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Challenges of Plastic Pollution and Implementation of Sustainable Strategies

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Abstract

Plastics are threatening the ability of the global community to keep the global temperature rise below 1.5°C as the greenhouse gases (GHG) are emitted throughout the plastics life cycle. The climate change is estimated just the extraction of these fossil fuels and their transportations to plastics factories emits 1.5 to 12.5 million metric tons of greenhouse gases. Plastic can wreak slow-but-certain havoc on an environment in multiple ways, from leaching toxic chemicals into the soil and groundwater to directly choking or poisoning animals that unwittingly ingest it. The UN Treaty to end plastics pollution represents an opportunity for global action against plastic pollution and should be promoted. Plastics became an integral part in our day-to-day life. Many products have been made with plastics. It has become a part of our world due to its versatility and the cost effectiveness. Plastic is ubiquitous from a toothbrush to our carry bags, every single item contains plastic. As the conditions around global warming continue to get worse, people are becoming mindful of their choices that would affect the environment. They are aware of the damage plastic can do to the Earth. And that is why consumers are now opting for an eco-friendly substitute for plastic as they are becoming more aware of its detrimental qualities and the impact it has on human life as well as the environment. The review study focused on recent data and relevant literature to provide a critical over view of the key challenges specially related to plastic pollution as they may undermine the implementation of sustainable strategies and action plans required to achieve the UN sustainable Goals 13 and 14.

Key Words: Plastic Pollution, Climate Change, Substitute Eco Friendly Products, Sustainable Strategies.

Introduction

Plastics are threatening the ability of the global community to keep the global temperature rise below 1.5°C as the greenhouse gases (GHG) are emitted throughout the plastics life cycle. Indeed, extraction refining and the manufacture of plastics are all carbon intensive activities. In 2015, CO2 for a cost of $341 billion annually (Minder oo-Monaco Commission on Plastics and Human Health, 2023). At the disposal stage incineration of plastics waste releases significant GHG into the atmosphere, alongside toxic pollutants. Other disposal methods including recycling, also come with their share of GHG emissions. The rapid global growth of the plastics industry, largely fuelled by natural gas, undermines efforts to reduce carbon pollution and prevent a climate catastrophe. Estimates indicate the GHG emissions from the plastics could reach about 13% of the entire remaining carbon budget by the year 2050 (CIEL, 2019). OECP projects GHG emissions from plastics to increase to 4.3 billion of plastics in the oceans may also interfere with the oceans capacity to absorb and sequester carbon dioxide, thus creating another pathway through which plastics pollution contributes to accelerate climate change, various ecosystems, such as the ocean and mountain areas, are particularly vulnerable both climate change and the plastics pollution, and the combination of both is a significant stress factor on biodiversity. The global plastics industry was worth $593 billion in the year 2021 projected to grow to $811.54 billion by the year 2030 at the compound annual growth rate of 3.7% from 2022 to 2030, (Global Market Research Report 2023).

Plastics pollution affects the most vulnerable communities first, and developed countries such as the United States, send plastics to developing countries for processing. Eventually the amount of plastics can become so overwhelming that these communities run out ways to dispose of the waste was covered in plastics trash. Plastics have become essential components of products and packaging because they are durable, lightweight, and cheap, but though they offer numerous benefits, plastics originate as the fossil fuels and emit greenhouse gases from gradable to grade. Cording to the May 2019 report called “plastics & climate”. The hidden costs of a plastics planet” released by the centre for international environmental law, a non-profit environmental law organization. The 21stcentury 4-8 % of annual global old consumption is associated with plastics, if this reliance on plastics persists, plastics will account for 20% of old consumption by 2050. Worldwide more than 300 million tons of plastics in produced every year, and half of this is single-use plastics. Single -use plastics includes water and soda bottles, plastics, grocery bags, produced packaging, straws, coffee, cups, and single-use plastics baggies (World Economic Forum, 2021).

The climate change is estimated just the extraction of these fossil fuels and their transportations to plastics factories emits 1.5 to 12.5 million metric tons of greenhouse gases. Removing forested land for oil extraction and the pipeline construction has also released more than 1.6 billion metric tons of carbon-di-oxide into the atmosphere. The land cleaning also limits the amount of carbon-di-oxide are removed from the atmosphere. The refinement of plastics emits with additional 184 to 213 million metric tons of greenhouse gases each year. Landfills, where single-use plastics are sent, will account for more than 15% of methane emissions. The disposable of more plastics in landfills which leads to increase in landfills size and their emissions.

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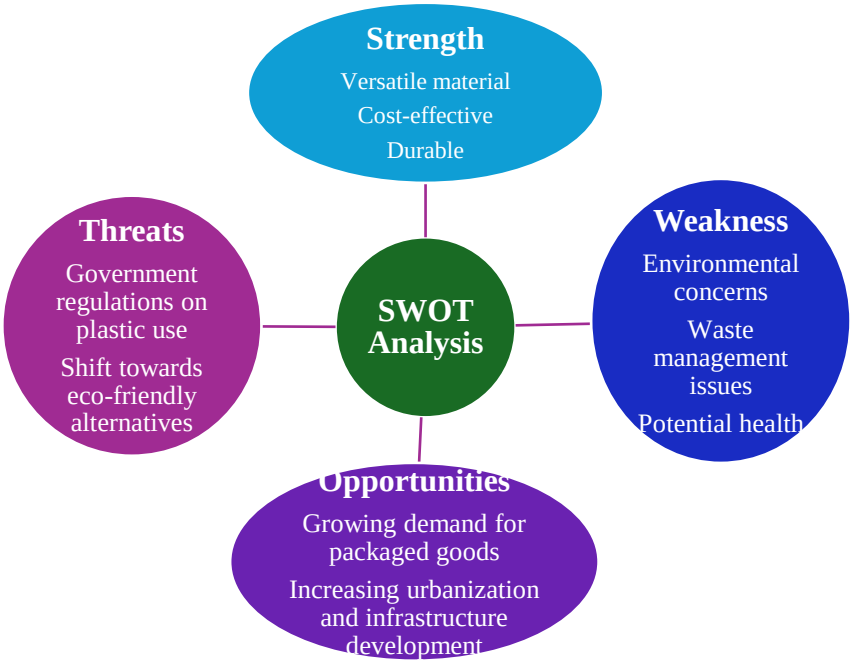

Statement of the Problem

The proliferation of plastics has emerged as a defining feature of the modern era, revolutionizing various industries and lifestyles with its versatility and convenience. From packaging materials to consumer goods, plastics have permeated nearly every aspect of contemporary life, offering unparalleled convenience and affordability. However, this ubiquity comes at a significant cost to the environment, as plastic waste accumulates in landfills, oceans, and ecosystems, posing grave threats to wildlife and human health. This study endeavours to explore the intricate relationship between global primary production and India's plastics consumption, elucidating the underlying drivers, trends, and implications. By examining the interplay between these phenomena, we aim to shed light on the complex dynamics shaping the global economy and environmental sustainability.

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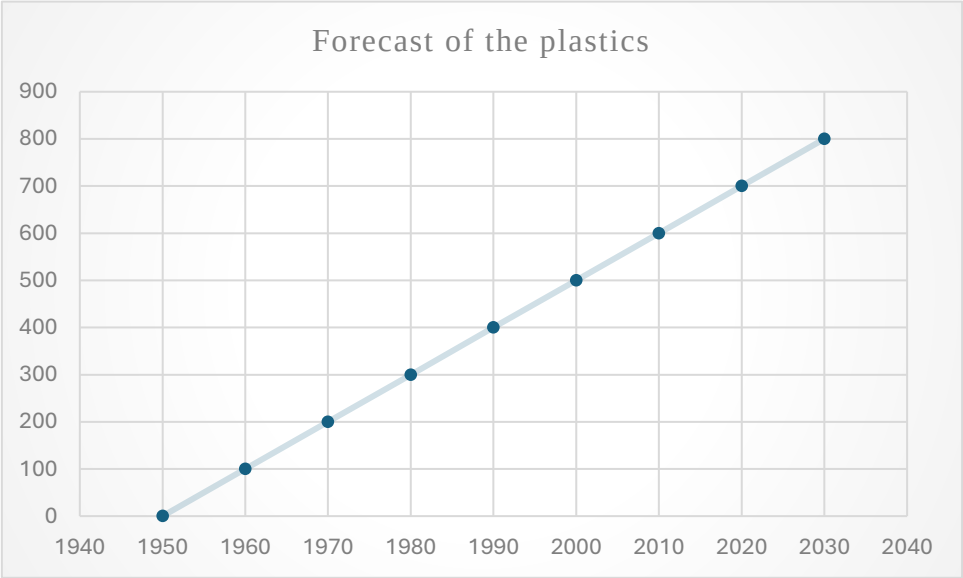
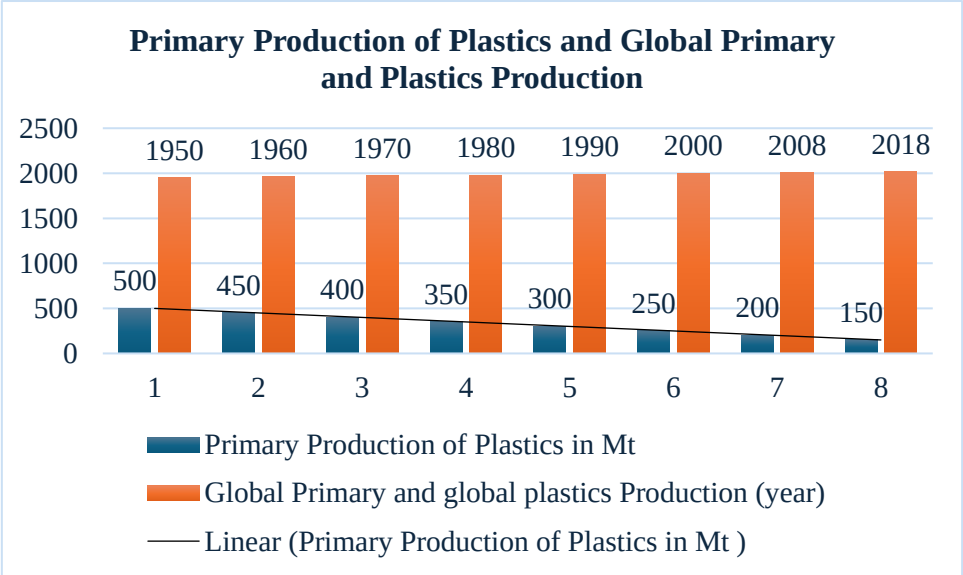
Global Plastic Production Forecasting



Source: Report on Alternative products, (2022).

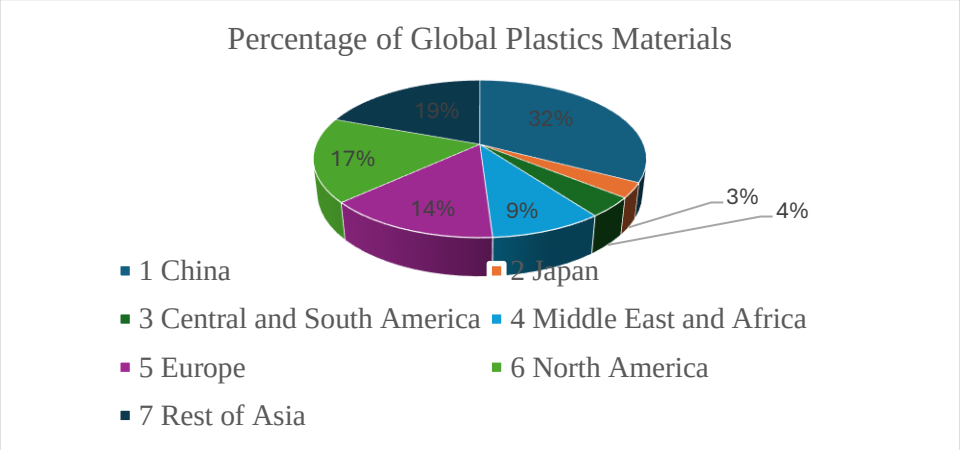
From the above figure explains globally 97.99% of the plastics are derived from the fossil fuels which will feedstock and the remaining with the percentage of the 1.3% percentage are come from the bio plant-based plastics." The world by every year and it was increased by the 2 million tons in the year of the 2015 production of the plastics consumption. The global per capita consumption in the year of 2014-2015 and it was the 28 tons of the plastics. Global production of plastics which will showed by the forecast of the plastics consumption till the year of 2040.



Source: Report on plastics Alternatives, (2022).

From the above figure 2 explains the primary production of the plastics 500.0 and the global primary and the global plastics consumption will be more than half of the amount of the plastics produced and

brought to the market after 2000. The expectation of the production of plastics will further increase to about the 600 million tons in the year of 2025. From the figure 1 the roughly twice the total weight of the world's population. The plastics packaging industry dominated the consumption by about 52% followed by the building and the construction sector by utilizing the 19% of the total plastic created. In the year of 2008 the primary production of the plastics 200.0. and in the year of 2018 the primary production of the plastics it was decreased to 150.0.



Source: Computed from Secondary Data, (2022).

Table-1

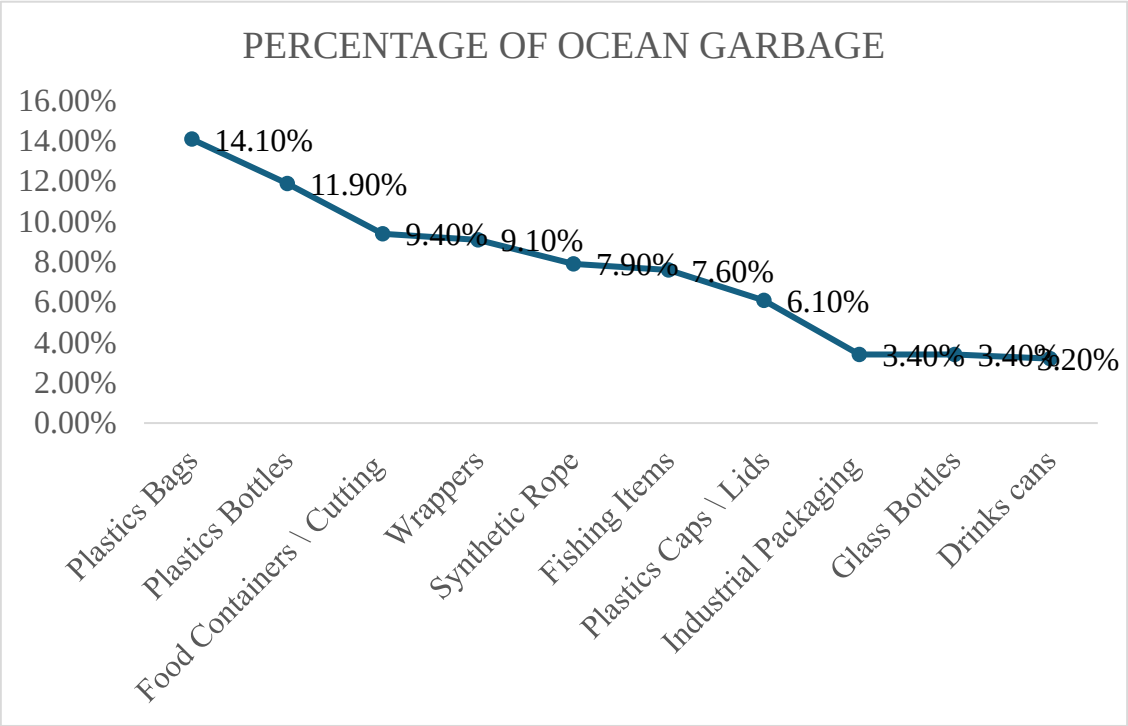
Developing Countries of Plastics Consumption

Sl.No	*Developing Countries*	*Plastics Consumption*
1	*Malayasia*	*2.29 kgs*
2	*India*	*0.09 kgs*
3	*South Africa*	*0.07 kgs*
4	*China*	*0.05 kgs*
5	*Japan*	*0.01 kgs*
6	*United states*	*0.01 kgs*
7	*Canada*	*0.01 kgs*
8	*France*	*0.01 kgs*
9	*Germany*	*0.01 kgs*

Source: Report on plastics Alternatives, (2022).

From the above table explains that the China is among the most prominent plastics consumer's accounting for the percentage of 20% of the global plastics consumption and it is followed by the Western Europe, which accounts for the 18 % of the plastics consumption in the developing countries. However, in terms of the plastics consumption percapita China is ranked much lower than the other

countries on the contrary, the United States is one of the largest per capita consumers of the plastics in the developing countries. India will consume the plastics production of 0.09 tonnes of plastics production. When compared to the China the plastics consumption of the Malaysia the consumption of the plastics will be increased to 0.09 tons of plastics.



Plastics Overshoot Day is determined based on a country's Mismanaged Waste Index (MWI). The gap in waste management capacity and plastic consumption is called MWI. The report highlights that an additional 68,642,999 tonnes of plastic waste will enter nature in 2023, indicating a severe plastics pollution crisis. The report identifies 12 countries responsible for 52% of the world's mismanaged plastic waste. India is among them, alongside China, Brazil, Indonesia, Thailand, Russia, Mexico, the United States, Saudi Arabia, the demographic republic of Congo, Iran, and Kazakhstan. The three countries with the highest mismanaged waste percentages- Mozambique (99.8%) , Nigeria (99.4%) and Kenya (98.9%) belong to Africa. India ranks fourth in the MWI, with 98.55% of generated waste. Short-life plastics, including plastics, packaging, and single-use plastics, make up approximately 37%. of the total plastics used annually. These categories pose a higher risk of leakage into the environment. Plastics Overshoot Day for India occurred on January 6, 2023, when the country's plastic waste generation outweighed its waste management capacity. India's per-person consumption is 5.3 kg, significantly lower than the global average of 20.9 kg.

Need for the Study

Plastics are widely used in food packaging, which helps to extend the shelf life of the perishable goods, reducing food waste and enabling efficient transportation of goods. plastics play a crucial role in modern medicine. They are used in medical devices, such as syringes, catheters, and artificial joints, which improve the patient care and quality of life. Plastics are used in automative applications to make vehicles lighter, which can lead to improved fuel efficiency and reduced emissions, contributing to a greener.Plastics materials are excellent insulators for electrical and thermal purposes. They help to

improve energy efficiency in buildings, and electrical devices. Certain types of plastics, like those used in pipes and the irrigation systems, help to conserve water by reducing leakages and improving water distribution efficiency.

Review of Literature

Roland Gayer, Jenna.R & Jambeck (2017) "Production, use, and fate of all plastics ever made". This review provides a comprehensive assessment of global plastics production, use, and the disposal. It quantifies the total amount of plastics produced to their distribution across the various sectors, and the environmental implications of plastics waste.

Nithin Kumar Singh and Arun kansal (2018)"Plastics Waste Management in India: An integrated Solid Waste management approach". They examined the focuses specifically on India's plastics waste management challenges and strategies. It discusses the current state of plastics consumption in India. The environmental and health impacts of mismanaged plastics waste, and potential solutions for improving waste management practices.

Ravi Agarwal and Sunita Narain (2018) "India's plastics Revolution". They focus the rapid growth of India's plastics industry and its implications for the environment and society. If examines the factors driving the demand for plastics in India. Challenges related to the plastics waste management and the policy interventions that is needed to address these issues.

Adnan Ahmad Chughtai &et.al; (2020) analyse the influence of price, quality, and friends urge on the buying behaviours. The data was collected from the 200 consumers. The study used the Likert scale to measure the attitudes of the respondents. The major findings of the study shows that the price of the particular product, perceived quality, and a role of media awareness programs and the friend's endorsement significantly influence with the buying decision of a particular product.

Matters and Materials

The world has a plastic pollution crisis. Since 1950, humans have produced more than 8 billion tons of plastic, more than half of which went straight to landfills and only about 9% of which was recycled. Plastic can wreak slow-but-certain havoc on an environment in multiple ways, from leaching toxic chemicals into the soil and groundwater to directly choking or poisoning animals that unwittingly ingest it. Larger, more populous countries tend to produce more plastic waste overall, but when the results are filtered to show the biggest producers per capita (i.e.: per person), the ranking changes significantly. The data was mainly based on the Secondary data. The data was collected from the articles, journals, newspaper, magazines, reports etc. The consumption of the Plastics production and the usage of the plastics will constraints the imposed by the scarce Natural Resources without the plastics were called the materials in the 21st century. Plastics have become an integral part of the society and the plastics have relied on them in all the walks of life.

Top 10 Plastics Waste Produced Countries in the World

S.No	*Countries*	*Metric Tonnes of Plastics*
1	*China*	*37.6M*
2	*United States*	*22.9M*

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3	***India***	***7.4M***
4	***Brazil***	***4.9M***
5	***Mexico***	***4M***
6	***Japan***	***3.8M***
7	***Germany***	***3.6M***
8	***Indonesia***	***3.4M***
9	***Thailand***	***3.4M***
10	***Italy***	***3.3M***

Major Findings

While plastic waste on land is undeniably a concern, a large percentage of plastic that isn't recycled, incinerated (which emits pollutants), or sent to landfills ultimately ends up in the oceans, where it creates even larger problems. While many high-income countries generate high amounts of plastic waste per person, they are also typically better at processing it safely, whereas middle-income and low-income countries still developing their infrastructure tend to produce a higher percentage of mismanaged waste plastic, which is more likely to find its way from land into the ocean.

India's Plastic Problem

India has emerged as one of the world's largest plastic polluters for several reasons, according to Cook. "Firstly, there is a large and increasing population which is becoming more affluent. That means more and more waste, and the country has struggled to keep pace with providing waste management services. In a way this is a typical situation seen in other countries, but it is more pronounced in India because of the large number of people." Dumping sites in the country are home to uncontrolled land disposal and outnumber sanitary landfills 10 to 1. The country's official waste generation rate, estimated to be 0.12 kg per capita per day, is possibly underestimated while waste collection is overestimated, the study noted. While India claims to have national waste collection coverage of around 95%, the study found evidence that official statistics don't include rural areas, open burning of uncollected waste, and waste recycled by the informal sector.

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Reasons for High Plastic Pollution in India

Issues Associated with Mismanaged Plastic Waste in India

Environmental Degradation: Plastic waste clogs waterways, leading to flooding and marine pollution. It harms marine life through ingestion, while burning it releases toxic pollutants, worsening air quality.

Public Health Concerns: Microplastics in water and food pose potential long-term health risks.

Plastic waste creates breeding grounds for disease vectors, increasing the spread of diseases like dengue and malaria. Burning plastic also releases harmful substances affecting respiratory health.

Economic Challenges: According to a FICCI report, India could lose over USD 133 billion worth of material value used in plastic packaging by 2030, with uncollected plastic packaging waste accounting for USD 68 billion of this loss.

E-commerce and Packaging Waste: Rapid e-commerce growth has led to increased plastic packaging waste, much of which is difficult to recycle and ends up as litter or in landfills.

Regulatory and Enforcement Challenges: Inconsistent enforcement of plastic waste regulations and issues with the Extended Producer Responsibility system hamper effective waste management.

India is among the top contributors to global plastic waste.

Microplastic Pollution in Agriculture: Plastic use in agriculture and inadequate wastewater treatment lead to microplastics accumulating in soil, impacting soil health and food safety.

Technological and Infrastructure Gaps: Inadequate waste segregation and processing facilities, along with limited advanced recycling technology, hinder effective plastic waste management. A lack of comprehensive waste tracking further complicates efforts.

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Regulations Related to Plastic Waste Management in India

Plastic Waste Management Rules, 2016

Plastic Waste Management (Amendment) Rules, 2018:

Central Pollution Control Board (CPCB)

Plastic Waste Management (Amendment) Rules, 2022

Plastic Waste Management (Amendment) Rules, 2024

Other Initiatives:

Swachh Bharat Mission

India Plastics Pact

Project REPLAN

Un-Plastic Collective

GoLitter Partnerships Project

Remedial Measures

Circular Economy: Promote RRR i.e. reduce, reuse and recyclability in design, set up recovery facilities, incentivize recycled plastics, and mandate recycled content in products.

Smart Waste Management: Integrate smart technology in waste management with IoT-enabled bins, AI for sorting, and mobile apps for reporting illegal dumping and locating recycling centres.

Extended Producer Responsibility (EPR): Strengthen EPR by introducing graded fees for difficult-to-recycle plastics, a plastic credit trading system, and extending EPR to the informal sector for better waste picker conditions.

Awareness Campaigns: Launch national campaigns in multiple languages, integrate plastic waste education in schools, conduct community workshops, and use influencers to promote plastic-free lifestyles. Establish a national innovation challenge for youth involvement.

Waste-to-Energy: Invest in advanced waste-to-energy technologies like pyrolysis and gasification for non-recyclable plastics. Ensure strict emissions controls and use generated energy to power waste management facilities.

Green Procurement: Apply plastic waste reduction criteria in government procurement and use government buildings as models.The Ministry of Environment, Forest and Climate Change of India has recently introduced amendments to the **Plastic Waste Management Rules, 2016**, through the **Plastic Waste Management (Amendment) Rules, 2024.**

Initiatives taken to Curb Plastic Waste

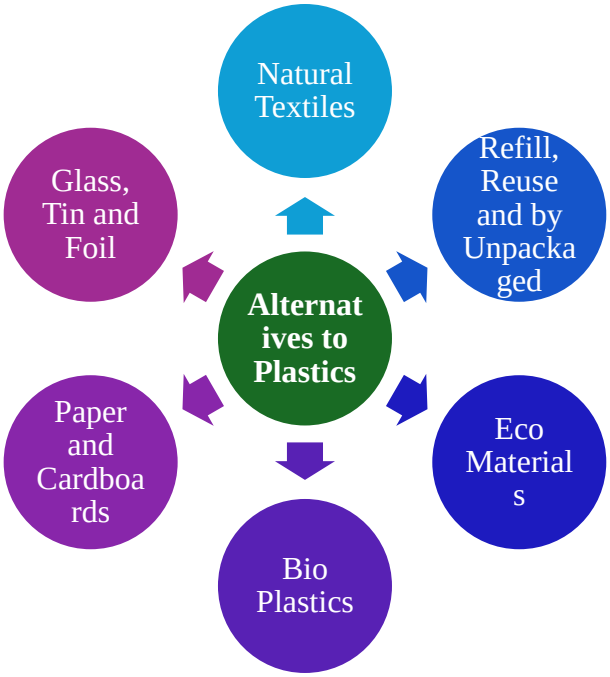
Swachh Bharat Mission: Plastic is ubiquitous. From a toothbrush to our carry bags, every single item contains plastic. As the conditions around global warming continue to get worse, people are

becoming mindful of their choices that would affect the environment. They are aware of the damage plastic can do to the Earth. And that is why consumers are now opting for an ecofriendly substitute for plastic as they are becoming more aware of its detrimental qualities and the impact it has on human life as well as the environment. Although we cannot undo the damage of a thousand years in a year or two, what we can do is try to make amendments by using ecofriendly alternatives to everyday items.

Sustainable Living: The benefits of going eco-friendly

It could be crushing when we start noticing how many plastic items, we use daily. And even more daunting when we realize how much these plastic items harm our environment. But wait, we do not need to panic about it. We can start simply including eco-friendly products and adapt them gradually into your lifestyle. Having a sustainable lifestyle is not a matter of few days, it is a commitment that we need to make to ourself and to our environment. There are multiple ecofriendly alternatives to plastic that we can incorporate into everyday use.

Alternatives to Plastics



Eco-Friendly products

Eco-friendly is the term simply describes a product that is not harmful to the environment. There are many benefits to using eco-friendly products that are not simply centered around the health and well-being of the Earth, but also the health and wellbeing of your family. The retailers play a very important role in selling the ecofriendly products to the customers. When they ensure that they are going to sell only green products then there is no other go for the customers they have to purchase only those products. Eco-friendly products are both good for the environment and safer for consumers. Eco-friendly products are goods designed to have minimal impact on the environment. And the eco-friendly products are typically made from sustainable, biodegradable, or the recyclable materials, produced using the processes which will conserve the resources and to reduce pollution.

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Characteristics of Eco-Friendly Products

Eco-friendly products have no toxic or little chemicals.

Eco-friendly products produced efficiently by utilizing the least resources possible through environment friendly practices, processes and policies.

are produced with easily recyclable materials.

Eco-friendly products use low energy and also use wind or solar power.

Eco-friendly products use energy sources efficiently.

Eco-friendly products save gas and produce low carbon emissions.

Eco-friendly products are packaged in 100 per cent recycled materials.

Eco-friendly products are easily recycled and reused.

Conclusion

By switching to Eco-friendly products, we can reduce waste and the carbon emissions and same our health, product manufactures design eco-friendly products to minimize the harmful effect on the environment, use natural materialsto make these products, and use renewable energy resources and fewer natural resources. **Extended Producer Responsibility (EPR) India** should invest in waste management policies like EPR which holds producers responsible for the end -of-life disposal of their plastics products and promotes circular economy. There is a need to invest in waste-to -energy plants that use advanced technologies like plasma gasification or anaerobic digestion to convert non-recyclable plastic waste into energy. These plants can help to reduce the dependence on fossil fuels and generate electricity while managing plastics waste effectively. The ministry of Environment, forests, and climate change has indicated that India has the capacity to process 14.2 million tonnes of plastics waste annually, which accounts for 71% of all primary plastics produced. Identifying plastics items that can be replaced with non-plastics, recyclable, or biodegradable materials is the first step. Find the alternatives to single- use plastics and reusable design goods by working with product designers. Promoting the use of Oxo biodegradable plastics, that are manufactured to be broken down by ultra-violet radiation and heat, more quickly than regular plastics. The country was among the first to propose a global ban on single -use plastics in the year of 2019. The UN Treaty to end plastics pollution represents an opportunity for global action against plastic pollution and should be promoted. Plastics became an integral part in our day-to-day life. Many products have been made with plastics. It has become a part of our world due to its versatility and the cost effectiveness. It compared with the other things such as metal, plastics make the total cost of the final product quite low.According to 2018 analysis by material Economics- as sustainability management controlling firm- using only zero- carbon energy sources, such as wind and the solar, in the manufacturing phase would decrease overall emissions by 50%. The review focused on recent data and relevant literature to provide a critical over view of the key challenges specially related to plastic pollution as they may undermine the implementation of sustainable strategies and action plans required to achieve the UN sustainable Goals 13 and 14.

Suggestions

Participate in a local cleaning up or pick up trash when walking, running, or hiking.

Support legislation that reduces plastics use.

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Buy products from companies committed to reducing plastics use.

Support organizations addressing plastics Pollution.

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