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Opportunities and Challenges of Waste Plastic In Current Scenario.

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ABSTRACT

Plastic has various advantages in terms of handling, water resistance& more durability. However in current scenario more usage of plastic in our daily routine creates environmental issues due to mismanagement of waste plastic. There is more consumption of plastic in making disposable plastic products for packaging, consumer and making plastic pipes for construction application, electronic goods, plastic furniture, and plastic parts for automotive application. Postusage, plastic become waste and then becoming part of street garbage. Most of the cities in India generating approx 15000 tons waste plastic per day. Recycling is a effective way to manage the waste plastic. Most of the plastics are recyclable but recycle plastic products are more harmful to the environment as these plastic products contain additives and colors. The recycle of plastic material can be done 2-3 times only and plastic material deteriorates due to thermal pressure and durability reduced. Plastic recycling is not permanent solution of disposal. The usage of plastic increasing day by day and demand of plastic is exceeding. There are issues about usage and disposal of waste plastic are diverse and utilse the waste in landfills. In this paper we will review the current scenario of opportunity and challenge of waste plastic.

Keywords: Waste,Disposal,Recycle ,Scenario

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INTRODUCTION

Plastics are light weight and water resistant materials, and can be different shaped which can be used for multiple uses. Plastic consumption in our daily life increased over past so many years. Plastic are used in our daily routine in so many applications. From packaging, plastic toys, plastic covers,bags,plastic equipments, plasticfurniture, plastic wares, different types of plastic used in automotive applications, plastic used in making electronic components and trends of using plastics in construction . After usage of plastics in so many applications, generates lot of amount of waste [1]. The demand of electronic component products increases and electronic component used in homes and global outcome of electronic products is more than 40 tonnes per annually and it will become huge in the future actually electronic products are popular.

Plastic is a synthetic material and having high molecular mass and can be molded into different shapes. Plastic is classified into two categories: Thermoplastic and Thermosetting. Thermoplastic examples are polyethylene, polypropylene, polystyrene and poly vinyl chloride. Thermosetting examples are Epoxy, phenol formaldehyde and urea formaldehyde. Plastic uses have been increasing day by day and plastic. Plastic waste is burning problem due to more usage and increasing urbanization.

There is 20,000 tons of plastic consumption per day in India which includes 60% recycled plastic and 40% unprocessed plastic. Plastic waste generated from municipal solid waste like residential, commercial and institutional location is increasing due to population growth and plastic waste dumping culture. Plastic waste is biggest concern in the world today. There is advantage to use plastic is corrosion resistance, high flexibility and low manufacturing cost, the production of plastic waste increasing very rapidly and drawn attention to post use of plastic bottles, plastic jars, plastic wrappers, plastic films, plastic caps, plastic furniture, plastic home wares which includes polypropylene, polyethylene, polyethyleneterephthalate and high density polyethylene .Plastic as material generating lot of environmental problems along. Waste plastics is one of important resource for generating fuels due to its combustion heat and easily available in local communities. Due to rapid development of social economy, there is rising demand of plastic products increases and becoming faster therefore plastic products is used only for short time has not been able to to satisfy people's needs.

The advantage of plastic are light in weight and possesses very good strength and toughness, excellent shock absorption capacity. Plastic are corrosion resistant and chemically inert, low thermal expansion of coefficient, good thermal and electrical insulation property. Plastic is very good water resistant and possess good binding property. The disadvantage of plastic are deformation under load, produces toxic fumes when it is burnt. Plastic dumps in open area post usage [2]

Today plastic are produced from petrochemical sources and approximately 4-5 percent of annual petroleum production is converted directly into plastics from petroleum. Approximately 50 percent of plastic utilized for disposable application such as packaging, films, and disposable plastic products.Plastics have only been bulk produced for so many years. Plastic durability in the different environment is certainly not known. Plastics products are not biodegradable. Biodegradable plastics needs the presence of microorganism. When a plastic products degrade in presence of different weather, it breaks down into smaller pieces of plastics. Recycling a clear waste plastic management technique, But it is only technique of implementing the waste plastics. It is helpful for reducing the environmental impact and resource depletion [3]

Plastic waste recycling has been focus of many researcher in the last few years. Thermoplastic contribute to the total plastic consumption by 80 % and are used for plastic products applications. Plastics are found in municipal waste plastic categories, plastic containers, plastic packaging. Plastics are found in durable good applications, appliances, plastic furniture, casing of lead acid batteries. There is increasing cost and decreasing space for landfills are creating the open opportunities plastic waste disposal. Plastic waste from commercial resins have been successfullyrecycled and make lot of products which is applicable in automobile parts, appliancesand plastic films.

Waste plastic recycling process could be classified into four category.re extrusion (Primary), mechanical (Secondary), chemical (tertiary), and energy recovery (quaternary).All the four process provides lot of advantages that make it beneficial for requirements. The continue development of recycling techniques in the different markets and participation by different industry are on priorities [1] Plastic recycling make a wonderful contribution towards maintaining plastic waste management.

The advantage of recycling process reduce energy demands and resources also. The potential advantage of recycling of plastic waste depend upon the market and technical acceptance of products and manufacturing process suitability. There are available end markets for recycled plastics from various sources such as plastic garbage bags or small polyethylene bags [3]

Plastic solid waste produced from municipal locations is increasing due to continue growth of population and plastic waste rejecting culture. Various waste to energy techniques exist to convert the municipal solid waste into heat and electricity. Thermoplastic contributes more plastic consumption in packaging, construction and consumer goods. Most of the thermoplastic products are single use and these plastics are used for producing electricity. Most of the plastic materials such as poly ethylene, polypropylene and polystyrene used in easy to tear packing have high heat of combustion. Waste to energy is a good option of recycling technique of waste plastics. Energy produced from municipal plastic waste has many advantages. Fuel obtained from waste plastic can be useful for high population area, providing them transportation benefit [4]

The effective utilization of waste plastic has changed the direction of waste materialresearch. The advantages of using waste plastics include corrosion resistance and lowering the manufacturing cost. The generation of waste plastic has been an overwhelmingly growing area. It attracts the society drawn attention to post consumer uses products including such as polypropylene, polyethylene, polyethyleneterphthlate and high density polyethylene. Due to rapid growing rate of plastic waste generation, landfill or incineration is available approach for post-consumer plastic techniques and continue increasing speed of plastic waste generation and release of toxic gases have alarmed environmental concerns due to incomplete combustion of waste plastic. Plastic recycling has grown rapidly due to regulatory and environmental issues. Among effective utilization of plastic waste, pyrolysis is one of the most suitable approach. The advantage of application of plastic waste to produce porous carbon is another suitable approach for usage of waste plastic more than activated carbon. The advantage of directly use of waste plastic to generate oils sorbents. Polypropylene and polyethylene waste plastic powder can be used for adsorption of oil from water [5]

Plastic has excellent properties, being light weight, durable and strong, the consumption of plastics has grown high. Plastics are creating environmental issues, when to produce plastic products, greenhouse emissions are generated. Plastic waste management issues and currently small portion of waste plastic is recycled due to more contamination and technical issues. Therefore major disadvantage of waste plastic management currently exist. There are issues for the use of recycle plastic depend on the quality and polymer homogeneity of the plastic material. If the waste plastic is cleaned and free from contamination and it can be used as a substitute of virgin material. If the waste plastic is mixed with another polymer, it involve down-cycling of plastics for less demanding applications. Due to these issues, thequality, use and barrier appear to limit the waste plastic recycling which suggests the options to better and improve the waste plastic management [6]

The total consumption of plastic approximately 298 million tons globally by 2015 and Asia is emerge largest plastic consumer. High density polyethylene, low density polyethylene, polypropylene and poly styrene in soil revealed that soil microorganisms including fungi and bacteria shown these plastics as carbon and energy source for their growth. Fungi degraded the high density polyethylene. In many countries open dumping is common method of municipal waste disposal because it is inexpensive in terms of investment and cost. In waste disposal sites such as landfills and open dumps, waste plastic have more chances to be biodetoriated by microorganism presence in the soil. The biodegradation of plastics is hypothesized under open dump area,which differentiates from the in absence of oxygen condition of landfill .Methane gas produce from open dump plastic waste . Methanotrophic bacteria are present in the soil where methane is produced such as wetland ,landfills including the stabilized organic waste in the open dump site and methane gas utilize as their sole carbon and energy sources via enzyme methane monooxygenase and is capable of the co-metabolism of some persistent compounds .Many co-metabolism bacteria have been identified and mostly it is methanotrophs.Methanotrophs bacteria is capable to bio deterioration of waste plastic in open dumping site where methane is being produced oxygen is limited [7]

Waste plastic overview

Global production of plastics is rising .299 million tons of plastic were generated in 2013.Apart from recycling, millions of tons of plastics utilize in landfills. Today an average person living in Europe or America consumes 100 kg of plastics every year and this consumption used as a packaging. An average person consumes 20 Kg per person in Asia. As per United Nations Environmental program 22 to 43 percent of the plastic used in landfills globally. Recovering plastic from the waste plastic mass for recycle or energy generation has greater opportunities to sort out the issues. Plastic collected for recycle is imported to other countries and burn the plastic for energy generation requires control the emission and produce hazardous substances. After usage of plastic it is scraped in most of the countries in world which is almost 56 percent of waste plastic. Most of the waste plastic is reprocessed with no control of environment. The environmental and social advantage of plastics must be looked against the issues that long lasting and high volume of the plastics. The advantage of plastic is help to reduce food waste by keeping product fresh in different environmental conditions. There are some issues exist in today scenario such as toxic additive presence in plastic products. Colors, flame retardants and plasticizers are creating awareness and demand for sustainable plastic product (World watch global plastic production rises, Recycling lags)

India generates 5.6 million metric tons of waste plastic annually and 60% of the waste plastic is recycled today. Plastic waste generation in 60 cities is estimated to be over 15000 tons per day while 6000 tons of waste plastic is remain uncollected. Municipal waste contains approx. 4-5 percentage by weight of plastic waste . In India majority of plastic waste generated from plastic packaging and polyethylene carry bags, colored plastic materials, PET mineral water bottles,Plastic cold drink cups , disposable plastic plastes,plastic shopping bags , plastic container, plastic stationary items and other household plastic items .

There are lot of environmental issues of waste plastic management in India. Because of more usage of polyethylene bags in our daily routine work, it created severe problem in environment. Burning of plastic waste generates toxic gases ,plastic bags , plastic films creates problem in sorting and recycling process, littered waste plastics creates environmental issues in water and choking the drain of water in pipeline in the various cities.Mixed plastic waste cause problems in landfills. Disposal and management of waste plastic is serious issue in India. Advancement of technologies helped to reduce the negative effect in the environment.

There are some useful techniques available to manage the plastic waste such as recycling, incineration and landfilling. Recycling of waste plastic is excellent technique. In this technique recyclers has to select the waste plastic for recycling while landfilling is conventional technique to manage the waste plastic and it needed space for landfills .But there are issues in landfills from a sustainability aspect is no material resource used to recovered the plastic. Incineration technique is helpful in reduce the need for landfills of waste plastics but in this technique toxic substance released into the atmosphere. The advantage of incineration is to generate energy from waste plastic.

There are some new technologies developed to utilize the waste plastic and blend the plastic with other polymers such example is construction of waste plastic coated bitumen road. Plastic waste could be used as fuels in some process applications, In which plastic waste can be heated at very high temperature and convert into liquid and gas can be generated from liquid fuel and generated gas can be useful for energy.

Waste plastic recycling opportunities and challenges

Primary recycling

Plastic used in a number of applications in daily needs and some plastic finish in waste after post usage. Reusing of waste plastic is preferable to recycle and it has lot of advantages.

Reusing and sorting

In the recycling process sorting and selection is most important for saving the time, The actual identification of the waste plastic is very necessary. In the case of plastic mineral water bottles sorting is essential due to shape, size paint and coating is delays the sorting . The best way to sorting out the plastic bottles based on density because most the plastics are very close the density 0.91to 0.96. The advantage of

sorting out of waste plastic based on density is very helpful to save the time. The challenge in sorting out the waste plastics is removal of paints on plastics. Grinding process could be applied for removal of coatings but the separation of plastic material from the coating or paint is a challenge [1]

Primary recycling of plastic waste

Primary recycling is also known as reintroduction of waste plastic. This process advantage is to utilize the waste plastics which has same property to the original product. The examples of primary recycling is injection moulding. Currently most of the waste plastics recycled through primary recycling technique. The advantage of primary recycling is to utilize the households waste. But there are challenges in primary recycling of households waste selection and segregation [1]

Secondary recycling or mechanical recycling

Mechanical recycling is the process of recovering waste plastic for the utilization of plastic by mechanical ways. The advantage of mechanical recycling is only with single plastic polymer waste e.g.poly ethylene, poly propylene,poly styrene etc. The challenge of mechanical recycling is degradation and heterogeneity of waste plastic [1]

Tertiary recycling or chemical recycling

Chemical recycling is a process which convert waste plastic into smaller molecules and these molecules suitable for petrochemical production. The opportunity and advantage of chemical recycling is depolymerization process and profit and sustainable technology. Pyrolysis, gasification, liquid gas hydrogenation, viscosity breaking, steam or catalytic cracking are the suitable examples of chemical recycling. Polyethylene can be converted to fuel (gasoline) by the help of chemical recycling. There are several methods available for chemical recycling are in currently use ,such as gasification, condensation polymers such as polyethylene terephthalate and nylon undergo degradation to produce monomers.The advantage of chemical recycling is the possibility of treating homogenous and contaminated polymers with limited use of pretreatment[1]

Pyrolysis

Pyrolysis is a process of thermal degradation of the waste plastic in the absence of air which generates recyclable products. Fuel can be obtained from plastic waste by pyrolysis. There is lot of plastic waste generates in the small cities in India and pyrolysis process is helpful to solve the plastic waste management problems to prevent the time consuming and long distance transportation. The advantage of pyrolysis process is to ensure proper capacity with energy products and pyrolysis is alternative technique of incinerators and landfills. The opportunities of pyrolysis technique is waste to energy convertor Dezhen Chen etal2015. The advantage of thermal degradation of waste plastics to convert into the fuels. Polyethylene and polypropylene and polystyrene polymers produces fuels upon cracking with suitable products and having excellent properties for energy applications [8]

Open dumping

The total plastic consumption is expected to reach by approx. 298 million tons in 2015.Waste plastics are expected to grow 16% of the total solid waste. There is advantage of open dumping to manage the waste plastic. But there are challenges in the open dumping method e.g. expensive operating cost, severe environmental problems. Open dumping of plastic waste supports the biodegradation by various types of microorganism from the soil [7]

Gasification

Gasification is another way to manage the plastic waste. The advantage of gasification is to decline the landfill and incineration of waste plastic. This technology supports thermolysis technology. The opportunities of this technique to obtain liquid fuels and gases from waste the plastic .Air is the gasification agents in this technology. Other advantages of this technology using air instead of the oxygen to reduce the

cost . The challenges of the gasification technology is the less calorific value of obtain fuels due to presence of inert gas in the air [1]

Waste to energy

In many countries, there are lot of initiatives taken to solve the waste plastic management issues and improve the situations including the landfill, plastic waste incineration with energy recovery, waste composting, recycling and plastic waste minimization. Waste to energy emerge as a promising solution to solve the manage the waste plastic problem and renewable energy source [8]

Other chemical recycling technologies

The addition of hydrogen by chemical reaction into plastic waste and covert into naptha and gas oil. In this technology plastic solid waste treatment employs a depolymerization where the agglomerate plastic waste is kept between 350 and 400 Deg. C . The condensate contains chlorine which will fed into a hydro treater. The hydrochloric acid is removed with formation of water. The plastic waste recycled by chemical recycling by other technologies: hydrolysis, glycolysis, fractionation, hydro glycolysis, aminolysis, methnaolysis. The advantage of hydrolysis is produce polyols and amine from post consumer waste plastic of PET and PU foams (reaction with water). Another chemical recycling is glycolysis and this method is used for Polyurethane and PET plastic [1]

Waste Plastic Landfilling - opportunities and challenges

Landfill is common way for managing the waste plastic in today scenario. Waste plastic generated from mineral water bottles to garbage bags made from traditional plastics. The advantage of landfill to recover the energy from the waste plastic and recover energy will be in the form of heat, electricity or fuel. The advantage of landfill with methane gas recovery generates electricity and heat. Waste plastic in bulk mass is ends up in landfill site and methane gas generation from landfill is best advantage and it is captured for energy generation. The issue of landfill gas recovery system is not successful on large scale due to lot of environmental issues and not feasible in economic terms [8] The disadvantage of landfill is that chlorinated plastic release harmful chemicals into the soil which can pollute the water source. Another advantage of landfills areas contain different types of plastics, In these landfills there are microorganism which can biodegrade of the plastics. Most of the plastic waste in landfills are single use plastic such as packaging, discarded plastics and it leak toxins and contaminating the soil and water. Another disadvantage is space for landfills is becoming big issues in most of the countries. [3]

Manage the waste plastic and blendwith other material- Opportunities and challenges

Blending of waste plastics(low density polyethylene and poly ethylene terephthalate) with concrete modified composites. The aim of adding waste plastic into concrete to improve the insulation properties of the modified concreates[9] Increase in population has led to rapid increase in the population increase the demand of domestic transportation. Due to increase demand of transportation leads to rapid deterioration of highways. To prevent to deterioration of highways is improving the material quality standards of which used for making highways. Bitumen is main material mixed with different dimensions of gravel used in construction of highways. The performance of bitumen material depends upon speed of the vehicle and temperature. When vehicle run on highway with high speed it behaves like elastic material and results is deterioration is thermal cracks. When vehicles runs at low speed and high temperature the bitumen behaves like a viscous liquid. Bitumen is used in modified form to minimize the effects of traffic loads. Waste plastics are light weight, durable and cost effective material. The advantage of waste plastic materials are resistant to corrosion and can remain in environment for long time. Waste poly vinyl chloride plastic is type of plastics is economically and easily available material and it easily blend with bitumen to make good highways [10]

The use of efficient diesel engine demands rise in the coming future because it consumes less fuel and reduce greenhousegases. If the diesel consumption is increasing and it fumes environmental concerns. Diesel engines are first preference in automobiles due to excellent thermal efficiency. There is challenge due to rapid growth of vehicles in transportation market segments, the consumption of fuels have given light to search for alternative fuels. Plastic waste disposal is a big issue across the globe. The advantage of waste plastic is to

developed alternative fuel which is mixed of waste plastic oil and useful for diesel engines. The advantage of waste plastic oil mixed with heavy oils isimproving the performance of the engines. The waste plastic materials polyethylene, polypropylene, Teflon, Nylon, mineral water plastic bottles, plastic carry bags,plastcroaps. Obtaining plastic oil from plastic waste is very helpful to solve the plastic waste management issue across the world [11]

CONCLUSIONS

The recycling technology of waste plastic is good solution to manage the plastic waste problems in India and word wide and benefit the current situation. There are certain challenges in recycling technology is selection of plastic waste and degradation. But there are certain opportunities to recycle the blend of two or more plastic waste materials. Chemical recyclingis very excellent technology to obtain fuel and gases from waste plastics and it will decline the traditional landfill and incineration process. There is also opportunities of waste plastic blend with other materials in other applications.

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