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REVIEW ARTICLE

The Impacts of Plastic Waste on Segments of Environment and The Appropriate Plastic Waste Management Techniques

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ABSTRACT

Plastics are materials that made from synthetic organic compounds which are widely used in different applications ranging from water bottles, clothing, food packaging, medical supplies, electronic goods, construction materials. Many scholars reported beside of their advantages they have many adverse effects of plastics in environmental segments and human health. The plastic materials as such at normal condition are not having substantial impacts in environment. The major influence found in plastic, when the wastes are generated and after the disposal of it. This review article covers the impacts of the plastic waster in the environment and the effective management techniques of plastic wastes.

Keywords: *Plastic Waste, Waste Management, environment, food*

INTRODUCTION

Background

Environment is the sum total of physical and biological factors that directly influence the survival, growth, development and reproduction of organisms. The environment is branded in to the complex interactions of segments that occur among the terrestrial, atmospheric, aquatic, living, and anthropological segments [1]. In short, environment is all biotic and abiotic things surrounding us, used for us and necessary for survival of human beings. This environment is the source of many challenges to the world people. The leading environmental problems are the result of natural occurrences, which cannot be controlled by people and human components that link local to global and short-term to long-term phenomena, and individual behavior to collective action [2] The complexity of environmental challenges demands that we all participate in finding and implementing solutions leading to long-term environmental problems [1, 2] Additional hand environmental problems are the direct result of peoples' actions. The improper utilization of natural resources and indictable desire of human being becomes the leading problem of today communities in the word. The long standing environmental effects, and even more recent and serious problems, such as the potential are harmful wastes and pollutants of anthrospheric origin [3]. Occurrences and conditions in the environment that people cannot control are known as environmental hazards, or sources of danger. Pollution from heavy metals, especially from their use in industry and mining, is also creating serious health consequences in many parts of the world. Incidents and accidents involving uncontrolled radioactive sources continue to increase, and particular risks are posed by the legacy of contaminated areas left from military activities involving nuclear materials [2]. Environmental hazards can result in damage or loss of property, as well as loss of life.

These environmental problems are directly or indirectly influence all the segments of environments. These segments of environments are Atmosphere,

Hydrosphere, Geosphere, Biosphere and Anthrosphere [4]. The hydrosphere contains Earth's water (chemical formula, H_2O) [5]. By far, the largest portion of the hydrosphere is in the oceans. Water circulates within Earth's environment through the solar-powered hydrologic cycle beginning with water vaporized into the atmosphere by energy from the sun. The water vapor and cloud droplets of water are carried through the atmosphere from which they fall back to Earth as rain or some form of frozen water [5]. Most of the hydro-sphere either rests on or is located beneath the surface of the geosphere, and the characteristics of water, especially water in underground aquifers, are very much influenced by contact with minerals in the soil [6]. Geosphere is largely composed of Solid Earth. Actually, Earth is not so solid because a few kilometers in depth below its surface, it becomes plastic and at greater depths liquid rock [4]. The geosphere acts as a sink for atmospheric contaminants, especially particles, and emits gases to the atmosphere, especially sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) from volcanoes [6, 7]. The geosphere is a source of metals, other critical minerals, and fossil fuels required by the anthrosphere.

The atmosphere has a very important relationship with the hydrosphere as a conduit for water moving through the hydrologic cycle [2, 6]. The atmosphere is crucial to the biosphere as a source of elemental oxygen for organisms requiring this element for their metabolism, as a reservoir of carbon dioxide, as a carbon source for plants performing photosynthesis, and as a source of nitrogen for organisms that fix this element as a key constituent of proteins (Manahan, 2013). The atmosphere provides the Anthrosphere with oxygen for combustion, argon as a non-reactive noble gas, elemental nitrogen for extremely cold liquid nitrogen and as a raw material for chemical synthesis of ammonia (NH_3) [7]. The atmosphere also serves the Anthrosphere as a sink for waste products, especially carbon dioxide from fossil fuel combustion [8].

The biosphere is strongly influenced by the other four environmental spheres and, in turn, strongly affects these spheres. Biosphere consist the diversified living organisms. Biodiversity is increasingly coming under threat from development, which destroys or degrades natural habitats, and from pollution from a variety of sources [2]. Organisms in the biosphere can be exposed to potentially toxic substances through the water they drink, the hydrosphere in which fish live, air from the atmosphere that animals must breathe, exposure of plant leaf surfaces to phytotoxic substances (those toxic to plants) carried by the atmosphere, uptake of toxic substances by plants growing in soil on the geosphere, and emissions released from the anthrosphere [9].

The anthrosphere, the part of the environment

constructed and operated by humans. Meeting the material and energy needs of the anthrosphere and handling its waste products safely and sustainably is a major challenge [6, 7].

A majority of substances of concern for their toxicities are made in, processed by, or released from the anthrosphere. There are a number of potential sources of anthropogenic pollution that could find their way to the environmental segments. One of the first problems that scientists were worried about was Concorde or stratospheric supersonic transport (SST). Aircraft engines produce large amounts of nitrogen oxides (e.g. NO) on combustion of the fuel [9]. The other potential source of environmental problem of the current world is rapidly developing technologies. Technology refers to the ways in which humans do and make things with materials and energy. In the modern era, technology is to a large extent the product of engineering based on scientific principles [3, 8]. It is essential to consider technology, engineering, and industrial activities in studying environmental science because of the enormous influence that they have on the environment [4]. Humans use technology to provide the food, shelter, and goods that they need for their well-being and survival. However, technology intelligently applied with a strong environmental awareness also provides the means for dealing with problems of environmental pollution and degradation.

The major ways in which modern technology has contributed to environmental alteration are Agricultural practices that have resulted in intensive cultivation of land, drainage of wetlands, irrigation of arid lands, and application of herbicides and insecticides and Modern transportation practices, particularly reliance on the automobile, that cause scarring of land surfaces from road construction, emission of air pollutants, and greatly increased demands for fossil fuel resources are countable [8]. This review focused on the Environmental problems raised through plastics that are recent technological product which dominantly used in this worldwide. The utilization of plastic materials in our everyday life makes the current era to be plastic era.

1.1. Plastic materials

Over the many million years, the materials desire of human beings started from use of ceramic, glass, wood, wicker and textiles have been the main materials used for containing and trading organic products and materials until the recent invention of plastics which marked the dawning of a new era [10]. Plastics are polymers, a very large molecule made up of smaller units called monomers which are joined together in a chain by a process called polymerization [11]. The polymers generally contain carbon and hydrogen with, sometimes, other elements such as oxygen, nitrogen,

chlorine or fluorine. There exist natural plastics such as shellac, tortoiseshell, horns and many resinous tree saps but the term “plastic” is commonly used to refer to synthetically (synthetic or semi-synthetic) created materials that we constantly use in our daily lives: in our clothing, housing, automobiles, aircraft, packaging, electronics, signs, recreation items, and medical implants to name but a few of their many applications [12].

The rising of plastic materials in the world is due to its different properties. Thus properties are lowest cost rather than other materials, such as ceramics, glass and metals. They are also very simple to process, making easy to manufacture in a wide range of desired utilities [13].

Plastics are also widely used for storing and packaging food and beverages. They are convenient, lightweight, unbreakable and relatively inexpensive [14]. However, there are both environmental and health risks from the widespread use of plastics. Plastics are most notorious non-degradable endures materials (e.g., bottles, sheets, fishing gear, pack-aging materials and small pellets), but also includes glass bottles, tin cans and lumber [15]

The unprecedented development of industrial society, the production of plastic waste has been an overwhelmingly growing domain and accordingly, it reasonable to find that the increasing research focus has been drawn to post consumer plastic products including thermoplastic such as polypropylene, polyethylene, polyethylene terephthalate and high density polyethylene [14]. The increasing usage of single-use plastics in developing countries is part of a bigger waste crisis: rising levels of waste generation where there are inadequate or non-existent waste management systems (and both are part of the bigger crisis of overconsumption) [16].

The rising tendency of plastic solid waste can lead to various environmental problems, including pollution which serve as a carrier of persistent organic pollutants transferable to aquatic organism [15]. Dealing with this plastic solid waste remains a challenging task in many countries in the world, especially in developing countries including Ethiopia.

1.2. The objective of the review

The objective of this article review is to know on some of the influence of plastic wastes in environment through improper use and dispose plastic materials. The objective of second part is to identify encouraging techniques of solid plastic waste management techniques and to recommend to community.

The impacts of plastic wastes on Environment

When plastics are used, recycled, or disposed of, or left in the environment as litter, they break down and release harmful chemicals. These chemicals and residues from the plastics bring pollution. The pollutants arise from the plastics include heavy metals such as cadmium and lead, and chemicals benzene, dioxins, and other pollutants, which all release harmful toxins into our air, water, and bodies [17].

According to study conducted by [18], Plastics act as pollutants can be classified based on their sizes into three aspects such as micro debris plastic, mega debris plastic, and macro debris plastic. The mega-plastics and micro-plastics are normally used in the manufacturing of packaging materials (such as plastic bottles, plastic bags etc.), footwear and other domestic items[5]. These are later found being washed off of ships or discarded in landfills. All these are still known as micro-plastic, meso-plastic and macro plastic [19]. The many plastics products such as plastic bottle, plastic bags etc. are being utilised/used for packaging, after they are being utilised, it is realised that they are discarded recklessly without thinking of what will be the consequence. These plastic wastes litters everywhere when not well discarded/disposed affecting the wildlife, wildlife habitat, humans and producing choking, and pungent odour. Due to the increase in generation, waste plastics are becoming a major stream in solid waste. After food waste and paper waste, plastic waste is the third major constitute at municipal and industrial waste in cities [12].

1.3. Plastics and Atmosphere

As indicated in introduction of this article, atmosphere is



Source: (Cook et al., 2019)

Open air burning of plastic waste releases black carbon, dioxins, furans, mercury and polychlorinated biphenyls into the atmosphere. All of these burning

products of plastics are direct threats to human health [19].

The studies around the world reveal that burning plastic materials that may contain chlorine such as plastics, pentachlorophenol (PCP), pesticide-treated wastes, other chemicals such as polychlorinated bisphenol (PCBs), and even bleached paper can produce dioxins [20]. From the chlorine consisting plastics, polyvinyl chloride (PVC) is the predominant plastics used in medical care. Primarily, HCWH was concerned with the public health and environmental impacts of the manufacture and disposal of PVC medical products [21]. These concerns centered primarily on the generation of dioxins, furans, and other toxic organochlorine compounds during the manufacture and incineration of PVC [22].

The results of several studies show that there is compelling evidence that plastic is a significant contributor to the hazards associated with burning waste. They increase the risk of diseases such as heart disease and cancer, respiratory ailments such as asthma and emphysema, skin and eye diseases, nausea and headaches and damage to the reproductive and nervous systems [23]

According to study [24], in Ethiopia, children from slums with uncollected waste were six times more likely to suffer from acute respiratory infections than those living where there were regular waste collections. Research has shown that burning plastic in incinerators releases toxic heavy metals and chemicals and that are significant sources of powerful pollutants, including dioxin and other chlorinated organic compounds that are well known for their toxic effects on human health and the environment [17].

1.3.1. The impacts of black carbon in atmosphere

The incomplete combustion of biomass and fossil fuel in the absence of oxygen, produce black carbon (BC) and it is the collective term for a range of carbonaceous substances encompassing partly charred plant residues to highly graphitized soot. Depending on its form, condition of origin and storage, and surrounding environmental conditions, black carbon can influence the environment at local, regional and global scales in different ways [25]. The recently finalized Report to Congress on Black Carbon, defines it as the “carbonaceous component of PM that absorbs all wavelengths of solar radiation”. Additionally, in 2012 report of the Joint World Health Organization (WHO)/Convention Task Force on Health Aspects of Air Pollution similarly describes black carbon as “an operationally defined term which describes carbon as measured by light absorption” [26]

According to study conducted by [27, 28] carbon black is a soot, which is powdery mass of fine black particles and consists of impure carbon, formed after the incomplete combustion of hydrocarbons.

The study of [29] describes the main source of environmental carbon black is the combustion of fossil-based fuels and burning biomass include coal, charred wood, petroleum coke, cenospheres, and tars [30].

The major problem associate with carbon back are premature human mortality and disability [31], respiratory and cardiovascular disease, cancer, and even birth defects [32] and because of its ability to absorb light as heat, it also contributes to climate change [33]. Exposing for pollution has been positively associated with premature death in people with heart or lung disease, as well as with a range of chronic and acute adverse cardiovascular and respiratory impacts, including nonfatal heart attacks, asthma, chronic bronchitis, reduced lung function, and irregular heartbeat [9, 33].

Black carbon is a potent, short-lived climate-forcing agent, estimated to be the second or third greatest contributor to global warming after carbon dioxide and possibly methane [34, 53]. Finally, the findings of researches described above clearly shows that, the carbon black arise from burning of plastic products build up negative influence over the environment particularly on atmosphere.

1.3.2. The impacts of dioxins, furans and polychlorinated biphenyls

Polyvinyl chloride is one of the world’s largest dioxin sources. Dioxin is the common name referring to a group of 75 chemicals that are extremely potent, persistent toxicants that bioaccumulate in the environment [22]. Dioxins are created when PVC plastic is burned in incinerators, household stoves, trash burning, and accidental fires in buildings and vehicles. The dioxins and furans are not manufactured or produced intentionally but are created when other chemicals or products are made. Health effects that may be caused by exposure to phthalates differ among the various individual compounds and depend on the timing and the size of the dose. Young, developing organisms are more vulnerable to exposure to phthalates than adults [36]. These chemicals may be created during burning of forests or household trash; chlorine bleaching of pulp and paper; or manufacturing or processing of certain types of chemicals, such as pesticides.

Dioxin is particularly toxic to the developing immune system causing immunosuppression and immune-depression, therefore decreasing a person’s resistance

to bacterial, fungal, and other infectious agents [37]. This immunosuppression may also increase a person's susceptibility to cancer. Once dioxins are released into the environment, they attach to dust particles and raindrops and fall back to the surface where they coat vegetation [22]. They have the potential to accumulate in humans and are fat-soluble. Their concentrations increase as they biomagnified up the food chain [38]. Therefore, the organism at the top of the food chain (humans) will have the highest concentration of dioxins.

The study conducted in Lancaster University in 1998, illustrates that, the concentration of Dioxins, furans, and polychlorinated biphenyls (PCBs) are increase in ambient air from remote to rural to urban industrial center. Then this study drew the conclusion that the combustible and chemical usage is the principal source of PCDDFs to the atmosphere [16, 38].

2.2. Plastic wastes in aquatic environment

Mismanaged plastic wastes also impart serious influence in aquatic environment. According to the study conducted by [40], in their study on "plastic waste input from land to ocean" show that the plastic pollution threat the health and future of aquatic environment. This study clearly shows two serious influence of plastic pollution in aquatic environment [41]. These are plastic waste influence the health of human beings and other organisms, those access the polluted water and it has also critical influence on the health of water itself. Similarly the study of [42], confirm that the accumulation of plastic wastes affects the current condition of hydrosphere. Another studies conducted on larger plastic debris, potentially far-reaching impacts on coral reefs by [43] and susceptibility to disease [43], indicates that plastic wastes have potential effect on hydrosphere.

Study conducted by [42], Exemplified that the source and quantity of plastic entering the ocean every year is unknown. While there have been estimates of some sources, such as municipal waste and there are more sources that do not have current estimates. While many scientists would agree that a large portion of mismanaged plastic comes from land, even the 80 percent from land is a questionable statistic since the true total from all sources remains unknown [44].

From the additives of plastic the well-known is phthalates which act as endocrine-disrupting chemicals (EDCs), producing severe health effects, and even have a long-term impact on the epigenome. Phthalates can alter an animal's [45]. The similar study conducted in Mexico entitled 'Phthalates affect the in vitro expansion of human hematopoietic stem cell' show that phthalate has divertible and can cause

cell damage and death and are [46], the Phthalates which are widely used plastic additives released into the environment have advisable effects.

The above scholar's study is the indication for plastic waste has adversely affected the aquatic environment. another study conducted by [43], shows that plastic pollution has now become a global concern as plastic debris have reached all the oceans of the world with adverse effects on marine organisms and biodiversity as well as on human livelihoods and economy. The plastic fragments in the ocean are mainly the discharge of wastewater and runoff water by river systems, including in the vicinity of outfalls from wastewater treatment plants, and the fragmentation of discarded plastic products from landfills (domestic and industrial wastes [47].

According to study carried out Status of Plastic Waste Management in India [48], showed that, 83% of tap water samples taken around the world contained plastic pollutants. This was the first study to focus on global drinking water pollution with plastics, and showed that with a contamination rate of 94%, tap water in the United States was the most polluted, followed by Lebanon and India.



Source: (Cook et al., 2019)

Marine plastic debris has major direct and indirect harmful effects on the marine biota and wildlife. Problems associated with absorption and entanglement of plastic debris include ingestion of specific plastic items by animals that mistake plastic waste for prey, and to a lesser extent consumption of pelagic fish and other prey that have plastic particles in their guts [49]. According to the study of [18], the accumulation of plastic debris in the marine environment can result in habitat degradation whereas floating plastics create new habitats and enable transport of invasive (alien) species over long distances.

The physical effect of plastic wastes in aquatic animals associated with entanglement and ingestion [42].

Potentially leading to suffocation or intestinal blockage, entanglement is largely underestimated as most victims are undiscovered over vast ocean areas when sunk or eaten by predators [50]. The second concern is the increasing exposure of marine organisms to toxic materials through ingestion of plastics and consequently entrance of hazardous pollutants into the food chain, either originating from the material itself (plastic additives) or from the chemical pollutants that adsorb to it from polluted surrounding waters [19].

Despite the fact that the United Nations Environment Program (UNEP) has declared plastic marine debris and its ability to transport harmful substances one of the main emerging issues in our global environment, little is known about the impact of ingested plastics that potentially contain high amounts of toxic chemicals on their surfaces; as well as regarding the possible bioaccumulation of the associated pollutants and their inter-action at organism and ecosystem levels [51]. Moreover, there is a growing concern about the negative health effects of some additives (added to the polymers during the manufacturing process) to which most people are exposed, such as phthalates or bisphenol A (BPA) because they are not chemically bound to the plastic matrix and they can easily leach into their surrounding environment; especially when plastics breakdown in smaller pieces and more surface area is exposed to degradation [52]. Experiments furthermore demonstrate that hard plastic trash discarded in the oceans leaches BPA at an accelerated rate when exposed to the salts in seawater [53] and that biodegradation of plastic polymers by bacteria introduces BPA into seawater [27, 53]. Recent studies also show that BPA which was originally developed by the medical industry to be a synthetic estrogen, leaches from the millions of gallons of epoxy plastic paint used to protect the ship hulls from corrosion and fouling with barnacles and other deposits [54]. Although major concern remains about the unknown impacts of the chemicals leached by plastics on marine food chain and concerning potential human health risks, laboratories experiments using aquatic organisms (molluscs, crustaceans and amphibians) demonstrate that most plasticizers appear to act by interfering with the functioning of various hormone systems (with some phthalates having wider pathways of disruption) [55]. There is also a lack of knowledge concerning the long-term exposure to environmentally appropriate concentrations of plastic, and about the ecotoxicity of the complex mixture of plastic materials [43], while a recent study suggests that ingestion of micro plastic by aquatic species does not lead to a relevant exposure to plastic additives [49]. Another major concern for marine organisms is that floating plastics in the ocean can serve as transport vectors for persistent organic pollutants (POPs) that accumulate on their surface (adsorption) during their long residence time

in polluted surface water [56]. POPs are persistent synthetic organic compounds with a hydrophobic nature, chemically stable and not easily degraded in the environment. The result of many [57], shows about the composition of marine debris; plastic waste is 40–80% of the total amount of marine waste, but only this is in the limelight because much of the plastic waste floats on the surface of the water, while other waste sinks to the bottom of the sea

2.3 The impact of plastic wastes on Geosphere

Despite the multiple benefits that the material offers, plastics are associated with high levels of waste and leakage to the environment. The study conducted by present study examined the impact of plastic enriched composting on soil structure, fertility and growth plants [58]. The result of single-use plastics applications, inadequate end-of-life treatment, low recyclability and reusability rates and high potential of disintegration into micro plastics [59]. The presence of plastics in the environment, whether as macro plastic debris or as micro plastics, has widely been recognized as a global issues [60]. It represents one of the most challenging anthropogenic phenomenon's that affects our planet and is among the major threats to biodiversity due to potential entanglement and ingestion [48, 59]. Therefore, plastic pollution on land is a problem of contamination and damage to terrestrial environments [57]. A widespread practice which is an important source of primary micro plastics contamination in soil is the application of sewage sludge from municipal wastewater treatment plants as a fertilizer for agricultural land.

The study conducted in Rome [61], states that there are three impacts of plastic wastes to soil : risks from elemental contamination (e.g. As, Cd, Pb); organic chemical contamination (e.g. PCBs, PAHs, POPs); and pharmaceutical contamination (e.g. estrogen, antibiotics). The three other risks are from soil pathogens such as anthrax and prions, micronutrient deficiencies, and under-nutrition due to degraded soils.

3. Management Of Plastic Wastes

The solid waste management systems cover all actions that seek to reduce the negative impacts on health, environment and economy. According to the study of [62], mismanaged waste is a major land-based source of plastic pollution that ma associated with use and disposal of plastic products in modern society, threatening economies, ecosystems, and human health. Environmental impacts of improper solid waste management in developing countries: a case study of Rawalpindi City 2010). According to some research results [63], many countries of world implemented

different techniques of managing plastic and solid wastes. The increase plastic waste has turned into a major challenge for local authorities, responsible for solid waste management and sanitation [64]. Owing to lack of integrated solid waste management, most of the plastic waste is neither collected properly nor disposed of in appropriate manner to avoid its negative impacts on environment and public health and waste plastics are causing littering and choking of sewerage system [65]. Due to extremely long periods required for natural decomposition, waste plastic is often the most visible component in waste dumps and open landfills [12].

The study of [66], indicate that waste treatment process based on the physical properties of the plastic. The physical properties of plastic waste are predominantly depends on properties of thermoplastics and thermoset. Thermoplastic is a type of plastic that can be recycled by reheating process while, thermoset are plastic that cannot be recycled or reprinted because the molecules in the plastic will be damaged if reheated [18]. Furthermore, plastic reduction waste can be done in 4 ways which are reduction in use, destruction by landfilling/incineration, recycle and reuse [60]. Reduction in use means a reduction in the use of plastic by substituting the use of plastic with other materials.

3.1. Management of plastics in a landfill

Furthermost post-consumed plastic waste was landfilled along with municipal solid waste. These plastics wastes affect landfill capacity because of the large and growing amount of plastic waste produced, not because the wastes are not degradable. Therefore plastic wastes are removed from the environment through destruction process. Destruction is the process of damaging plastic structure that can be done by landfilling or incineration [67]. Incineration is the process of burning plastic waste at high temperature. On additional hand landfilling process is used to exterminate plastic wastes from the external environment. Landfilling is a process where plastic waste will be buried in the ground [68]. In many cases, it is caused by inappropriate planning, the absence of laws, poor technology and lack of economic investments to encourage and support environmental development. In most cases, the resulted of study [68], openly shows that dumping a complex environmental threat which is often widespread in rural regions across many countries in the south due to the lack of formal waste management service.

3.2. Management of plastics in an incinerator

Plastics contribute significantly to the heating value of municipal solid waste, with a heating value of three times that of typical municipal waste [69].

Emissions of particular concern are acid gas emissions and dioxin/furan emissions. Plastic additives containing heavy metals (e&, lead and cadmium) contribute to the metal content and possibly the toxic of incinerator ash. Additional investigation is needed to determine with greater accuracy the impact of plastic additives on incinerator ash toxicity (Le., whether lead- and cadmium-based plastic additives contribute to leachable lead and cadmium in ash) [70].

3.3. Plastic Waste Recycling

Recycle is a process where plastic waste will be processed to be used again. Reuse is a process of reusing plastic that has been used before [68]. This can be done using plastic products that can be used repeatedly like refillable plastic bottles.

In terms of plastic waste, recycling process [71] solid plastic waste types is generally done in three ways [72]. After efficient production, reducing the consumption of wasteful products is beneficial, but sometimes hard to achieve due to food safety and lack of [62], nonetheless, avoiding unnecessary packaging (e.g., double-packaging) or choosing eco-friendlier alternatives is still possible.

First method is mechanical recycling. This process contains of separating, sorting, baling, washing, grinding, compounding, and palletizing [73]. Recycling using this process can be configured using closed and open loops where the application will provide a different final version of the recycled product [46, 71]. The closed loop process will produce products that have properties similar to the original material so they can be used as raw materials with high added value. The process carried out by a method of extrusion [74]. The open loop process will produce products that have more labor properties than the original material so they are only suitable for specific applications such as garbage bags and pipelines. This process is carried out through the stages of cutting, washing, drying and re-granulating. Second method is chemical recycling. The process of breaking the polymer structure [75]. The aim is to get genuine monomers or other valuable chemicals [76]. Chemical recycling can be done by chemolysis, pyrolysis, fluid catalytic cracking (FCC), hydrogen technologies, Catalytic Pressure-less Depolymerization (KDV) process, and gasification combined with methanol production. The last approach is energy recovery. Energy recovery is carried out by burning plastic waste aimed at electricity production and district heating with efficiency above 90%. This process is usually done for plastic waste that cannot be recycled [77].

The study conducted in Korea [76], plan for effective plastic waste management, shows that the Waste

policy of Korea began with the basic concept of “safe disposal”. The safe waste disposal method consists, landfill, incineration and recycling techniques. From these techniques recycling of plastic wastes accounts the highest rate up to 84.3%. The result of this study provides for the safe disposal of plastic wastes, recycling technique is the preferable one.

Another study conducted in New York [78], on recycling agricultural plastics illustrated that recycling improves environmental quality through alleviating disposal problems such as open burning adds pollutants to the air that pose risks to human health; dumping can compromise water quality and future farm operations; and random piles of used, partly-degraded plastics are unsightly [79]. On other hand, according to the World Economic Forum (2018), 16% of plastic waste was recycled, but only 2% of plastic waste can be recycled effectively. In addition, 14% of the plastic waste was burned, 4% was buried in End Disposal Site (EDS)/ Temporary Disposal Site (TDS), and 32% polluted the environment and disturbed the ecosystem [61, 79]. From the justification of World Economic Forum 2018, we can recognize that, although recycling of plastic wastes protect environment from pollution, recycling process has also its own draw back [80]. This drawback is that recycling plastic waste naturally will take up to 600 years [77]. Only a small amount of plastic waste treatment is truly effective which is why contributions from industries are needed to help managing plastic waste as well as possible.

Plastic products and packaging may contain substances that are harmful to human health and to the environment, and that may be forbidden in specific products, e.g. food packaging or children’s toys [27, 68]. These substances or additives comprise flame-retardants, pigments, fillers, UV-resistant chemicals, plasticisers and stabilisers that are used to attain or improve the product’s properties and reduce costs. Even if these substances are not substances of very high concern in an environmental perspective, they may still hinder the recycling of plastics [73]. These harmful additives and restrictions related to their use must be taken into account in order to ensure that efforts to increase the volume of recycling of plastic do not cause unintentional exposure through the use of secondary plastic materials in new products [80]. Dealing with problematic substances, therefore, is a significant challenge for a circular economy based on high-quality materials and non-toxic material cycles [81]

CONCLUSION

Ethiopia is among the countries that seriously affected by plastic wastes. The problem of plastic waste arises from town to far villages’ as well as from the hotels

and burs to farm lands. Along within the increasing domestic wastes from each household, a large volume is accounted by plastic wastes. a large number of people in Ethiopia have not yet realized the danger of environmental pollution as well as the current serious pollution situation and the lack of awareness still remains among the multitudes. Garbage plastics is piled up, stagnant for a long time, creating conditions for flies, mosquitoes to reside, causing bad smell, losing beauty and environment and that is no longer a strange thing for many people [81].

Therefore the management of solid plastic wastes, in Ethiopia is not the favorable strategy to build appearance but it is mandatory to sustain natural state environment. In order to prevent, control and reduce environmental pollution arise from plastics, it is obligatory to draw strategies to disseminate awareness about use and managements of plastics throughout the residence of country. The management of plastic wastes need cooperation of community, government and all concerned bodies in whole to conserve natural environment.

RECOMMENDATION

The various research findings above show that plastic waste can have an impact on every environment. Therefore, I would like to convey that I believe it is important for anyone who uses plastic containers to keep the community and the environment clean, and to dispose of plastic waste properly.

ACRONYMS

ABS	Acrylonitrile Butadiene Styrene
BOT	Build-Operate-Transfer
BFR	Brominated Flame Retardants
C&D	Construction & Demolition
CIWMB	Californian Integrated Waste Management Board
CL	Confidence Level
CV	Calorific Value
CRV	Californian Redemption Value
DTIE	Division of Technology, Industry and Economics
ESTs	Environmentally Sound Technologies
E-Waste	Electronic Waste
HDPE	High Density Polyethylene
HIPS	High Impact Polystyrene
IETC	International Environmental Technology Centre
ISWM	Integrated Solid Waste Management
LDPE	Low Density Polyethylene
LLDPE	Linear Low Density Polyethylene

MC	Moisture Content
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
NGOs	Non-governmental Organizations
OECD	Organisation for Economic Co-operation and Development
PA	Polyamides
PC	Polycarbonates
PE	Polyethylene
PES	Polyester
PET	Polyethylene Terephthalate
PP	Polypropylene
PPVC	Plasticized Polyvinyl-Chloride
PRC	People's Republic of China
PS	Polystyrene
PSP	Private Sector Participation
PU	Polyurethanes
PVC	Polyvinyl-Chloride
3R	Reduce, Reuse and Recycle
RPPCS	Rigid Plastic Packaging Containers
SAN	Styrene Acrylonitrile
SPI	Society of the Plastics Industries
StEP	Solving the E-waste Programme
TPE	Tons Per Employee
UNEP	United Nations Environment Programme
WEEE	Waste Electrical and Electronic Equipment
WGF	Waste Generation Factors

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