

A STUDY ON MICROPLASTIC POLLUTION: ITS SOURCES, IMPACTS AND DETECTION

by

Vivek Sai Chandra Vinjamuri

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of Master of Engineering in Nanotechnology

Examination Committee: Dr. Tanujjal Bora (Chairperson)
Dr. Wenchao Xue
Dr. Gabriel Louis Hornyak

Nationality: Indian
Previous Degree: Bachelor of Technology in Electrical and
Electronics Engineering,
Jawaharlal Nehru Technological University,
Kakinada, Andhra Pradesh, India

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ABSTRACT

Microplastic pollution represents a side effect from the global plastic waste mis-use and it includes degraded particles or mass-produced plastic particles less than 5mm in the largest dimension. Although, microplastic pollution is widespread across the land, water, and air, these environments are commonly considered independently; however, in reality are closely linked. Micro plastics contain a mixture of chemicals added during manufacture, the so-called additives, and efficiently sorb (absorb or adsorb) persistent bio accumulative and toxic contaminants from the environment. Thus, it is necessary to review the current literature surrounding this topic and identify areas where the study of microplastic can be pushed forward. Here we study different research papers and review articles about microplastic and we prepare the detailed report on the background from where the microplastics are arrived and where it all begun, where can we identify the sources of the microplastics in our day to day usage and how is the transport of microplastics occur and what are the side effects of microplastic pollution on environment, aquatic and human health care systems. In addition, we review current methods and practices in and around the world to reduce the usage of microplastics.

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CHAPTER 1

INTRODUCTION

1.1 Background

Plastic is one of the reformist advancements of human humanity has transformed into a certain piece of human life. The life expectancy, light weight and adaptability have made plastics more suitable for some local and mechanical purposes than some different materials. Notwithstanding its more critical occupation in different regions, the solidness of plastics and its non-biodegradability make it a justification combination of issues including plastic tainting. Recently, plastic waste age has extended at an upsetting rate.

Plastic is a word that at first connoted "foldable and helpfully slipped". It actually transformed into a name for class of materials caused polymers. Over the span of the latest century and half individuals have sorted out some way to make designed polymers and to a great extent using trademark substances like cellulose anyway more consistently using the plentiful carbon particles given by the oil and other non-environmentally friendly power sources. It is the length of the chains and the models wherein they are coordinated that makes polymers strong, light weight and versatile. With everything considered it is what makes them plastic. These properties make designed polymers executionary supportive and since we have sorted out some way to make and control them polymers have moreover been a crucial piece of living spirits. Especially all through the latest 50 years, plastics have doused our existence and changed the way that we live.(Chavoshani et al., 2020)

Polymers are outstandingly broad class, similarly as plastic they are furthermore fuse silicon reliant upon silicon instead of carbon arranged in everything from the chest additions to the fire retardants, they even fuse DNA. Shock was the at first made possible by the flexible which could be used to ensure electric switches while the fundamental submarine connections for media transmission from 1851 were canvassed in a cautious layer of cousin of versatile called "gutta percha" yet the enormous jump forward – clearly the presentation of present-day plastic period came in 1907 with an

invention of Bakelite. It was the essential made plastic, the first to be gotten not from the plants or animals yet rather from oil-based commodities.

Plastic pollution is the accumulation of plastic objects and particles (eg: plastic bottles, bags and microbeads). In general plastic pollutants are categorised to

1. Micro plastics- size less than 1-5mm
2. Meso plastics- size less than 5 to 25mm
3. Macro plastics- size greater than or equal to 25mm
4. Mini micro- size less than 1micro meter to 1mm

Plastic pollution can impact land, water from different points of view. It is surveyed that 1 to 8million metric immense heaps of plastic waste is evaluated to enter the ocean from coastline organizations and besides surveyed 86million colossal heaps of plastic marine commitments with a doubt of 1.4% of overall plastics conveyed from 1950 to 2013 has entered the ocean and gathered there. Consequently, pondering the recently referenced arrangements, microplastics are a transitional state between huge scope trash and nano based materials.(Campbell, 1967)

1.2 Microplastics

Little pieces, under 5mm (0.2 inch) long that occurs in environment because of plastic pollution. Microplastics are accessible in combination of things from cosmetics to fabricated dress to plastic packs and compartments. By and large science there is a commonplace understanding on the general characteristics of microplastics.(Campbell, 1967)

- MPs are synthetic materials with high polymer content
- They are solid particles, insoluble in water
- Smaller than 5mm and not degradable

Microplastic pollution is conceivably the most pressing normal issues of the 21st century. Microplastic has gotten an extended thought due to the expansive occasion of MPs in the environment they have been represented any place in immense ocean, waterfront area in various new water, wetlands, soils, air and in various natural elements paying little psyche to abundance, wilderness level of dealing with method. The majority of microplastic tainting comes from land and is passed on by streams, reaching

the marine environment. Land based MPs sources (eg: solid waste) have gotten correspondingly little thought, despite the way that they address the guideline stream of microplastic into the maritime conditions. Solid waste microplastics sources essentially join landfill, deny seepage and food waste. Microplastics in these streams can be connected with various impacts on human prosperity as they enter the common hierarchy.

Figure 1.1

Solid waste microplastics associated with human health



1.3 Types of Microplastics

Microplastics are divided in to two types:

1. Primary MPs
2. Secondary MPs

Fundamental microplastics are those which are normal made and purposefully dead, a symptom of some association or through sudden conveyance. Fundamental MPs enter environment directly through any unique of the various channels for example a thing use, inadvertent adversity from the spills during gathering or transport or scratched spot during washing or attire of dressing made with made material. Fundamental microplastics generally fuse.

- Micro beds – found in personal care products, for scrubbing, in personal products, cleaning products etc.,
- Plastic pellets or nurdles- used in industrial manufacturing such as clothing, plastic based paint, car tyres.
- Plastic fibres- used in synthetic textiles.

- Un-intentional release during transport

Secondary microplastics are from the breakage of greater particles/plastics. This conventionally happens when greater particles go through suffering through the transparency (eg: wave movement, wind scratched spot and UV radiation from sunlight). Any plastic thing in a stream can be partitioned through natural variables like animal explanation, waves, etc,

1.4 Transport of Microplastic Pollutants

Microplastics are continually conveyed into the terrestrial environment from sources where they are used and made. These microplastics store up in soils, build-up, new water bodies and some are given through wind and water to the oceans. The obsession incline between natural in land and sea shore front areas the factors that sway the concentration and the fundamental vehicle estimates that could effectively impact the scattering of microplastics are cloudy, while most of the MPs in storm water are given to new water bodies, microplastics in waste water are relocated in the slime which can be conveyed into the environment due to their application as bio solids on agricultural land. Since microplastics are of size under 5micron meter on account of the collaboration of photodegradation, real scratched territory, hydrolysis and bio-defilement particulates travel through wind and get settled stream top as a screen and thereafter by terrestrial and environment conditions and by depends upon the stream all the plastic trash made on road through mileage particles of tires, vehicles and trucks are then moved to the ocean came about microplastics are commonly been seen as marine poisons with evaluations of 93 to 236 thousand metric tons skimming on the overall sea surface.(Bilal & Iqbal, 2020)

Packaging and consumer items were the most experienced item classifications in stream while fishery things overwhelmed in the maritime climate. Plastics from gadgets, building and development and transport are scarcely noticed for polymers, polyethylene and polypropylene contributed most to contamination in all conditions the higher the thickness in polymers utilization was found in maritime and freshwater dregs the most ordinarily revealed plastic sort was for icy masses and lake, PE for waterways and PP for different conditions like estuaries, metropolitan streams and maintenance lakes. PET has a comparable thickness to PVC yet it is distinguished all the more often

conceivable in light of the fact that almost 10% of the bundling business utilizes PET. The dissemination of MPs in the climate are affected by measures including fixation, despondency, dispersion, debasement, settling, adsorption and collection transport of microplastics can shift with microplastics types due to a distinction in their essential properties like thickness, contact point and dielectric steady, while thickness can impact their dispersion and settling, the contact point can influence the entomb molecule powers among microplastics and other common plastics . microplastics can be entrained by wind because of a few interactions including direct outflow from soil surfaces, discharge from assault during saltation and emanation from the dis mix of enormous particles of totals.(Wang et al., 2021)

CHAPTER 2

SOURCES OF MICROPLASTICS

Most of the microplastic defilement comes from the materials, tires and city dust which addresses over 80% of all microplastic pollution in the environment. The presence of microplastics in the environment is regularly settled through maritime examinations these fuse taking models analysing focus on sandy, messy models/residue, seeing vertebrate and invertebrate use and surveying substance poison collaboration.

Significant arrival of MPs to the climate is for the most part thought of or perceived because of unseemly waste administration and ill-advised human conduct notwithstanding of enormous number of existing investigates covering the wealth, creation, sources and effect of microplastics as another ecological test. Consequently, with the expansion contribution of microplastic to the environmental schematic portrayal of different plastic sources and their definitive weathering our time into microplastic and nano plastic and transport into water related ecological networks. Some of the sources of microplastics to the environment are(Guo et al., 2020)

1. Sewage and wastewater treatment plant
2. Cars and trucks
3. Cosmetic industry
4. Clothing and textile industry
5. Manufacturing plants
6. Fishing plants
7. Packaging and shipping
8. Plastic Bottles
9. Surgical facemasks.

2.1 Sewage and Wastewater Treatment Plant

Micro plastics have been found everywhere to the bottom seas and tops of the mountain in the air that we breathe and in rainwater but they also run in waste waters and also plays a major role in releasing MPs to atmosphere. When microplastics are released through certain sources and from the plastics which is not bio-degradable so it left over time to rot in light and rain waters through which plastic particles breakdown into

smaller particles and thus carried to the oceans and freshwaters through means of air and any means of transport and finally laid on the surface of the waters and thus treated by WWTP and sewage treatment plants. Micro beads added into facial cleanses, toothpaste can be directly discharged into wastewater through human activities. Also, synthetic clothing such as polyester, nylon might shed thousands of fibres into waste water during the washing process.(Yang et al., 2021)

2.2 Cars and Trucks

Figure 2.1

Composition of polymers in tyre wear and tear (Jekel, 2019)

Compounds	Content in %	Ingredients
Rubber/Elastomer	40 - 60	Poly-butadiene (BR), styrene-butadiene (SBR), neoprene isoprene (NR), polysulphide
Fillers	20 - 35	Carbon black, silica, silanes
Process oils	12 - 15	Mineral oils
Vulcanization agents	1 - 2	ZnO, S, Se, Te, thiazoles, organic peroxides, nitrocompounds
Additives	5 - 10	Preservatives, anti-oxidants, desiccants, processing aids
Textile and metal reinforcement	5 - 10	

Roads are a tremendous wellspring of microplastics to removed domains including the oceans. Vehicle tires are probably the best wellspring of plastic tainting in our streams and seas. The surges from vehicles and tires are liberally higher than those of various wellsprings of scaled down plastics (eg: plane tires-2%, counterfeit turf-12-15%, brake wears-8%, road markings-5%). As a rule, the significance of tire wear plastic particles under the nonexclusive term "microplastic" isn't totally clarified and there are some specific definitions for plastic particles from tire wear and roads. They are,

- Tyre: elastic tire contains characteristic elastic, NR, SBR, carbon-dark, silica and different sorts of added substances including natural zinc
- Tyre wear: the deficiency of the tire material in driving leading to the development of the particles.
- Tyre particles (TP): particles beginning from tire track by various sort of cycles like cryogenically granulating, cutting, destroying, scraped area and so forth

- Tyre wear particles (TWP): shaped by driving on street or in streets test system
- Tyre and street wear particles (TRWP): containing particles from the street or street dust
- Road particles (RP) or Road dust (RD): unadulterated street particles shaped with or without collaboration with tire wear
- Road related microparticles (RAMP): a wide range of particles starting from driving and from the street Non fumes particles: created by traffic, barring the particles in the fumes because of the burning cycle in the motor and staying after exhaust treatment(Jekel, 2019)

Despite the way that assessment of natural pathways remains a test the general responsibility of tire wear to unquestionably the overall proportion of plastics ending up in oceans are around 5-10%.

2.3 Cosmetic Products

Cosmetic product represent product used daily and which are intended to clean the human body perfume, change the appearance, correct body odours, protect and keeping good condition. The main product group include for instance, products for skin and hair cleaning such as soaps, shower gels and shampoos. They also include decorative products (makeup, lipstick) and also products like sunscreen, toothpaste, perfumes, deodorants and antiperspirants. There is a list of chemicals used in cosmetics for the cause of microplastic pollution and are listed as INCI list of forms of microplastics that can be felt on skin. The plastic ingredients used for scrubbing function are most referred to as plastic beads/plastic micro beads. Micro beads made of polyethylene are by far most frequent application but in addition polyurethane, EVA etc., were also used in advantages of using micro beads for scrubbing and exploiting functionality are plastic micro beads have soft peeling effect associated with a good skin tolerance, they have a broad range of positive properties they are chemically inert substances, odourless, non-sensitive and non-irritating. In addition, they also have technological advantages (Bennet, 2016)

- Performance, molecule size and unpleasantness and effectively movable with great quality.

- Smooth surface, no cutting points and edges. Simple to deal with.
- Favourable physical/synthetic properties and microbiologically straightforward.
- Constant item quality concerning molecule size and actual hardness.
- Improves the cleaning impact of the item.
- No(negative)influence on item strength.

Other than micro beads, no other fixing commonly used in improving specialists and individual thought things has been perceived in marine plastics. Plastic trimmings are accessible in different things at different rates going from a little bit of a percent to more than 90% in a couple of cases. Makeup was the easiest to find in microplastics 63% tested contained microplastics. In hair styling products MPs are used as fixating components and is also very common. 30% of hair sprays and mousses. 35% of scrubs and peeling contains polymers less often microplastic was found in ingredients of various body care products, face creams, shampoos 24%, 10%, 9% respectively. Notably approx. 10% of children's cosmetics also have plastic particles including products that are designed to use by kids from the first day of their lives or that are positioned as ecological.

Figure 2.2

List of products/chemicals used as microplastics in cosmetics and their functions according to INCI (Bennet, 2016)

INCI	Funktion
Acrylate Copolymer (AC)	Antistatic, film forming
Acrylate Crosspolymer (ACS)	Emulsion stabilising, film forming, viscosity controlling
Dimethiconol	Emollient, film forming, antistatic, antifoaming
Methicone	Antifoaming, lubricant
Polyamide (PA, Nylon-6, Nylon-12)	Bulking, opacifying, viscosity controlling, abrasive
Polymethylmethacrylate (PMMA)	Film forming
Polyacrylate (PA)	Solvent
Polyethylene (PE)	Film forming, viscosity controlling, abrasive
Polyethylene glycol (PEG)	Penetration enhancing
Polypropylene glycol (PPG)	Antifoaming, plasticiser, lubricant, abrasive
Polyethylenterephthalate (PET)	Film forming
Polypropylene (PP)	Viscosity controlling
Polyquaternium (PQ)	Antistatic, film forming
Polystyrene (PS)	Light stabiliser, viscosity controlling
Polyurethane (PUR)	Film forming
Siloxane	Skin conditioning
Silsesquioxane	Skin conditioning

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2.4 Clothing and Textile industry

Various made strands like polyester, nylon, acrylics and spandex can be shed from clothing and drive forward in the environment designed materials like polyester, acrylic and nylon address about 60% of the articles of clothing materials all throughout the planet. Out of the 60% the most used one is polyester for these man-made materials significantly notable and when in doubt picked by plan industry was the destiny of their openness, toughness, deterrent and sensibility. Materials are addressing 34.5% of overall microplastic pollution. Right when made, washed and worn, pieces of clothing made out of fabricated materials lose infinitesimal particles of plastic strands that end up in environment.

The conveyance of smaller than expected plastics from fabricated articles of clothing is fundamentally achieved by the mechanical pressing factor and engineered loads that surfaces go through during a washing cycle in an attire machine. These little pieces called microfibers are more unassuming than 5mm and are known as fundamental microplastics which ordinarily not observable to the independent eye. Fundamental microplastics are clearly conveyed in the environment, for instance, a contrary to helper microplastics which by and large comes from the corruption of layer plastic considering our dependence on speedy plan, produced materials and garments washers microplastic contamination of all regions is likely going to increase and has been food to the animals/marine creatures as its larger part end up in oceans, seas and fresh waters. (De Falco et al., 2019)

2.5 Manufacturing

The assembling of plastic item utilizes granules and little pitch pellets as their crude materials through unintentional spillage during area or ocean transport unseemly use as bundling materials and direct outpouring from preparing plants these crude materials can enter sea-going biological systems. Numerous modern destinations where helpful crude plastics are as often as possible utilized one situated close to waterways. Whenever spilled during creation these materials may enter the general climate contaminating streams.

2.6 Fishing Industry

Microplastics may enter oceanic conditions through various pathways and they have been accounted for in every natural network, sea shores, dregs, surface waters and water segments. Lacking administration of plastic waste has prompted increment defilement of new water, surface water and marine conditions microplastics contain a combination of synthetic compounds added during make the supposed added substances, and productivity sorb (adsorb and absorb) persistent, bio aggregate and harmful contaminants (PBTs) from the climate. The ingestion of miniature plastics by amphibian organic entities and the gathering of PBTs have honey bee fundamental to saw danger and hazard of microplastics in the climate. The improvement of fisheries and hydroponics has depended intensely on plastic use and is probably going to keep doing as such soon. Ropes and nets are made utilizing from engineered strands regularly more noteworthy strength and sturdiness at a lesser weight when contrasted with common filaments. Plastic materials in boat development (counting painting and hostile to fouling coats), boat support, fishing gears (nets, fish nets, dig nets, traps, drifts, baits, snare and lines), fish hold protection and fish cartons.(Lusher et al., 2017)

In aquaculture, plastic materials are used for fish packaging and transportation, ropes, fish cases and boxes, fish limits, lake lining fish feeders and fish tanks are on a very basic level made of plastics and are kept by light plastics and hold set up with lines and ropes. In fisheries and aqua-farming industry abandoned lost or discarded fishing gears (ALDFGs)are the essential wellspring of plastic waste in the environment. Plastic contamination of maritime conditions will continue extending achieving creating proportions of small and nano plastics in these conditions.

In marine fisheries the most helpful areas are the northwest pacific, the central western pacific, and north east Atlantic addressing 27.2%, 15.3% and 11.4% of total. Huge fishing nations are tended to by china, Indonesia, US of America, Peru, Russian union, India and japan. These are approx. 52% of overall marine fisheries. The greater part of overall sea profundities usage is gotten from tank-farming creation with a development to 62% of overall use expected persistently 2030. It is to be evaluated that 46% of the mass of plastic pollution is in the mind-boggling pacific waste fix comes from the discarded nets are known as the nebulous vision nets. They stream around the ocean

recurring patterns or sink down to sea base habitually catching marine life. This can cause marine animals to suffocate or smother to death quickly or all through some time interval. (Baechler et al., 2020)

2.7 Packaging and Shipping

The environmental distributions of microplastics can consequence in food contamination via the processing and packaging of the products, as well the geospatial location of their sources. The packaging construction and vehicle regions address practically 70% of revenue in plastic with practically 40% alone in plastic sacks packaging. In the food region packaging helps away, transport, security and assurance of things while diminishing their loss in food territory just as in various territories cosmetics, water, clothing, etc, similarly expects a crucial part in packaging and supply to the necessities and deeds wherein microplastics are conveyed in some time. Opening of the package as well transport of the package and through shipping the equipment also microplastics have been observed. These can also be seen in salt, in beers, in water bottles. These generally smaller than 100micro meter apparently. Conveyance has essentially added to marine defilement. A couple of experiences show in 1970, a business shipping task forces all through the planet and dropped in excess of 23000 tons of plastic waste into the marine environment. Regardless, conveying stays a prevalent source of plastic tainting, having contributed around 65million immense heaps of plastic during the 1990's.

2.8 Plastic Bottles

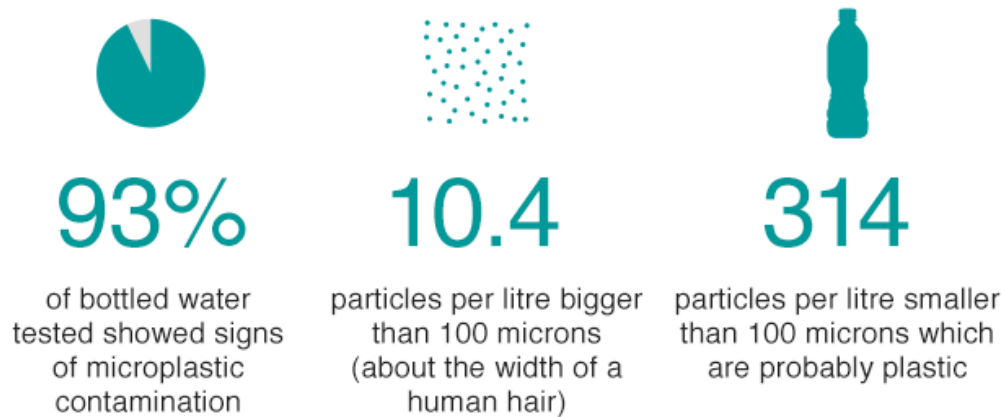
Little bits of plastic that dirty the climate can be delivered by essentially opening a plastic container or tearing a food covering. Air is an evident source one reason conjectured for plastics entering the containers is they are low thickness materials and effectively airborne. They could emerge out of the assembling or packaging conditions in industrial facilities from fans machines or the escape coat of the specialists. On a normal there were 10.4 particles per liter that were 100 microns or greater than that. This is double the degree of microplastic in the faucet water tried in excess of dozen nations across the landmasses. As per the WHO the most well-known sort of plastic part was polypropylene a similar kind of plastic used to make bottle covers. Microplastics are little parts of plastic frequently excessively little for the eye to see.

They are made as plastic showcases and they are wherever they are delivered in colossal amounts from the plastic child bottles when they are utilized to get ready equation as per the standard rules. The jug took care of new born children all throughout the planet might be burning-through more than 1.5million particles each day on a normal.

Figure 2.3

Testing of microplastics in bottles water per litre (Joana Correia Prata et al., 2020)

Testing for microplastics in bottled water



Source: Orb Media/State University of New York Fredonia

BBC

The researchers picked 10 kinds of plastic kid bottles, depiction of practically 70% of the overall market and assessed the levels of microplastic conveyed when they were used to prepare child formula according to rules set by WHO. Those are powdered formula with water and then heat it to 158-degree Fahrenheit to reduce bacteria loads and when the certain temperature reaches the bottles released 1 to 16million particles per litre. The bottles even released trillions of Nano plastics. The hotter the liquid inside a baby bottle, the more microplastics are released.

2.9 Facemasks

Wearing facemasks has gotten the new typical worldwide because of worldwide spread of Covid sickness in 2019, careful face veils were initially evolved to contain and channel beads containing miniature creatures removed from the mouth and nasopharynx of medical services laborers during medical procedure, consequently

giving the insurance to the patient. The careful veil is dispensable and for the most part comprised of three or four layers. It is typically planned mind two strands that forestall section of material more prominent than 1micron hence having microorganisms of that size or bigger. The assurance managed by this veil is 4hrs. since the rise of Coronavirus pandemic the use of clinical face veils has forcefully expanded to roughly 89million covers every month. Albeit the dispensable face veils were essentially made for the insurance of medical care laborers to forestall word related risks, non-clinical experts embraced the utilization of face covers during the flare-up of SARS in 2003 and H1N1 in 2009. This interest of facemasks during the flare-up brought about remarkable ascent in the worldwide creation of face veils which are delivered utilizing polymeric materials. Expendable face covers are delivered from polymers like polypropylene, polyurethane, poly acrylonitrile, poly styrene, poly carbonate, poly ethylene or polyester. They comprises of three layers; an internal layer (delicate filaments), centre layer (melt-earthly coloured layer), and an external layer(non-woven strands). (Aragaw, 2020)

Figure 2.4

Used masks found in marine, soil causes microplastics



The melt-brown is the primary separating layer of veil created by the customary manufacture of miniature and nano strands where liquefied polymer is reached out through minuscule spouts, with fast blowing gas. The filter diameter of melt-brown filter is around 1-5micro meters. In this manner it displays its high filtration execution that is adequate for dismissing microbes, suspended particles, beads and aerosols.

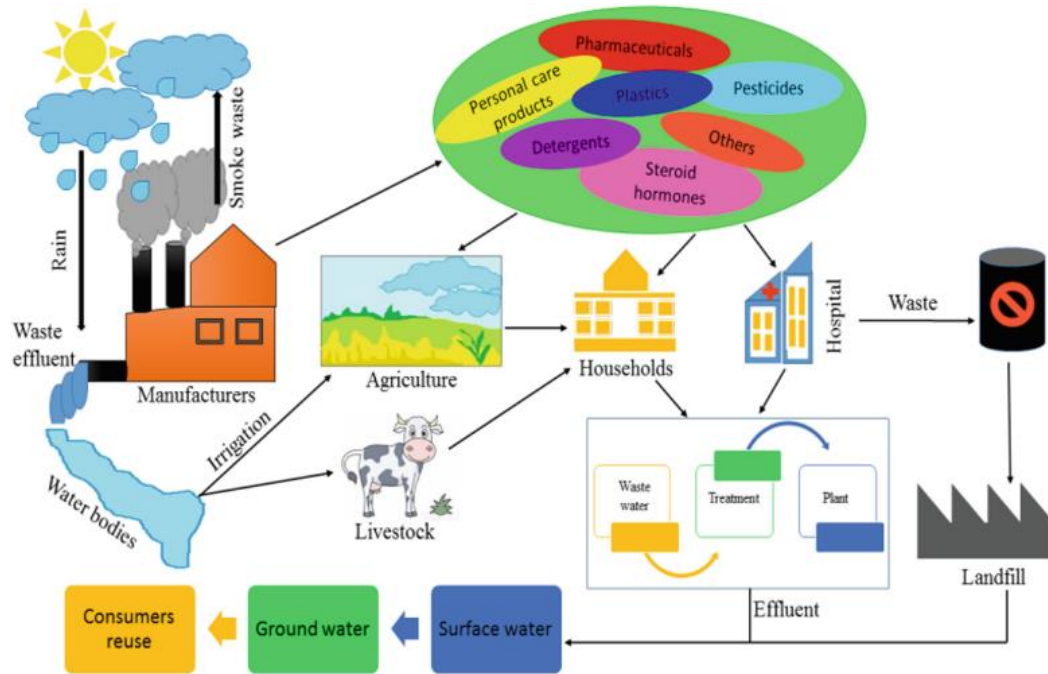
Wearing a N95 veil lessens the inward breath hazard of circular kind microplastics by 25.5 occasions contrasted with not wearing a cover. The gigantic utilization of face veils by the crisis of Coronavirus gives proof on the ecological issue and that the worldwide pandemic has not decreased to testing of expanding plastic contamination in the climate. Removal of face covers which comprised of polymeric materials have been getting into the climate first as a removal in landfill and dumpsites or littering in open territory then after into the new water, seas as another arising wellspring of microplastic strands.

2.10 Emerging Micropollutants

The term emerging contaminants called the "natural CONTAMINANTS" portrays a grouping of engineered blends that are correct currently used and conveyed into the environment. The emerging micropollutants pack involves substances which basically vary tin terms of noxiousness, direct, remediation/treatment technique. New engineered creation changes being utilized and expulsion of combinations can make the new reasons for emerging poisons are an overall concern in the land and water proficient conditions and have you real threats for species perseverance more straightforward permission to EMP blends like pharma's, pesticides, cleaning agents and individual thought things. Has generally extended the stacking of such blends in both the ordinary and manmade environment. The presence of these combinations in wellsprings of water varies starting with one territory then onto the next and centre omen essentially higher in ground water and surface water than in drinking water. Arrival of harmful normal micropollutants from various present day, agrarian and metropolitan sources have achieved perpetually contaminated water bodies.(Trapido et al., 2014)

Figure 2.5

Schematic representation of emerging micropollutants and their sources (Trapido et al., 2014)



Some of the sources of EMP are

- Industrial waste water
- Run off from agriculture, livestock and aquaculture
- Landfill leachates
- Domestic and hospital effluents

The EMPs fixation in WWTP is impacted by factors remembering arising poisons conveyance for a locale, EMP extraction rate. EMP fixation has expanded during climate conditions and has diminished during wet climate conditions. It s found that drugs in water tests uncovered lower focus in summer than those in winter this could be because of two reasons.

- Stimulated bio degradation of pharma's in higher temperature in summer
- Increased dilution during wetting summer

EMPs alone or in blend in with regular structures can affect microbial activities receptiveness to especially high centralizations of EMPs that come from phenomenal

regions like clinical facility sewage lead to a more noticeable change in the development of the sludge organizations.

CHAPTER 3

EFFECTS OF MICROPLASTIC POLLUTION

3.1 Effects of Microplastics on Human Health

Since MPs are less than 5micro meter in size it enables them to enter human body in various ways oral consumption of during water or food contamination with MPs is a primary route of human exposure. There is a high risk of ingesting MPs when consuming marine products bio-accumulation of MPs, potentially containing harmful additives, can result in high toxic sea food products than can eventually reach the human consumer. Although skin has been shown to provide an effective barrier against microplastics there are concerns their even small counter parts such as nano plastics, could potentially penetrate and can be absorbed into the skin. Furthermore, inhalation is another way of microplastic pollution, that can enter human body.(Rahman et al., 2021)

Its lines cleanser jars, drains out of capacity compartments stows away in house hold dust and is additionally found within toys, hardware, cleanser, restorative and endless different items. Microplastics are utilized to make a great many single use things from staple sacks to forks to sweets coverings. Yet, the issue is we are not just utilizing plastics we additionally ingest it. At the point when you eat a nibble of food or even have a taste of water you are very likely taking in little plastic particles alongside it. These synthetic compounds have been connected to an assortment of medical conditions including regenerative mischief and corpulence in addition to issues like organ issues and improvement delays in youngsters.

There are a few cases and confirmations in regards to the microplastics that mother might have the option to go microplastics through placenta to a creating hatchling. A portion of these MPs might actually filter bisphenol-An and phthalates. Bisphenols are known to meddle with chemicals and these are considers connecting bisphenol openness to diminished ripeness in people. Phthalates ae additionally known to upset chemicals and parental openness to phthalates is connected to bring down testosterone in male posterity. Styrene is another substance found in plastic and some food bundling has additionally been connected to various medical problems, including sensory system

issues, hearing misfortune and disease. Microplastic particles can likewise aggregate poly-chloride biphenyl's (PCBs) different synthetic compounds that are connected to hurtful wellbeing impacts including different malignancies, a debilitated insusceptible framework, conceptive issues and the sky is the limit from there.(Campanale, Massarelli, et al., 2020)

Endocrine dangerous engineered materials perceived as a substance that are exogenous to the human or animal living being have the hormonal activity that happens the homeostasis of the endocrine structure. Thusly, they are of explicit concern these combinations interfere with the improvement of the endocrine system and effect the limit of organs that respond to compound signs. There is a sequence how it effects they are

- Mimic natural hormones
- Antagonize their action
- Alter their pattern of synthesis and metabolism
- Modify the expression of specific receptors

Figure 3.1

list of microplastic used goods and their entry in human body and their impact (Joana Correia Prata et al., 2020)



Continuous science communicates that EDC in like manner associated with various diseases and conditions, for instance, hormonal cancers(breast, prostate, balls), conceptive problems(general glitches, desolateness), metabolic disorders(diabetes,

heaviness), asthma and neuro developmental conditions(learning wrecks, mental unevenness range disorders).both microplastics and these engineered mixtures may gather up the advanced lifestyle, possibly influencing the whole eco-systems recollecting the prosperity of soils for which we build up our own food. MPs in the water we drink and observable surrounding we breathe in can in like manner hit individuals clearly. When entering the respiratory parts through internal breath, most MP might be kept on the avionics course or got by the lung lining fluid. Regardless, the fragmented plastic particles especially nano-plastics may dismiss the opportunity segments of the respiratory parcels and lung and a short time later participate in human life works out. By the baffling frameworks of build-up over-trouble endocytosis, persorption, oxidative pressing factor and quality change the internal breath of climate MP by individuals may cause the aeronautics course ailments, bury terrestrial lung combustible and safe responses and even danger.

Dermal contact with MP is considered as the less immense course of transparency disregarding the way that it has been hypothesized that small scale plastics and nano plastics could Transerv the dermal receptiveness to monomers and added substances of plastics. Human bended cells experience the evil impacts of the receptiveness to smaller than usual and nano-plastics too. After the transparency particles may cause area or central safe responses, subject to their dispersing. In any case, every so often natural receptiveness is adequate to upset the safe limit inclining toward auto immune disorders or safe suspension. Auto safe sicknesses may be achieved by the internal breath of explicit matter through segments of particle development, oxidative pressing factor appearance of safe modulators and conglomeration of safe cells achieving self-receptiveness to self-antigens and making of auto antibodies.

3.2 Effects of mps on Environment

Microplastics present dangerous impacts at the tissue and cell level and meddled with energy reallocation conceptive accomplishment and family execution which address a peril to bio assortment and environment. Though recognized as an emerging characteristic impact on the new water conditions and its organic progression we produce a considerable number of enormous heaps of plastic all through the planet reliably so it should not come as a surprise to find that we can't remain mindful of the

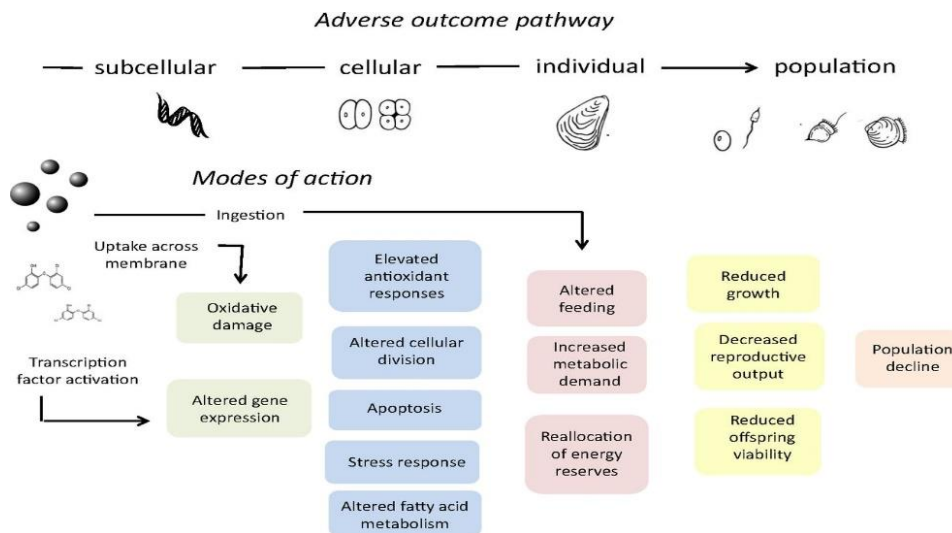
proportion of plastic we utilize and discard normal disastrously, its larger part ends up in landfills and because plastic doesn't commonly bio-degradable it is seen as maybe the most pollution wellsprings of our soils and our oceans.(Joana Correia Prata et al., 2020)

End of life doesn't mean completion of impacts since plastic materials endures and debase long after their arranged use. It has gotten clear that there isn't anything of the sort as end life for plastics, dependent upon how plastic is used it may address a threat to environment and to the climate when it shows up at the waste time of its life cycle while incineration of plastics is much of the time named as energy recovery genuinely when plastic is burned it communicates greenhouse gases, essentially carbon dioxide. At any rate plastic consistently contain added substances which are hazardous when conveyed in to the environment during consuming the sorts, assesses and center depends upon the sort of plastics being utilized and different centralizations of engineered accumulates.(Rozman et al., 2021)

3.3 Effects of mps on Marine and Aquaculture

Figure 3.2

modes of entry in marine organisms and their impact (Lusher et al., 2017)



Plastic junk is a wide spread and unavoidable emerging poison of maritime natural frameworks and makes an arrangement out of tones, designs and materials. Plastics can be corrupted to more humble particles in maritime environment by mechanical or photo

substance powers achieving different characteristics stood out from greater plastic particles. The intriguing nature of MPs, for instance, gentility and persistency lead their wide dissipating through streams from polar regions to shore lines, beaches, seabed build-up, surface water and far off sea waters. In a couple of examinations MPs were seemed to make physiological damage maritime animals at individual and people levels such mischief join gut blockage, oxidative pressing factor, tissue hurt changes in the protected structure and diminished assimilation capability. These effects prompt lessened health, neuro transmission disfunction, decreased energy processing reduced improvement rates and mortality in different aquatic animals. At any rate most examinations found no exceptional blocking effects of MPs on movability or perseverance of land and water proficient animals at naturally significant or even high centralizations of MPs various animals, for instance, sea turtles, sea birds and marine warm-blooded creatures have been known to ingest marine junk.(Gallowaya & Lewisa, 2016)

The junk thing may be mistaken for food and ingested as a trademark food or may have been by chance ingested close by other food. Ingestion of marine trash may provoke decline into absorption of enhancements in the gut, lessening the proportion of space for food in the gizzard and stomach loss of sustenance, inside injuries, intestinal blockage, starvation and surprisingly passing. Ingestion of MPs by marine living creatures in the pelagic zone and sedimentary living spaces has extended at assemblies of 150-2400 particles for each meter shape. marine litter explanation some veritable monetary loses do various regions. Among the most really impacted are waterfront communities(increased use for coastline cleaning, general prosperity and trash evacuation), tourism(loss of pay, terrible openness), shipping(costs related with fouled propellers, hurt engines, litter removal and waste organization in harbours), fishing(reduced and lost catch, hurt net and other fishing gear, corrupting), fish developing and shoreline aquaculture(reduced sea base usage).

CHAPTER 4

DETECTION OF MICROPLASTIC POLLUTION

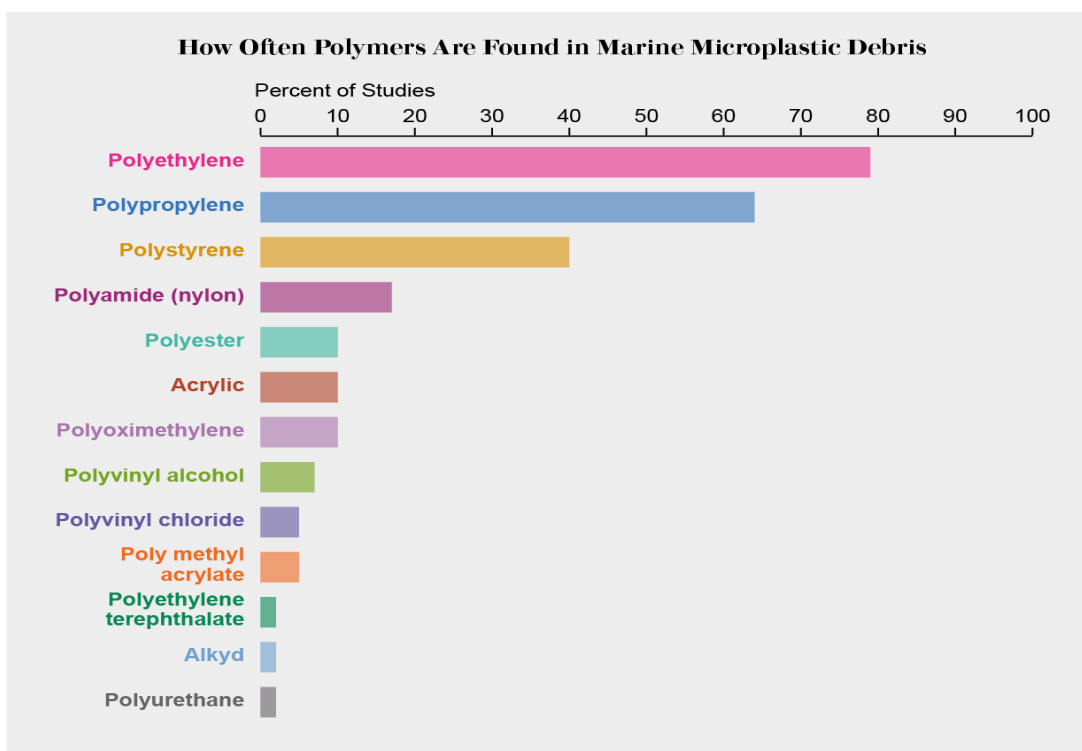
The wide extent of microplastics and complex nature of their shapes, tones and polymer types have held experts back from developing a consistent gathering of microplastic data which makes data assessment more inconvenient. Generally speaking, microplastic assessment contains two phases.

- Physical characterization of potential plastics
- Chemical characterization for conformation of plastics

Before the term microplastics became mainstream the event and conveyance of enormous microplastics was accounted for the most part on sea shores and in surface waters. Because of generally huge size scope of microplastics arranging and distinguishing proof is done in a plate with forceps and the unaided eye. Some little plastics can be utilizing visual strategy bright plastic pieces and pre creation sap pellets that have a size scope of 2-5mm can be related to the unaided eye.(Shim et al., 2017)

Figure 4.1

list of polymers most frequently used in daily goods (Guo et al., 2020)



4.1 Microscopy

Sound construction/dissecting microscopy is a generally used undeniable verification system for microplastics whose size falls in different micron range. Anyway, most particles of this size range are usually certain by microscopy, particles of the sub hundred-micron size range (under 100micrometer) with no tone and standard shape are difficult to portray with conviction as plastics. Only 1.4% of the plastics plainly looking like microplastics were of mix. Polymer root synthetic (e.g.: polyester) and average (e.g.: masked cotton) fibres were difficult to see by microscopy alone.

SEM can give staggeringly clear and high redesign pictures of plastic like particles. Basic standard photos of the outside of the particles work with the withdrawal of microplastics from customary particles further appraisal with energy dispersive X-shaft spectroscopy gives the vital course of action of particles is useful for seeing carbon unavoidable plastics from inorganic particles. The shades of plastics can't be used as identifiers in SEM. The structure is proposed for extra surface depiction and ordinary appraisal of express plastic particles other advanced microscopy systems have been

used to see plastic particles in unequivocal cases charmed optical microscopy was viably used to see polyethylene particles in research place assortment and harmful quality tests. Crystallinity changes even with relative polymers depending on the social occasion correspondence.(Wu et al., 2017)

4.2 Fourier Transform Infrared Spectroscopy

Gives information on the specific compound commitments of the particles carbon-based polymers are viably recognized by this methodology and assorted security structures produce uncommon spectra that isolates plastics from other common and inorganic particles. Little microplastics require the usage of small FTIR which is used to perform impression of smaller than normal assessed plastic particles going before spectroscopic insistence on a lone stage by trading the objective point of convergence and IR test, transmission, reflectance and debilitated hard and fast reflectance modes are available in FTIR examination for microplastics. Regardless, microplastics with a biggest length under 50micro meter require various fundamentals or it might be difficult to procure clear spectra that engage exact ID. Pre-modified, self-loader arranging without the prerequisite for the infinitesimal preselection of particles for assessment can be used to diminish the manual effort in the FTIR collaboration since arranging with single FTIR demands longer working events and covers a simply a limited area for the picked wave number of the specific polymer types it is only here and there important for the typical examination of complex field tests. Though self-loader arranging development by and large decreases the functioning time in FTIR, it needs at any rate 9hrs to inspect one channel paper. These are additional issues to be embarked to allow routine usage of this methodology in microplastic assessment. This each spot and reach as of now ought to be checked genuinely after the examination.(Campanale, Savino, et al., 2020)

4.3 Raman Spectroscopy

Raman spectroscopy has moreover been used to recognize small scale plastics. The laser column falling on a thing achieves different frequencies of back dispersed light dependent upon the sub-nuclear development and particles present, which produce a novel reach for each polymer. Raman assessment recognizes particles just as gives profiles of polymer plan of every model like FTIR. The different responses and spectra among FTIR and Raman spectroscopy from a microplastic can deal each other in

complex microplastic unmistakable evidence. The humbler the distance across of a laser shaft in Raman spectroscopy near with FTIR grants the distinctive confirmation of microplastics as little several micrometres in size. The non-contact examination of Raman spectroscopy offers the benefit that the microplastic tests stays impeccable for possible further assessment. Confocal microscopy close by the Raman spectroscopy can be used to recognize little plastics in zooplankton tests.

4.4 Thermal Analysis

Are which evaluations changes in physical and substance properties of polymer depending upon their warm adequacy has been actually gone after for MP conspicuous confirmation. Differential separating calorimetry is a useful methodology for thinking about the warm properties of a polymeric materials. The methodology requires reference materials to perceive polymer types considering the way that each plastic thing has different ascribes in DSC. DSC can similarly be useful for recognizing confirmation express fundamental MPs like polyethylene, smaller than normal beds which reference materials are open. Thermo-gravity got together with DSC perceived polyethylene and polypropylene yet fail to recognize PVC, PA, PES, PET, PU as a result of their covering stage change signals. Pyro gas chromatography and mass spectrometry is another strategy that examination thermally rotted gas from polymers. The got programs for tests are differentiated and reference pyro grams of known models. At any rate warm examination is a perilous technique, thwarting following additional assessment of microplastic tests DSC is tolerably fast and fundamental yet the limitations in recognizing microplastics from various polymer things in biological models. Warm assessment got together with GC and MS can simultaneously research added substance fabricated materials in microplastics.

Figure 4.2

List of identification techniques and their advantages and limitations (Shim et al., 2017)

Identification method	Advantages	Limitations
Microscopy	<ul style="list-style-type: none">- Simple, fast, and easy	<ul style="list-style-type: none">- No chemical confirmation- High possibility of false positive- High possibility of missing small and transparent plastic particles- No polymer composition data
Microscopy (+FTIR/Raman) ^a	<ul style="list-style-type: none">- Plastic confirmation of subset samples- Polymer composition of major or typical plastic types	<ul style="list-style-type: none">- Possibility of false positive- Possibility of missing small and transparent plastic particles- Representativeness of polymer types with spectroscopic analysis of subset samples
FTIR spectroscopy ^b	<ul style="list-style-type: none">- No possibility of false positive data by chemical confirmation of all the plastic-like particles- Reduction of false negative data- Non-destructive analysis- Detection of down to 10 μm plastics in size- Automatic mapping (FPA-reflectance)	<ul style="list-style-type: none">- Expensive instrument- Laborious work and time consuming for whole particle identification- Contact analysis (ATR)
Raman spectroscopy ^b	<ul style="list-style-type: none">- No possibility of false positive data by chemical confirmation of all the plastic-like particles- Reduction of false negative data- Detection of down to 1 μm plastics in size- Non-destructive analysis- Non-contact analysis	<ul style="list-style-type: none">- Expensive instrument- Laborious work and time consuming for whole particle identification- Interference by pigments
Thermal analysis	<ul style="list-style-type: none">- Simultaneous analysis of polymer type and additive chemicals (pyro-GC/MS)	<ul style="list-style-type: none">- Destructive analysis- A few polymer identification (DSC)- Complex data (pyro-GC/MS)

CHAPTER 5

METHODS TO REDUCE MICROPLASTIC POLLUTION

Microplastics are little pieces of plastics that end up in our streams around the world. Plastic trash from disposed of modern plastic items from old water jugs to cleanser compartments, is a significant wellspring of worldwide contamination. The public maritime and barometrical administration (NOAA) says while plastic contamination is a global concern, microplastic are an alternate sort of ecological pollutant. One reason that plastic contamination is such an issue is that it doesn't disappear plastics are until the end of time. Everybody can plan something for lessen the measure of plastic that enters the sea there are a few different ways to diminish the microplastic contamination

5.1 Reduce Your Usage of Single Use Plastics

The least difficult and most direct way that you can start is decreasing the utilization of single use plastics. These are worthy that are made fundamentally from non-sustainable power source based artificial materials and are expected to be orchestrated soon after the use oftentimes in just minutes single usage of plastics are most routinely used for packaging like containers, covers, straws and sacks. We produce 300million gigantic heaps of plastic consistently all throughout the planet, half of which is for single use things that is practically indistinguishable from weight of the entire human people. Diminishing plastic use is the best strategies for avoiding this waste. Passing on reusable packs and containers is one of the staggering strategies to avoid single use plastics in our regular daily existence these single use plastics are left alone as they are not more used to reuse. Additional time sun and warmth bit by bit change plastics into more humble pieces until they over the long haul become known as microplastics Always pack a reusable bag when shopping(Joana C Prata et al., 2019)

- Cook more often to reduce more often to reduce your use of plastic heavy takeout containers
- Buy in bulk avoid individually packaged goods like snack packs
- Though buying online sometimes has a lower carbon footprint than shopping in a store, online shipments are still chock-full plastic to reduce this walk, bike or take public transit to buy in person

- Avoid plastic wrap altogether by strong leftovers in reusable containers. Try to reduce and compostable beeswax wrap for an easy and decorative option
- Buy a metal or a bamboo reusable straw
- Talk to owners of the restaurants you frequently visit as if they have non plastic alternatives
- Let companies that make your favourite products know that you care about packaging. Ask them to switch to more durable, recyclable, compostable, renewable and or recycled content packaging with less fossil fuel derived plastic.

5.2 Recycled Properly

At the point when you utilize single use plastics that can be reused consistently make certain to reuse them at present only 9% of plastic is reused overall reusing helps keep plastics out of sea and lessens measure of new plastic available for use when reusing plastic jugs verify whether they say pound to save on the mark if so eliminate the top and pulverize the jug by curving. After its squashed spot the top on back of the container so it tends to be reused by reusing utilized plastic jugs into new ones, we can decrease our need to make new plastic. We can also

- Conserve non-renewable fossil fuels
- Reduce the consumption of every used in production of new plastic
- Reduce the amount of solid waste going to the landfill
- Reduce emissions of gases like carbon dioxide into atmosphere.

5.3 Participate in Beach Clean-up

Help dispose of plastics from the oceans and hold them back from showing up leading the pack position. These clean-ups genuinely change the way where people see and partner with the environment. Exactly when we clean up coastline we can save marine animals, pressure our trademark fortunes, can keep harmful contaminations out of the water, can help the close by economy, can build up safer environment, can sort out some way to mastermind the misfortune in a right way, make fish safer, can meet gigantic heaps of new people, can get some extraordinary exercise by a similar token.

5.4 Support Bans

Numerous regions all throughout the planet have captivated restrictions on single utilize plastic packs, Take out compartments and containers. Stay educated on the issues identified with plastic contamination and helps other people to mindful of the issue and furthermore instruct them to utilize material sacks keep away from miniature beds utilization in beauty care products. Miniature beds are found in some face cleans, tooth glues and body washes and they promptly enter our seas and streams through our sewer frameworks and impact many marine species. Stay away from item containing plastic miniature beds by looking for polyethylene and poly propylene on the fixing's names on the name of beautifying agents. There are numerous non benefit associations attempting to lessen and take out sea plastic and utilization of miniature beds which are destructive for our lives, we can likewise channel the faucet water to diminish the microplastics contaminations. It's imperative to comprehend the size as this will affect the tire of sifting needed to refine the water and make microplastic free.

- Carbon-blocks fixture channels: the most effective, for example, TAPP2 eliminate 100% of all known microplastics.
- Reverse assimilation channels: can channel down to 0.001micron

So will eliminate all known microplastics however are more costly and require upkeep. Engineered garments filaments may altogether add to MP in the event that you can purchase garments made of regular strands, for example, cotton can help keep away from microplastics. The guppy friend pack is likewise a potential arrangement which gathers the filaments that manufactured dress sheds during washing so MP doesn't wind up showing the channel.

CHAPTER 6

CONCLUSION

This paper concurred the expansive information about meaning of study on MPs tainting as a fundamental environmentally issue. In such way, the going with topics were discussed (1) Types of MP (2) Sources of MP (3) Transport and distinguishing proof methodologies for microplastics (4) Impacts and current frameworks followed to diminish the microplastic pollution. From the researcher's point of view, it might be induced that as a result of the certain usage of plastics there are an exceptional number of wellsprings of fundamental and discretionary microplastics in the environment. Since plastic is exceptionally steady in the environment, scratched spot and crack of greater plastic things in the environment have been considered as critical wellsprings of microplastics. Exactly when engineered substances are assessed and constrained by their resoluteness, bioaccumulation potential, toxicity and controlled framework, it might be normal that microplastic defilement is to be examined contrary to the above rules proposed for the portrayal of innovative common poisons. In any case, a microplastic is definitely not an individual component, yet involves a perplexing blend of polymers, added substance engineered compounds, devoured organics and living substances. The assessment of each substance freely is most likely not going to reflect the net measure of their movement or to enough review their bioavailability to natural elements. Though the impact of microplastic tainting on regular and biological prosperity and limit is questionable, getting, noticing and preventing further microplastic pollution in environment is vital. If we can't decrease the test, we are facing today in microplastic pollution prompts further more bewildered condition making more unobtrusive estimated particles or plastics indicated nano-plastics which are especially dangerous for human prosperity and marine tank-farming. So microplastic pollution through step by step usage stock are ought to be considered as a probable threat to society and besides train individuals to blacklist or lessen the utilization of plastics from the source level itself.

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