IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

Use of Plastic Wastes in Pavers Block Production: A Review

Arun Kumar Pipersenia, Assistant Professor
Department of Civil Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- apipersenia@yahoo.com

ABSTRACT: ***In India, solid waste disposal is one of the most pressing environmental issues. Landfills are becoming rarer, and the cost of constructing landfills is rising. However, the proportion of plastics in waste is typically high. Polyethylene is the most common form of plastic waste, followed by polypropylene, polyethylene terephthalate, and polystyrene. The most commonly used building material on the planet is concrete. The use of waste and recycled materials in concrete mixes for paver blocks is becoming highly necessary in order to handle and process both industrial and urban solid waste. These blocks were rectangular and were about the same size as the bricks. The block form has evolved steadily over the last five decades, from non-interlocking to multiple interlocking forms. The use of non-biodegradable plastic waste is increasing in the world, posing a threat to the environment in many ways. This research shows how waste plastic can be used to make concrete paver blocks, and how this can be a cost-effective way to dispose of plastic waste.***

KEYWORDS: ***Concrete Mix, Plastics, Paver Blocks, Plastic Waste, Recycling.***

1. INTRODUCTION

Plastics have become an integral part of modern life. Plastic is used in almost every aspect of our society, including cars, computers, glass, telephones, clothing, and packaging. Since most plastics are non - degradable and will stay non-biodegradable for decades, there is a growing amount of waste space needed for plastics, as more and more plastic items, particularly plastic packaging, are soon discarded. In India, approximately 56 lakh tonnes of plastic waste are dumped each year. The dumping of garbage pollutes the atmosphere. As a consequence, it has overt and indirect effects on both humans and wildlife. As a result, it is important to properly dispose of plastic waste in accordance with our government's regulations. The compositions of waste vary in many countries, as they are influenced by social characteristics, waste management systems, and usage practices, but the amount of plastic in waste is typically high; polyethylene is the primary component of plastic waste, followed by polypropylene[1].

Plastics, on the other hand, have been recycled in a variety of ways since their invention over a century ago, but recent technologies and applications necessitate the advancement of infrastructure for their recycling. Polyethylene Terephthalate (PET) is a commonly accepted and common packaging material among the various types of plastics available[2]. It's a transparent polyester that's solid but light. PET is a non-biodegradable material. As a result, dumping it in landfills would endanger the atmosphere. As a result, compost is the best solution to solve the issue of PET waste disposal. Any operation including the reclamation, regeneration, or replacement of items or papers may be classified as recycling. It also helps to prolong the life of plastics[3].

The streets and the gutters are covered with plastic bags, sheets of plastic and bottles of different sizes, colors and designs that create a significant environmental hazard. This pollutes the soil and clogs drainage systems. Several efforts to prevent the use of plastic bags and other plastic items

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

have failed due to their versatility in everyday use. Since the recycling and reuse of plastic waste materials requires a large amount of labor and a high production expense, only a limited percentage of plastic waste is recycled and used, with the remainder ending up in incinerators, landfills and dumps. Currently the challenge is in what way to best diminish the effects of plastic waste for the least amount of money. Several studies have attempted to use plastic waste, but only a handful have considered its use in concrete in various ways. Figure 1 shows the road built with the wastes[4].

Figure 1: The above figure shows the road built with the wastes [bangkokpost].

The use of waste in the building industry has two obvious benefits: first, the environmental effect is mitigated by waste management, and second, the economic impact is mitigated by the fact that waste is readily available in vast quantities, anywhere, and at a low cost. With the recycling problems of plastic waste in mind, numerous studies and experiments have been conducted on its use in concrete [5]. Disposable applications often lead to rising solid waste volumes, as many plastic items are only consumed once before being discarded. The disposal issue is not only technological, but also social, fiscal, and political in nature. This is why a variety of approaches to addressing the issues associated with polymer waste handling and recycling have been investigated and implemented [6].

Plastic has evolved into a modern manufacturing medium that is a very valuable substance in our everyday lives, but it is extremely difficult to dispose of after use. However, we can use it in a variety of ways. Plastic has a variety of properties and can be mixed with almost any substance. The goal of this work is to use plastic waste to replace cement in paver blocks, reducing the cost of paver blocks compared to standard concrete paver blocks. As a result, it has the potential to

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

support both the atmosphere and the economy[7]. Various concrete mixes were made of different proportions of waste plastic aggregate collected by heating plastic waste (160-200 centigrade).

The authors used a concrete mix which included ordinary Portland cement, Natural River sand, crushed granite stone and washed portable water and varied waste plastic bags as ground aggregation. The attachment of plastic bags to a concrete specimen reduces the compressive strength, and as the proportion of plastic bag fragments increases, the compressive strength decreases. 0n the other hand, the introduction of tensile strength to the cement mix by up to 0.8 percent of the plastic bag components increased; however, the addition of tensile strength decreased over 0.8 percent of plastic bag parts[8]. The authors concluded that the usefulness of plastic bag components can enhance tensile strength. This is just an early study on the use of concrete plastic bags. Differing plastic bags' shape and size in concrete mixtures needed more attention. Low density poly ethylene waste plastic as a substitute for coarse aggregates in order to assess their viabilities in the building industry and to research the behaviour of fresh and hardened concrete. Diverse concrete mixtures have been made in a granular recycling machine with various amounts of plastic recycling aggregates, collected by heat treatment of plastic waste (160-200 degrees Celsius)[9]. A concrete mixture pattern of 1: 1.5: 3 proportions was added with a ratio of 0.5 water/cement and different quantities of the acrylic aggregate in place of crushed stone. A proper mixing procedure was followed, and a homogeneous mixture was formed. A significant decrease in compressive strength was observed 7, 14 and 28 days after casting as the percentage of plastic aggregate replaced with crushed. According to the article, the plastic aggregate can be used in light weight aggregates. Their study focused solely on concrete's compressive strength, with no consideration given to the material's flexural properties. They propose that future studies on plastic aggregate be based on its break tensile strength in order to determine its tensile behaviour and reliability for columns and beams[10].

The waste plastics are collected and send for shredding, once the shredding process is done it is heated at an optimal temperature. After the heating and mixing process the moulding and de-moulding of plastic waste is performed respectively. Figure 2 shows the various process performed on plastic waste. After the completion of all these process it is tested for the quality-check.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

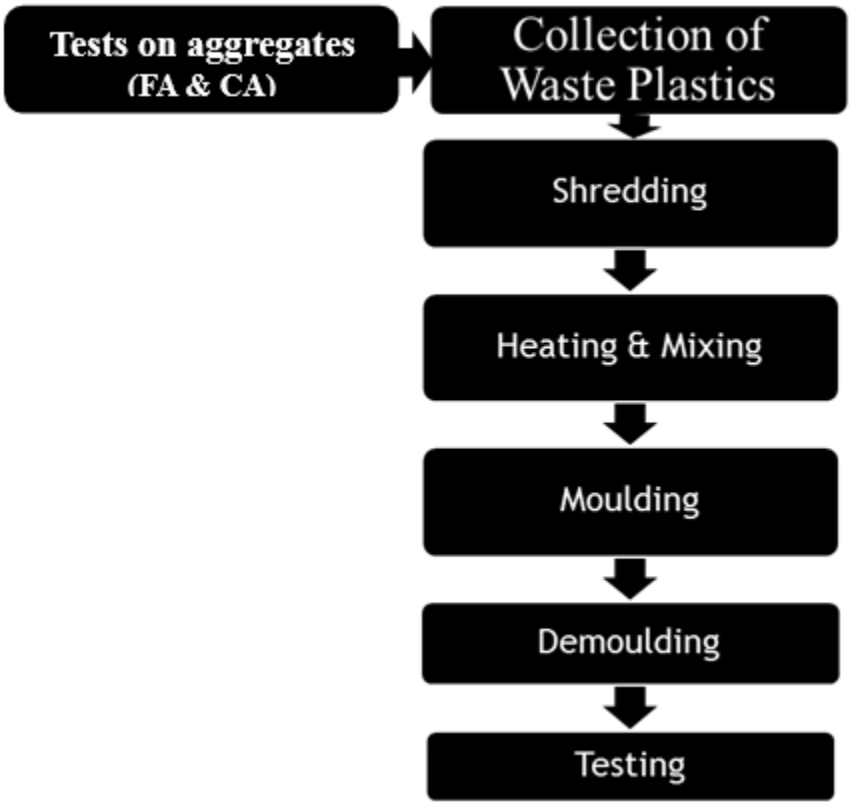

Figure 2: The various process performed on plastic waste. After the completion of all these process it is tested for the quality-check.

1.1 Material Used:

1.1.1 Waste Plastics:

Plastic waste for the construction of paver blocks is obtained from the immediate dumping area. It comes in a variety of shapes and sizes, from cups, plastic packets, food and drink cans, and so on. There is a need for proper treatment, and if at all possible, these wastes are used in recycled forms. This can be accomplished by a plastic management process. Plastic waste can be managed by recycling; if they are not recycled, they can become a major pollutant in the atmosphere because they do not decompose quickly. Figure 3 shows the image of a dumped plastic waste. Plastic waste can be managed by recycling; if they are not recycled, they can become a major pollutant in the atmosphere.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

Figure 3: The image of a dumped plastic waste. Plastic waste can be managed by recycling; if they are not recycled, they can become a major pollutant in the atmosphere [The Economic Times].

1.1.2 M Sand:

For concrete building, manufactured sand (M-Sand) is a replacement for river sand. Crushed hard granite stone is used to make factory-made sand. Crushed sand is cubic, cleaned and classified for use as a constructive substance with the grounded corners. M-Sand has a particle size of less than 4.75mm. Figure 4 shows the image of M Sand. M-Sand is a replacement of river sand for the construction of concrete building.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

Figure 4: The image of M Sand. M-Sand is a replacement of river sand for the construction of concrete building [Indiamart].

1.1.3 Coarse Aggregate:

The coarse aggregate was sourced locally. Aggregates that passed through a 12mm sieve and were maintained on a 10mm sieve were sieved and measured according to Indian Standard IS: 383-1970. Figure 5 shows the image of a Coarse Aggregate. The coarse aggregate was sourced locally.

Figure 5: The image of a Coarse Aggregate. The coarse aggregate was sourced locally [civilclick].

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

2. DISCUSSION

The author discussed about the use of steel fibers of waste plastics to ensure the complete use of waste plastic in concrete. In comparison to concrete mixes made only of plastic waste, the combined combination of plastic waste and steel fibers has shown to be stronger. With the addition of plastic waste, the main purpose of this study was to address the issue that compression is reduced. Used along with plastic waste, steel fibers can influence all properties of cement but the scientists have focused on compressive power only, which is insufficient to provide an accurate photograph. Plastics, on the other hand, have been recycled in a variety of ways since their invention over a century ago, but recent technologies and applications necessitate the advancement of infrastructure for their recycling. Polyethylene Terephthalate (PET) is a commonly accepted and common packaging material among the various types of plastics available. It's a transparent polyester that's solid but light. PET is a non-biodegradable material. As a result, dumping it in landfills would endanger the atmosphere.

Impressive resilience has been cast in Pentagon forms for plastic paver blocks with sides 70 mm and diameter 50 mm. The full load should be taken at malfunction reading and the total compressive force determined by the following equation.

Compressive strength (N/mm2) = (Ultimate load in N / Area of cross section (mm2))

The authors used a concrete mix which included ordinary Portland cement, Natural River sand, crushed granite stone and washed portable water and varied waste plastic bags as ground aggregation. The attachment of plastic bags to a concrete specimen reduces the compressive strength, and as the proportion of plastic bag fragments increases, the compressive strength decreases. 0n the other hand, the introduction of tensile strength to the cement mix by up to 0.8 percent of the plastic bag components increased.

3. CONCLUSION

Construction costs will be minimized, and it will also help to prevent the popular method of disposing of waste plastics, including incineration, which has a negative impact on the environment. Updated pavement blocks have a higher compressive strength than traditional blocks. It's appropriate for non-traffic and light-traffic roads. The removal of waste materials eliminates the issue of land requirements for dumping plastic. The conversion of flue gases into synthetic oil, for example, reduces greenhouse gas emissions. The use of plastics in pavement blocks lowers weight by up to 15%. Paver blocks constructed from plastic waste, fine aggregate, and coarse aggregate have shown better results, and they are also heat resistant. Since no salts are deposited on the surface of the bricks, efflorescence is not a problem. Waste plastic, which is readily available, may be put to good use in the production of paver stones. It has been found that as plastic material increases, compressive strength increases, but based on our findings, we suggest a ratio of 1.5: 2: 0.5 as compared to traditional blocks. The most commonly used building material on the planet is concrete. The use of waste and recycled materials in concrete mixes for paver blocks is becoming highly necessary in order to handle and process both industrial and urban solid

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 7, July 2022

waste. These blocks were rectangular and were about the same size as the bricks. The block form has evolved steadily over the last five decades, from non-interlocking to multiple interlocking forms. The use of non-biodegradable plastic waste is increasing in the world, posing a threat to the environment in many ways. Finally, the use of recycled plastics in pavement blocks is the safest choice for waste recycling and, as a result, decreases plastic contamination in the world.

REFERENCES

[1] A. M. Al-Sabagh, F. Z. Yehia, G. Eshaq, A. M. Rabie, and A. E. ElMetwally, "Greener routes for recycling of polyethylene terephthalate," *Egyptian Journal of Petroleum*. 2016, doi: 10.1016/j.ejpe.2015.03.001.

[2] N. E. Zander, M. Gillan, and R. H. Lambeth, "Recycled polyethylene terephthalate as a new FFF feedstock material," *Addit. Manuf.*, 2018, doi: 10.1016/j.addma.2018.03.007.

[3] B. Shanmugavalli, K. Gowtham, P. Jeba Nalwin, and B. Eswara Moorthy, "Reuse of Plastic Waste in Paver Blocks," *Int. J. Eng. Res.*, 2017, doi: 10.17577/ijertv6is020162.

[4] M. Meera, B. D. V. Prashad, and S. Gupta, "Experimental investigations on concrete with fly ash and marble powder for paver blocks," *Int. J. Eng. Technol.*, 2018, doi: 10.14419/ijet.v7i3.32.18410.

[5] C. Banupriya, S. John, R. Suresh, E. Divya, and D. Vinitha, "Experimental investigations on geopolymer bricks/paver blocks," *Indian J. Sci. Technol.*, 2016, doi: 10.17485/ijst/2016/v9i16/92209.

[6] P. Velumani and S. Senthilkumar, "Production of sludge-incorporated paver blocks for efficient waste management," *J. Air Waste Manag. Assoc.*, 2018, doi: 10.1080/10962247.2017.1395373.

[7] Y. Qin, Y. He, J. E. Hiller, and G. Mei, "A new water-retaining paver block for reducing runoff and cooling pavement," *J. Clean. Prod.*, 2018, doi: 10.1016/j.jclepro.2018.07.250.

[8] R. Kumutha, S. Aarthy, and K. Vijai, "Properties of double layer geopolymer concrete paver blocks with polyester fibres," *Int. J. Civ. Eng. Technol.*, 2018.

[9] B. M. Rethinavelsamy and N. Chidambarathanu, "Investigation on precast concrete paver block with waste tyre crumb rubber," *Road Mater. Pavement Des.*, 2016, doi: 10.1080/14680629.2015.1119056.

[10] E. A. Reddy, V. Gupta, D. Garg, and M. Tech Scholar, "Effect of Partial Replacement of Cement by Rice Husk Ash Using Nylon Fiber in Concrete Paver Block," *IJSRD-International J. Sci. Res. Dev.*, 2015.