering the environment far exceeds the rate of feasible clean-up and or complete mineralization.

Terminology:

Due to the various sources, polymer types, and sizes, a range of terminology has been used to describe plastic debris in the environment. Plastic debris can be defined in numerous ways including by origin (e.g., debris from the land, fishing-related or sewage-related debris), size, shape, color, polymer type, or original usage. As plastic debris has been reported across a wide range of sizes from discarded fishing nets that can be thousands of meters in length to microscopic fragments just microns in diameter, size is one of the commonly used classifications. Four categories that are widely used to describe the size of plastic contamination include macro plastic (>20 mm diameter), Mesoplastic (5–10 mm), micro plastic(<5 mm), and Nano plastic (1–1,000 nm)⁷.

Macro plastic refers to plastic items larger than 20 mm. Due to its high visibility, contamination of the environment by macro plastic may be perceived as one of the most concerning forms of plastic pollution, and its accumulation has been reported in a wide range of habitats. Cleanup campaigns typically focus on these larger items, and there is wide geographical variability in abundance, which increases the difficulty of analyzing potential trends. However, due to the size of this debris, it is often possible to categorize items according to their original usage, for example, packaging, fishing, or sewage-related debris ^{7,9}.

Meso plastics are relatively large plastic particles that typically measure between 5 and 10 mm in size.

Micro plastics (particles less than 5 mm in diameter) accumulate from primary and secondary sources. The distinction between the two is based on whether the particles were originally manufactured within the micro plastic size range (primary) or whether they have resulted from the fragmentation of larger items (secondary). Although the term micro plastic was first used to describe microscopic fragments of plastic in 2004, it is apparent that micro plastics are a ubiquitous component of anthropogenic debris in different environments and have been reported since the 1970s. Micro plastics substantially outnumber large plastic items in marine systems, but only account for a small proportion of the total mass of plastic in the ocean ^{5,8}.

Nano plastics are typically regarded as pieces less than 1,000 nm. Similar to micro plastics, Nano plastics can result from the erosion or breaking down of larger plastic debris and are consequently highly polydisperse in physical properties and heterogeneous in composition¹⁰.

Plastic & Social Justice

Plastic pollution is an environmental and social justice issue which disproportionately impacts Black, Brown, and Indigenous (BIPOC), and rural and low-income communities. These systemic injustices are built into government policies, society, and our economy. There is a strong connection between environmental and social injustice, racism, and classism and exposure to air pollution caused by waste incineration, landfills and illegal dumps; industrial water and soil contamination; heightened risk of accidents and explosions; and myriad other environmental injustices globally⁶. We recognize that these are all part of a single, globally connected Movement for Justice. Vulnerable communities deserve protection and respect.

Causes:

- Single-use plastics: The proliferation of single-use plastics, such as bags, bottles, and packaging, contributes significantly to plastic pollution.
- Improper disposal: Inadequate waste management systems, littering, and improper disposal of plastics into water bodies exacerbate the problem.
- Micro plastics: Micro plastics, tiny plastic particles resulting from the breakdown of larger plastics, come from sources like micro beads in personal care products and synthetic clothing.

Health and Environmental Issues:

Plastic pollution is a serious threat to the environment. Plastic pollution harms ecosystems, leading to habitat destruction, wildlife entanglement, and ingestion by marine and terrestrial animals. Plastic pollution leads to economic losses in industries such as fishing, tourism, and coastal clean-up efforts⁵. The scientists have been warning about its adverse effects. The problem has been particularly grave that despite various widely-publicized cleanliness drives, nothing is untouched by the plastic waste, and be it villages, towns, cities, metropolises, not even the country's capital, despite the fact that the use of polyethylene is prohibited. There is no gainsaying that plastics have contributed immensely to the rise of human civilization; however, the distribution of plastic

debris (macro, micro, and Nano plastics) in the environment and its entrainment into biological systems have become a serious issue. Various health conditions such as thyroid dysfunction, obesity, diabetes, and reproductive impairment have been attributed to plastic pollution¹². For example, it has been shown that Nano plastics impact negatively the composition and diversity of microbial communities in the human gut, which, considering emerging research evidencing the strong relationship between the gut and neural networks in the brain, could negatively impact the endocrine, immune, and nervous systems. As already highlighted, pollution changes the dynamics of systems and environments with consequential impacts on the natural characteristics of their living and nonliving components; thus, it is reasonable to infer that the entrainment of Nano plastics into the human gut holds physiological consequences. The nontoxicity of micro- and Nano plastics to DNA has been established. It has been demonstrated that if the plastic matter is small enough to cross the nuclear membrane surrounding the DNA, damage can occur, impairing the DNA structure or forming lesions, which, unrepaired or misreported, can cause mutagenic processes that are considered to play a role in the carcinogenesis of cells. Additionally, it was found that the type and level of damage of DNA depend on the shape, functional groups, and chemical composition of the plastic debris. The human airway is a key pathway for plastic fiber entrainment into the lungs, and bio persistence of the fibers depends on their length, structure, and chemical composition. Moreover, at certain exposure limits, all plastic fibers are likely to produce inflammation, which can lead to lung challenges such as the formation of reactive oxygen species with the potential to initiate cancerous growth through secondary nontoxicity^{11, 12}. Furthermore, PET, a common plastic employed in the food and beverage industry, is a source of endocrine disruptors; these endocrine disruptors leach from the plastic packaging into the consumables that it contains. Even at standard room temperature, phthalates (potential endocrine disruptors) are known to leach from PET packaging into various food contents in the presence of water.

The low thermal conductivities of plastic materials, although considered advantageous in certain applications (e.g., heat insulation), contribute to global warming when these plastics are distributed in aquatic environments; they displace equal volumes of water and restrict heat flow from the sun to the aquatic environment, leading to a rise in sea levels and the dissipation of energy into the immediate environment. The degradation pathways of plastics in the environment can also contribute to environmental stress.

Recommendations:

Plastic pollution is a significant environmental issue with far-reaching consequences. Addressing plastic pollution requires a multi-faceted approach involving collaboration between governments, businesses, communities, and individuals to enact meaningful change and protect the environment for future generations.

Some recommendations are as follows:

- **Reduce, Reuse, and Recycle:** Implementing the 3Rs principle—reduce plastic consumption, reuse items where possible, and recycle materials—can significantly mitigate plastic pollution.
- **Policy interventions:** Governments can enact policies such as plastic bags, taxes on single-use plastics, and incentives for sustainable packaging to regulate plastic use and encourage alternatives.
- **Public awareness and education:** Increasing awareness about the environmental impacts of plastic pollution through educational campaigns can foster behavioral change and promote responsible consumption habits.
- **Innovation and technology:** Investing in research and development of biodegradable plastics, alternative materials, and innovative recycling technologies can offer sustainable solutions to reduce plastic waste.
- **Corporate responsibility:** Encouraging businesses to adopt sustainable practices, such as using eco-friendly packaging and reducing plastic in their supply chains, can help mitigate plastic pollution.
- **Community involvement:** Engaging local communities in clean-up efforts, beach clean-ups, and river clean-ups can prevent plastic waste from entering water bodies and raise awareness about the issue.

Therefore, our foremost priority should be on reducing the use of plastics and minimize debris.

Conclusion:

Over the past decade, there has been substantial growth in plastic debris research, which has largely focused on identifying the sources, distribution, accumulation, and impacts of plastic in the environment. Plastics are destroying nature due to their harmful effect and plastic bags have become the main cause of land pollution today. The

plastic bags entering into the water bodies are a major cause of water pollution and these are deteriorating our environment in every possible way. Plastic pollution is a complex and multifaceted issue with far-reaching ecological and health consequences. Addressing this challenge requires concerted efforts at individual, community, corporate, and governmental levels to reduce plastic consumption, improve waste management infrastructure, and promote sustainable alternatives to single-use plastics. Such actions are crucial to mitigate the detrimental impacts of plastic pollution on ecosystems, wildlife, and human population. Also, plastic pollution represents a complex and interconnected challenge that requires concerted action at the global, national, and local levels. By implementing a combination of regulatory measures, technological solutions, and behavioral changes, society can mitigate the impacts of plastic pollution and transition towards a more sustainable and circular economy. Collaboration among stakeholders, including governments, businesses, civil society organizations, and the scientific community, is essential for achieving meaningful progress in addressing this urgent environmental issue. Further, addressing plastic pollution requires concerted efforts from governments, industries, communities, and individuals to adopt sustainable practices and mitigate its adverse impacts on the environment and society.

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