# Utilization of Pet Wastes Aggregate in Building Construction - A Review

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***Abstact:** The rapid increase of plastics waste produced worldwide today poses a danger to human health because of the pollution caused by the unsafe disposal and non-biodegradability of this waste combined with toxic gas emissions during incineration. Globally, PET (polyethylene terephalate) is commonly used for bottling water and other plastic containers. Recycling the waste would be an additional benefit. This study focuses some researchers on the forms, methods of recycling and various literature applications of PET wastes. Recycled PET can of course be used when combined with the sand aggregate to manufacture of various construction materials, such as tiles, bricks, paving stones etc. This research focuses on its application as it attracts substantial building materials such as the manufacture of various PET waste tiles and their unique mechanical , physical and chemical properties; There are some important studies discussed in relation to PET waste, recycling methods , and results from the study. Even various applications are described here. Its usefulness is further defined as roofing Composite concrete, floor tiling and other applications.*

***Keywords:** polyethylene terephthalate; waste; recycling; aggregate; tile; etc.*

## I. INTRODUCTION

Plastic is a synthetic, solid, hydrocarbon-based polymer used every day in various ways such as shopping bags, food containers, drinks and water bottles, etc. [1-2]. Because of its wide global use, plastic bottle waste is primarily caused by solid waste disposal due to its rapid increase in production. These plastics are non-biodegradable in nature, they can remain on the soil without degradation for a very long time, making their disposal very difficult because they can pollute the environment and affect people. [4, 5]. It also contributes to low soil quality, groundwater contamination, emission of harmful gases, if deposited on landfills or incineration. This pollutes the environment. Majority of the numerous plastics produced are not reused and repossessing as the process needs large workforce treatment when wastes are separated and recycled for use in output. The EPA chose a new formal nomenclature for recycling, main recycling involves the use of industrial pre-consumer scrap and rescue, whereas physical reprocessing as a tertiary recycling of chemical products refers to secondary recycling and processingand high processing costs [4].

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PET productsdo not affect human health used for food package in the food industry[9].Under the Environmental Protection Agency (EPA), "Recycling" is known as waste
High resistance, light weight and little gas permeability (mostly $CO_2$) and cosmetic outlook (good light transmittance, smooth surface) characterize PET bottles are the significant characteristicsof PET, which lead to its extensive-ranging usage in packaging production.
disposal. Post-consumer plastic recycling is categorized into three different approaches [10, 11]: 1) which could be used again;(2) Physical reprocessing such as shredding, heating and reforming; (3) chemical [10]. Single type safe, uncontaminated waste disposal is advanced pre-consumer scraping and rescue. Recycled waste or scrap is either mixed to maintain quality compatibility with new material or used as a substitute material [10, 12, and 13]. Reuse can be defined as zero-order. The plastic product remains intact is easy reused.Plans for the reuse of plastic bottles may also require a cap on the number of cycles in usage a bottle can experience, the expiry date of its operation, the gross pollution physical monitoring scheme and the affected bottles[11]. A fourth type of plastic waste disposal is recycling by incineration (combustion) of their energy content. Incineration saves money and is the most efficient means of minimizing the volume of hazardous waste that can then be disposed of in landfills due to the lack of any disposal possibilities. Plastics are high-yielding energy sources, be they thermoplastic or thermosetting[10]. There are six major plastics: high-density municipal industrial waste polyethylene, low-density polyethylene, polyethylene terephthalate, polystyrene, polypropylene, and polyvinyl chloride; polyethylene terephthalate ( PET) is a thermoplastic polyester primarily used in the manufacture of various cloth fabrics, films, bottles, and other molded materials [14]. Much of the world's PET production is for synthetic fabrics (more than 60 per cent), with bottle production contributing about 30 per cent of global demand. One of the key reasons for the extensive use of PET is their ability[15] [16] Virginija and others. (2008) The recycling of PET waste and the extensive use of recycled articles are very important in reducing the amount of polluting PET waste. Recycling plastics saves landfill space, fuel, water, resources and reduces pollution.

## II. DESCRIPTION OF PET

Polyethylene terephthalate (PET) is used for high impact resistant soda cans, cooking oils, and peanut butter packaging. It is used for Microwave food trays, cereal box liners. It is used in plastic vessels and Implantation medicine.PET is resistant to heat, and stable chemically. Polyethylene terephthalate (PET) is toxic, base resistant, some solvents, some oils, some fats.

Terephthalate polyethylene (PET) is difficult to melt and is translucent. PET is made from the terephthalic acid ethylene glycol see Fig. 1 and examples of PET wastes shredded in Fig. 2 Underneath.

Because of its high stability and pressure resistanceit is mainly used in industry. It also has a low reaction with other materials and could preserve gas in gaseous beverages [22].

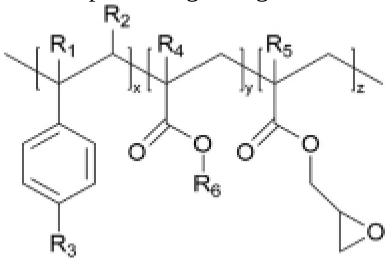


**Fig. 1. Chemical principle of a PET chain extender. [K. Ragaert et al. (2017]**

**Fig.2. PET wastes (shredded) [23]**

**2.2. PET Bottle Properties:**

PET / PETE bottles (Polyethylene Terephthalate Ethylene) are made from thermoplastics. This type of plastic is polymer, with or without cross-linking and branching, softening with or without pressure when applying heat and requiring cooling to be adjusted to a shape. [24].Table. 2. Properties of Plastic [24]

| Full Form | Polyethylene terephthalate |
|---|---|
| Molecular formula | $C_{10}\ H_8\ O_4$ |
| Structure Composition | Polyester of Terephthalic acid and ethylene glycol |

**Then there are PET (plastic bottle) properties [24].**

I. PET is wax-like, odourless, translucent and one of the lightest plastics.
II. PET can be versatile over a large temperature.
III. It is heat resistant.
IV. It is soluble in chemicals.
V. PET retains no humidity

**2.3. Advantages and Disadvantages of PET waste**

**2.3.1 Advantages of Recycled PET Wastes**

PET can be used for different purpose such as plastic bottles which after used once become a waste and throw as trash, but other types of plastic items can be re-sued severally before dumping as waste. PETs can be recycledthou requires a large amount of power and money. According to the EPA [25], Eighty percent of post-consumer plastics waste is sent to US landfill; It is incinerated by 8 per cent and recycled by just 7 per cent. PET reuse significantly helps to decrease the quantity of plastic waste that needs disposal and plastic recycling may have many other advantages including:

I.PET wastes recycled as storage of non-renewable fossil fuels.
II. Plastic processing uses 8 percent of oil production in the world, 4 percent as feedstock and 4 percent during manufacturing.
III. Recycled PET scrap decreases energy consumption.
IV. PET recycled decreases the volume of solid waste that goes into landfill; and
V. Reduced levels of carbon dioxide ($CO_2$), nitrogen oxide (NO) and Sulfur dioxide ($SO_2$);

**2.3.2 Plastic Bottles Advantages [PET]**

The drawbacks of plastic bottles include:
I. Its breakdown
II. It is not regenerative
III. It is difficult to use
IV. Recycling is tricky

**A) Decomposition:** The biggest disadvantages of plastic bottles are the amount of time they require to decompose, the average plastic bottle takes 500 years of plastic decomposition and can be aggressive due to multiple reasons, such as packaging shapes; surrounding and nature of the landfill; product also lasts a long time will definitely dump on landfills**.**

**B) Non-renewable:** Plastics are not renewable when they are made from gasoline, and the amount of natural gas that could be used or preserved in many other uses has been limited in plastic use. For example, natural gas may be used for heating houses and cooking meals.

**C) Difficult to use:** Plastic is hard to use since the conventional disposable plastic bottle is meant for one reason and not many. Water bottles, for example, are mostly reused in the household but are getting less and less durable over time and ultimately thrown away.

**D) Difficult to recycle**: plastic is difficult to recycle, e.g. glass bottles can be recycled and quickly reused as tin cans, but it is not that easy to recycle plastic. Most plastics in recycling boxes are not recycled at all, because most plastics cannot be recycled, and recycled bottles are not used to make new bottles. On the alternative, discarded plastic bottles are used to make non-recyclable products like t-shirts, lactic lumber or parking lot bummers. This implies that it is important to use more raw materials to reproduce new plastic which is not like some other materials which are easily recycled examples are tin and glass.

**2.4. SAND**

Sand exists naturally as a granular material composed of mineral particles and finely dispersed material. Its composition varies depending on local rock environments and origins, but quartz silica dioxide ($Sio_2$) is the most important constituent of sand in continental inland settings and coastal non-tropical zones. The other commonly used sand is calcium carbonate, e.g. aragonite, which has been produced over the past half billion years primarily by various life forms, including coral and shellfish. Sand is found in all manner of houses, physical properties of sand; see Tab.3 below.

**Table.3. Sand Physical Properties [28]**

| Properties | Limit |
|---|---|
| Type | River Sand |
| Silt Content | 9% (has been washed) |
| Absorption (%) | 2.71 |
| Max. Size (mm) | 9.5mm |
| Density ($kg/m^3$) | 1688 |
| Specific gravity | 2.62 |

### 2.5.1 The Sand River

River sand is often distinguished from gravel by grain size or particle size but is distinct from clays containing organic minerals. Sands which are filtered out and isolated from the organic material by the action of water currents or by winds across arid lands are usually very uniform in grain size. Commercial sand is typically collected from riverbeds or originally produced by the action of winds from sand dunes. Most of the earth's surface is sandy, and the sand is usually quartz and other silica products, a sample of river sand often used for building construction is shown in figure 5 below.

**Fig.5. River sand [40]**

## III. RECYCLING PET WASTES

PET bottle recycling is the process of turning PET wastes collected from different locations such as dump sites, waste bin, trash or landfills into new products or materials for other uses. This will reduce the pollution caused by such wastes.

### 3. 1 Forms of recycling

In primary, secondary, tertiary and quaternary recycling this can be segmented.

### 3.1.1 Primary recycling

Recycling of uncontaminated, single-type polymer with virgin content propertiesis also known as re-extrusionor closed loop process. This process uses recycled plastics which have similar features to the original [96] products. It can be done only after the contaminated parts have been successfully filtered with clean or semi-clean scrapings. Usually MSW is not appropriate for primary recycling because of excessive contamination.This technique is user friendly and common in manufacturers, as plastic waste is turned into an original quality product.

### 3.1.2 Secondary recycling

Secondary recycling is conversion by mechanical mean of PET waste for less demanding products. Secondary recycling may require the following steps: cutting / shredding, decontamination, isolation of flakes by floating. The single polymer PET wastes are then processed and grinded into small particles or granules together. Following pre-washing this is achieved by drying to remove all sorts of contaminants from the glue. Chemical cleaning is commonly achieved by using caustic soda to dissolve glue. After the pigments and additives are applied the commodity is processed, packaged and sold. Also included in secondary recycling are various recycling methods such as screw extrusion, injection molding, blow molding etc.

### 3.1.3 Tertiary recycling

Tertiary recycling includes different types of recycling, such as pyrolysis, cracking, gasification and chemolysis. Tertiary recycling is basically the recovery of monomers from PET waste by the process of depolymerisation. Chemical and thermal recycling are major forms of tertiary recycling techniques available. Chemical depolymerization of PET waste is called solvolysis and thermolysis is by heat. In the absence of oxygen, pyrolysis is when more processing happens. It is then called gassing when it is performed in regulated environments.

### 3.1.4 Quaternary recycling

In this method PET waste is treated by incineration to recover energy [107]. This results in a decrease in the amount of waste at the landfills [100]. The recycling of PET waste by energy recovery system can be only acceptable if other methods of recycling are not feasible as a result of difficulties [96]. Since plastic products are manufactured from palm oil and have very high calorific value.

### 3.2Methods of Recycling of PET Wastes

Mechanical processing, chemical alteration and molding of co-extrusion and co-injection may be used.

3.2.1 Machinery recycling

A system for recycling (Al-Salem et al., 2009a). Typically, this process entails the material being gathered, sorted, cleaned and grinded. Steps can be taken in a certain order, several or not at all, depending on the sources and nature of the waste. This is the only way to measure them in order to decrease the consumption of electricity and capital and to limit $CO_2$ emissions (Melendi et al., 2011). The biggest problem the recycler faces though is the plastic waste depletion and heterogeneity. The more toxic and complex the waste becomes, the more complicated it becomes to recover (Al-Salem et al . , 2009). The choice of mechanical recycling to valuate it is also not an environmentally and economically appropriate alternative because of the size and emissions of the municipal (Panda et al., 2010).

**Steps in the method of mechanical recycling**

a) Before recycled materials are directly reprocessed into new goods, there needs to be a conversion from waste to fresh raw materials. Mechanical recycling of PET rubbish includes:
b) Collection – includes collection on the roadside, from recycling bins and direct from factories.
c) Manual sorting – Plastics collected are separatedinto different category based on their products.
d) Chipping – plastics sorted are shredded in machines into small pieces / slicing plastic bags.
e) Washing- The contaminants such as labels, and stains are removed by washingwith stains removal substance in agitating tank.

f) Pelleting- Washed and shredded plastic waste are heated through machine extruder and shaped into noodle likes tubes before cutting into pellets which are used for new plastic product.

g)

### 3.2.2 Chemical recycling of PET

Chemical treatment of PET waste will completely depolymerize it into its monomers of terephthalic acid (TPA), dimethyl terephthalate (DMT), terephthalate (BHET) bis(hydroxylethylene), and ethylene glycol (EG). In this case depolymerisation is the reverse reaction of the polymer forming direction.

In part of oligomers or other chemical compounds PET can also be depolymerised. Various depolymerization routes occur, such as methanolysis, glycolysis, hydrolysis, ammonolysis, aminolysis, and hydrogenation, depending on the chemical agent used to sever the PET chain. Image: Image. Illustration. 24 Summarizes the different choices for PET chemolysis and the product process which can be derived from PET depolymerisation [93]. PET methanolysis is based on treating PET with methanol at relatively high temperatures (180–280 C) and pressures (20–40 atm), resulting in the formation of DMT and EG as the main products. PET degradation products after glycolysis and aminolysis find potential applications in the generation of value-added products such as UP resins, polyurethanes, textile dyes, antibacterial drugs, epoxy resins and vinyl esters as plasticizers, crosslinking agents, chain extenders, corrosion inhibitors and precursors. Hydrolysis, i.e. the reaction of PET with water at high temperature and pressure under neutral, acidic, or basic conditions, breaks the polyester chains into TPA and EG. The key disadvantages are the low purity of TPA and the fact that this alternative is relatively slow, as water is a poor nucleophile. Glycolysis is the easiest and oldest PET depolymerisation process. It is also a commercial PET recycling process used by globally renowned firms such as DuPont / DOW, Goodyear, Shell Polyester, Zimmer and Eastman Kodak (Scheirs, 1998). It is a flexible recycling method because, in addition to monomer formation, advanced oligomeric products such as, xdihydroxy materials (polyols) are also produced. The above can also be used for polymer synthesis, such as unsaturated polyesters, polyurethanes, vinyl esters, epoxy resins, etc.When the incoming PET feed is of high quality, glycolysis is the preferred recycling method. It is completely unsuitable for extracting low levels of copolymers, colourants or colourants. It is better adapted for PI scrap recovery (Scheirs, 1998). Glycolysis involves the transesterification of PET with an excess of glycol at temperatures between 180 and 250 C to facilitate BHET formation. For glycolysis of PET, various glycols such as EG, diethylene glycol (DEG), propylene glycol (PG), polyethylene glycol ( PEG), 1,4-butanediol and hexylene glycol growing be used. Since the process is sluggish in the absence of any catalyst, catalysts for transesterification are usually used (George and Kurian, 2014).

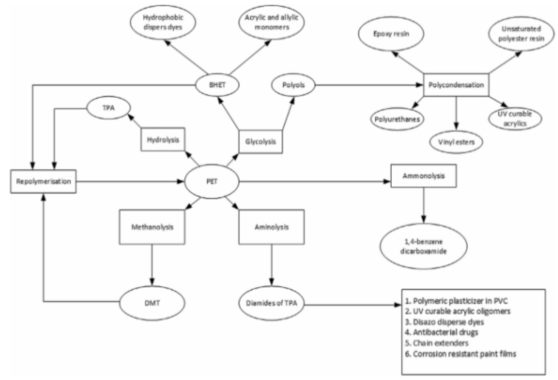


**Fig. 24. Different methods of PET chemolysis and the value-added products (Aguado and S, 1999).**

## IV. USE OF PET WASTES AS BUILDING MATERIALS.

### 4.1. PET waste used as concrete reinforced with fibres

The use of PET waste bottles as PET fibres for the manufacture of fibre-reinforced concrete was considered in several research [30, 16]. The quantity of fibre content in concrete ranges from 0.3% to 1.5%. But the process recycles small volumes of PET plastic waste [30, 16]. The easiest way to do so is to use PET waste as a mortar and concrete substitute. As a result, using PET waste as a concrete aggregate has certain benefits such as reducing renewable resource use, eliminating pollution, preventing air contamination and saving resources [29,21 and 6].

### 4.2. PET waste in concrete as fine aggregate replacement

According to Frigione (2010), who performed a 5 percent substitution study for the same weight of PET aggregates made from unwashed Water bottle wastes. The findings reveal that unwashed PET with a cement volume of 300 kg / m3 – 400 kg / m3 and 0.45–0.55 water to cement (w / c) ratios has about the same depression as ordinary fresh concrete. In comparison, the compressive and tensile strength of this type of concrete is slightly weaker than the reference batch, but it has a greater modulus of elasticity; this is equivalent to more plasticity.

### 4.3. PET waste as used as coarse aggregate in concrete

Marzouk et al. (2007) used polyethylene terephalate waste particles of a small size of 5 mm as aggregates in concrete. Results demonstrate that the sum of PET aggregates is equal to the intensity that marginally reduces the strength of the samples as PET aggregate rises from 0 percent to 5 percent. Furthermore, if the volume of replacement PET aggregates exceeds 50 per cent, the mechanical properties of the sample will decrease significantly.

### 4.4. PET Waste used on flexible flooring

The use of Poly-Ethylene Terephthalate (PET) and High-densitypolyethylene (HDPE) shows the road construction undertaken in Ghana, according to Johnson Kwabena Appiah et al. (2017) The materials available for pavement construction are chosen, and laboratory tests are performed. This implies that when the thermoplastic modifiers are applied to standard bitumen to improve bitumen elastic behavior.

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This study also shows that waste plastic changed bitumen holds great potential as an alternate form of recycled plastic waste management in Ghana, as well as a non-traditional, revised roadbuilding binder. Axay Shah et al. (2015) also explain the paper on the use of waste that is not capable of landfilling, incineration and that is not environmentally friendly. All the big bitumen tests are completed, and Marshall Stability Point decides the optimum polymer material. The paper concludes that the behavior of modified polymer bitumen is improved by various factors, the waste polymers in a pavement that improves the performance of paving. Moreover, Brajesh Mishra (2016) describes the usefulness of plastic waste mixed with bitumen to produce flexible paving, testing to verify its characteristics and performance. This paper concludes that mixed waste plastics minimize the void ratio in the aggregates and can be used in bitumen as modifying agents. Vishwajit Jaiswal et al. (2017) conducted a paper dealing with the use of industrial waste in flexible pavement construction. Industrial waste was assessed and collected. The materials have been tested to determine strength and other characteristics, and the results have been compared to normal aggregate properties.

The paper concludes with some proportion that we can use industrial waste, building demolition waste and tiles waste in road construction.

**4.6 PET Waste used in construction of road**

Akhilesh Yadav & Ruchi Chandrakar (2017) identified plastic wastes and found that they can be used in road building to minimize waste storage around the city**.**The plastic roads improve the route 's longevity and strength. Dry process and wet process decreased the amount of waste plastics and blended with bitumen. This paper concludes that polymer-modified bitumen provides better efficiency, reduces rutting, raveling and no creation of potholes.

Moreover, S. Rajasekaran et al. (2013) were responsible for the reuse of treated waste plastics aggregates and reinforced bitumen mix for road applications followed by green processes. Related waste was analyzed, and the products described their characteristics. The waste plastics have been fused and coated and matched with normal aggregates. The findings indicate that the plastic-tar road efficiency is good for heavy traffic due to improved binding over a prolonged duration of exposure to climate change heterogeneity with increased intensity and better surface consistency. Usage of waste materials as a partial replacement of bitumen to create a new binder for conventional techniques identified by Shubham Bansal et al. (2017). Where rubber and plastic have been proportionally combined with bitumen, and binder testing is performed.The aggregate testing for the bituminous concrete mix is performed and the optimum binder content is determined through Marshall Analysis. The paper suggests that the use of rubber tyres and waste plastic bottles improves the BC mix's strength and durability by increasing its total performance. It may also prevent air pollution caused by dumping certain waste products into the soil. Furthermore, V.Rushendrareddy et al . (2017) describes the paper on using waste plastics in flexible pavement. Mixing and processing waste plastics and bitumen, the combined bituminous plastic and aggregate is heated and weighed again. This paper concludes that bituminous plastics are used to increase the binding between aggregates, decrease the voids and avoid the absorption and oxidation of bitumen by trapped air from moisture. Dinesh will research in depth the recycling of waste plastic into a useful road pavement and its costs and efficiency. Monsieur Sutar et al. (2016). The paper's main aim was to compare the cost and performance of the bitumen coat road and plastic coat road and to use the plastic as road seal coat material. The plastic waste from the municipal solid waste recycling yards and streets carries containers, polyester fibres, bottles, and cans. All the basic process is performed such as washing, shredding, compilation, sealing. The paper concludes that the use of plastic waste for road building improves durability and road shine through plastic seal coating and functions as a modifier in bituminous. Bitumen is used as binder in conventional road-making systems, according to Amit Gawande et al. (2012), the use of plastic waste to build highways, and flexible pavements has been tested. An important use for such materials is the use of recycled waste plastic in asphalt paving. The use of modified bitumen with the inclusion of recycled waste plastic of around 5-10 percent by bitumen weight helps to dramatically boost the stability, strength, fatigue life and other beneficial properties of bituminous concrete mix, thereby enhancing toughness and paving performance with marginal savings in bitumen use.This paper concludes that polymer-modified bitumen can be used for lower quantities, the plastic-coated aggregates avoid moisture absorption, rutting, raveling and no pothole formation.

**4.7. PET waste used for plastic tiles and results**

Along with G. Siva Kumar Reddy et al. (2019) who conducted research on the development of plastic waste tiles using plastic granules along with the sand and binding content are combined in proportion to obtain the mixture. Epoxy resin and MEKP were used as the binding agents. Manually they blended epoxy resin and MEKP with sand and plastic granules. This method is known as casting method of thermosetting, i.e. in the absence of heat. After setting time, the tiles were tested for abrasion and flexure testing, the study concludes that the flexural strength of plastic tiles was significantly higher than the regular / ordinary tiles. Compared with ordinary tile, abrasion of plastic tile was very negligible. With respect to the permeability and aesthetics of plastic tiles, they were more and greater against the ordinary tiles, respectively. The performance of bonds was said to be greater than the normal tile. Comparing the cost, plastic tiles were marginally more expensive than standard tiles. Table 5 and 6 provides a comparison of the experimental performance of Plastic Tiles with conventional tiles.

**Tab.5.Observations of Flexural Test (Sample Size L=250 mm, b=300 mm, t=15 mm) [64]**

| S. No. | Description | Breaking load i.e. W(N) | Strength F=3WL/2bt$^2$ (N/mm) | Deflection (mm) |
|---|---|---|---|---|
| 1. | Proportion 1:1:2:4 | | | |
| | 1 | 15.85 x $10^3$ | 88.05 | 21 |
| | 2 | 16.55 x $10^3$ | 91.94 | 24 |

| | | | | |
|---|---|---|---|---|
| | 3 | 16.20 x $10^3$ | 90 | 23 |
| 2. | Proportion 1:1:3:3 | | | |
| | 1 | 16.75 x $10^3$ | 93.05 | 23 |
| | 2 | 17.35 x$10^3$ | 96.39 | 20 |
| | 3 | 17.05 x$10^3$ | 94.72 | 21 |
| 3. | Proportion 1:1:4:2 | | | |
| | 1 | 17.15 x $10^3$ | 95.27 | 19 |
| | 2 | 16.80 x $10^3$ | 93.33 | 19 |
| | 3 | 17.00 x $10^3$ | 94.44 | 19 |

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**Tab.6. Comparison of Traditional Tiles and Plastic Tiles [64]**

| Description | Plastic Tile | Ordinary Tile |
|---|---|---|
| Flexural Strength | 95 N/mm$^2$ | 2.24 N/mm$^2$ |
| Abrassion Test | 0.87mm | 1.32mm |
| Cost | Rs.147 per tile | Rs. 70 per tile |
| Aesthetic | Better | Good |
| Permeability | More | Less |
| Bond Strength | More as compared to Ordinary Tile | More |
| Chemical Resistance | Negligible | Less |

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**4.8. PET wastse used for Roof Tiles and results**

G. Bamigboye et al. Al. (2019) [7] carried out research on the manufacture of PET waste roof tiles combined with plastic and sand to produce a homogeneous mixture at 230 ° C. The weight percentage of plastic used to sand was: 10:90, 20:80, 30:70, 40:60, 50:50, 60:40 and 100:0 per cent respectively. Compressive strength, density and water absorption tests were conducted on roof tiles manufactured in compliance with [36-39] specifications, the study concludes that the plastic tiles have low water absorption, which makes them impenetrable to micro-concrete tiles in all intents and purposes.40% and 50% PET composition plastic tile produced said to gives the best result in term of strength and physical properties, which shows that recycled PET waste can produced plastic tiles instead of micro-concrete tiles. The quality created were marginally better and because of these values, PET roof tiles can be made from PET waste and fine aggregate as a complete cement substitute

## V. CONCLUSION

PET waste that is otherwise hazardous to all living species by improper disposal can be used for building purposes. It was discovered from the reviewed papers that PET waste can be used as an aggregate replacement or complete replacement for building, can be used as an asphalt component, as a base / subbase in road construction and as a flexible pavement,Eco-friendly floor and roof tiles, with low water absorption, higher flexural strength , low abrasion, stronger aesthetic strength and strong bond strength compared to cement. Furthermore, PET waste recycling and the improper use of recycled items, It is very important to protect the environment from contamination caused by such waste that is harmful to human health; PET waste recycling plastics often saves landfill space, electricity , water, money and reduces emissions.

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