Manufacturing of Plastic Bricks and Comparative Study

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I. ABSTRACT

This study explores the innovative process of manufacturing bricks from recycled plastic waste and compares their properties with conventional clay bricks. The increasing environmental concern over plastic pollution has necessitated the development of sustainable construction materials. Plastic bricks, produced by melting and molding waste plastic, present a viable alternative. The research focuses on the methodology of plastic brick production, including the collection, cleaning, and shredding of plastic waste, followed by heating and compression molding into brick shapes. Various plastic types, such as PET, HDPE, and LDPE, are examined for their suitability. A comparative analysis evaluates the physical, mechanical, and thermal properties of plastic bricks against traditional clay bricks. Tests include compressive strength, water absorption, thermal conductivity, and durability assessments. Preliminary results indicate that plastic bricks exhibit higher compressive strength and lower water absorption rates, making them suitable for certain structural applications. However, considerations regarding thermal expansion and long-term environmental impacts are discussed. The study concludes that while plastic bricks offer significant environmental and economic benefits, further research is required to optimize their performance and address potential drawbacks. This comparative analysis provides a foundation for future advancements in sustainable building materials, promoting recycling and waste reduction in the construction industry.

Keywords: Plastic Brick, Recycle, Sustainable.

II. INTRODUCTION

Plastic bricks are a type of building material made from recycled plastic waste. They are an environmentally friendly alternative to traditional clay bricks, as they reduce the amount of plastic waste going to landfills and conserve natural resources. Plastic bricks are also stronger and more durable than clay bricks, making them a good choice for use in construction projects. Plastic bricks are a sustainable and environmentally friendly building material made from recycled plastic waste. They offer several advantages over traditional clay bricks, including higher strength, durability, and insulation properties. The manufacturing process of plastic bricks involves melting and molding recycled plastic into the desired shape.

III. LITERATURE SURVEY

1. Samuel Kofi Tulashie, et al., (2020) [2] analyzed the conversion of plastic wastes into pavement blocks in Ghana. The physical and chemical properties of the pit sand, sea sand, plastic wastes, and pavement block were studied. The plastic-pit sand pavement block (PPPB) had fibrous surface with smaller pore volume and grain size than the plastic-sea sand pavement block (PSPB). At 20% plastic composition, the water absorptivity of plastic-pit sand pavement block and plastic-sea sand **pavement ma**ximized at 3.98% and 4.60%, respectively. The maximum compressive strengths of PPPB and PSPB were 40 N/mm2 and 28 N/mm2. The maximum tensile strength of PPPB (8.2 N/mm2) exceeded the PSPB (6.1 N/mm2). Furthermore, increasing the plastic composition improved the average penetration resistance of both pavement blocks. The results showed that converting plastic wastes into pavement blocks is

feasible. The amount of plastic decreased the water absorptivity of the blocks but increased the compressive strength. The maximum water absorptivity of PSPB was 15.5% higher than the PPPB. This was recorded at 20% plastic composition. From the FTIR, Quartz and Kaolin minerals were the main components of the sand samples, whereas those of the plastic wastes were polyethylene and polypropylene. The compressive and tensile strength of both blocks remained nearly constant at 80% and 90% plastic composition.

2. Adeniyi Salami, et al., (2019) [6] research work was aimed at investigating the suitability of making compressed earth bricks (CEB) with a mixture of soil and striped waste plastic. Specific gravity, particle size distribution and compaction tests were carried out on the soil to determine the properties of the soil. The compressive strengths and erosion rates of the CEB made with the soil and the mixture of soil and varying proportions of striped waste plastic of two size-categories were determined. The soil was classified as clayey sand (SC). The highest compressive strength was obtained for the CEB containing 1% waste plastic of sizes of the CEB samples stabilized with striped waste plastic, the sample containing 1% waste plastic of sizes <6.3 mm also had the least erosion rate. The use of waste plastic that would have constituted an environmental nuisance has the potential to produce stronger and economical bricks for providing economical housing. The purpose of this research work was to investigate the effects of stabilizing a soil with striped waste plastic on the suitability of using the stabilized soil to produce compressed earth bricks (CEB). To improve the compressive strength and durability of CEB containing striped waste plastic, a binder such as cement, lime or another additive with adhesive properties may be mixed with the soil and striped waste plastic during the production of the CEB.
3. Kognole, et al., (2019) [13] studied the ill effects of plastic waste. The most dangerous type of wastes is HDPE and PTE and the plastic below 50 microns is also causing a grave problem. These plastic wastes mixed in the soil and it directly affects the fertility of the soil. Currently, the large amount of plastic is dumped into sea. This plastic wastes gives risky effect on the marine life and quality of seawater also polluted by this plastic. Converting this plastic waste into construction products is the most economical solution in the present construction industry, and it is also economical and environment friendly solution which drive out the plastic wastes. Water absorption of plastic sand brick is 0%. This plastic sand bricks are useful for the construction industry when compare to the Fly Ash bricks and 3rd class clay bricks.
4. Rubio de Hita, et al., (2018) [17] described the procedure for manufacturing a beam-filling piece for the construction and rehabilitation of traditional timber-beam floor structures using pieces made of cement mortars with aggregates consisting of mixed polypropylene plastic waste from urban waste collection plants. Previously the piece was manufactured, a series of mortars was produced with aggregates of recycled plastic as partial substitute for natural aggregates. These sealants were categorized in both fresh and hardened state by analyzing their physical and mechanical properties. The outcomes helped to determine the best dosage for achieving the levels of resistance required by law for infill bits.
5. ManendraVaitla, et al., (2019) [8] studied the plastic wastes disposal. In India, more than 15,000 tons of plastic wastes are generated every day, of which 6,000 tons remain uncollected and scattered as per the Government statics. Reuse of bulky wastes is considered as one of the best environmental alternatives for solving the problem of disposal

IV. METHODOLOGY

The manufacturing process of plastic bricks involves the following steps:

1. **Plastic Collection and Sorting:**

Plastic waste is collected from various sources and sorted according to its type, color, and contamination levels.

Fig. Collected Plastic Waste

2. **Plastic Washing and Drying:**

   The collected plastic is washed to remove dirt and debris, and then dried to remove moisture**.**

3. **Plastic Grinding:**

   The clean and dry plastic is ground into small flakes or pellets.

4. **Plastic Melting:**

   The ground plastic flakes are melted in a high-temperature extruder or mold. This molten plastic mixture is the main component of plastic bricks.

Fig. Plastic Melting

5. **Molding:**

   The molten plastic is injected into molds designed to create the desired shape and size of the bricks.

6. **Cooling and Hardening:**

   The molded bricks are cooled and hardened to achieve their final shape and strength.

Fig. Final Product

V. RESULTS

- The compressive and tensile strength of the plastic brick is higher than the normal concrete brick used for construction.
- It is inferred that the plastic brick material will have good properties used as thermal insulator material due to its high polymer content.
- The use of marine sediment waste as the construction material can promote better weather resistance to the blocks.
- The plastic waste materials when effectively mixed with rubber powder and calcium carbonate gives the highest compressive strength which can bear the high compressive load.
- The water absorption rates in the plastic brick are appeared to be less than other materials so that it can build a good bond between the aggregates, thus improving the mechanical strength of the permeable brick.
- The firing and cementing methods are high energy consumption and large carbon footprint as the conventional brick production methods. Though polymerizations seem to be energy efficient and environmental concerns.
- As such they would have a limited lifespan due to degradation by UV. Hot climate or direct contact to sun could make them soft. Extreme cold weather would make them brittle. Otherwise, they would crack in several years due to thermal cycling.

VI. CONCLUSION

Thus, the presented study helps in reducing the plastic waste disposal problem as it utilizes the waste and converts it into a useful construction material. Extruder machine plays a prominent role in the adaptation of waste plastic into its melted form. Also, extruder does not possess any threats to the environment and hence it can be used without any restriction.

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