

## A REVIEW ON PLASTIC MATERIAL CONCRETE AND AGGREGATE

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### ABSTRACT

Plastics are cheap, lightweight, versatile, and readily accessible material. The utilization of plastic has become a necessary facet of our day-to-day lives, and its production has risen exponentially in the last 50 years. As a result, there is an increase in the generation of waste related to plastic that leads to undermining the environment. This encourages researchers to use this waste in concrete manufacturing as a sustainable material. However, this paper reviews recent research on how the utilization of recycled plastic in concrete is an effective solution to enhance sound and thermal insulation. The aggregate comprises the largest and heaviest portion of concrete which accounts for 85% of its weight. Besides, the plastic has a low density compared to the aggregate. As a result, the use of plastic waste as a partial replacement (50% to 75%) for the total aggregate significantly boosts the efficiency of thermal and sound lightweight concrete insulation. In addition, the cost of its manufacturing is drastically diminishing in comparison to that of ordinary concrete, and plastic can be installed and utilized quickly with less labour due to its lightweight nature. Plastic waste may be considered a typical material for the production of lightweight green concrete

**KEYWORDS** – Plastic material concrete and aggregate, compressive strength and tensile strength, plastic reduction.

### 1. INTRODUCTION

The disposal of plastic waste is a big problem because without organic compounds, it is a non-degradable material and turns out to be a threat to our environment because it has many health risks. Because plastic degradation is a serious problem because it takes a very long time and affects the environment in many ways. So, we can use it in construction, where it is necessary to improve the service life of the structure, and the use of plastic waste after some processing can help reduce environmental waste, which is the new motto of civil engineering.

### 2. LITERATURE REVIEW

The current research is predicated upon prior investigations conducted in the domain of utilizing waste materials as substitutes for conventional coarse aggregates. Such studies provided valuable insights into the challenges associated with waste disposal, as well as the potential advantages of employing appropriate waste materials to replace the increasingly scarce conventional crushed coarse aggregates and mixing materials.

**P.MANIKANDAN (2014)** - The strength, such as compressive strength and tensile strength, is increased by 30% to 60%

- The self weight of concrete is too low compared to conventional concrete
- When plastic is added above 10% the concrete will have to be loose its compressive strength abruptly
- The applications of plastics enhance the strength of the concrete as well as one of the ways of disposal of waste plastics without affecting in any manner.

**Isaac Galobardes (2022)** – The utilization of plastic in concrete is the preferred solution toward achieving environmental sustainability. Furthermore, plastic wastes are ideal, economical, and safe materials to be used within the manufacturing of lightweight green concrete in buildings development; specifically, sound insulation and thermal insulation; and for achieving environmental sustainability and give good compressive and tensile strength

**B.Jaivignesh (2017)** – At all curing ages, the compressive strength decrease is mainly due to adhesive strength between the surface of the waste plastic and the cement paste. The hydration of cement is also restricted by means of using waste plastic, which is a hydrophobic material. In addition, waste plastic is due to the presence of plastic aggregate, relatively less when compared with effectively used as a conservation point of view.

**Rohit Khobragade (2020)** – Due to the use of recycled aggregate in the construction industry, it can slow down the impact of the waste on the environment. Higher ratio of Recycle aggregate can affect the properties and strength of the mix. Hence proved that recycled aggregate can use with natural aggregates. It can be further analysed that again more improvement is to be carried out in the recycled aggregate to replace common aggregate properly.

**Byron K.N (2023)** – 1. The physical characteristics of plastic aggregates largely control the workability performance and microstructure of the cement composite, which includes plastic aggregate and PVC plastic aggregate. The size and shape of plastic aggregate were found to exert a major influence on the performance of fresh-state as well as the pore formation mechanism within the cement matrix.

2. . PVC plastic aggregate can be used for substitution for a coarse aggregate at low content level
3. The PVC plastic in powder form can be applied when the strength is not their main priority in the concrete application, for example, for the concrete infrastructure application, with a moderate strength of about 21 to 30 MPa.
4. The PVC plastic aggregate can be strengthened by using modification methods that enhance bonding characteristic within the cement matrix.

**T.Hazra (2024)**– The presence of plastic aggregates was found to diminish compressive strength, with the most significant reduction occurring when natural coarse aggregates were substituted with polyethylene terephthalate (PET) aggregates. Although a decrease in compressive strength was observed in correlation with an increase in the proportion of plastic aggregates, it has been established that a replacement of up to 30% with polyethylene (PE)-based concrete remains permissible. Moreover, the mixed concrete demonstrates suitability for lightweight structural applications, as the minimum compressive strength achieved exceeds 17 N/mm<sup>2</sup>.

**Puneet Sharma (2019)** – In the present study, plastic was incorporated into concrete as a partial replacement for coarse aggregates, with proportions of 0%, 2.5%, 5%, 7.5%, and 10% being utilized. Based on the findings of this investigation, several conclusions were drawn:

- The materials utilized in the experiments demonstrated satisfactory workability and overall quality.
- The admixture employed in the experiments had a significant effect on the compressive strength of the concrete.
- The specific gravity of the plastic was found to be lower than that of the conventional aggregates.
- During the assessment of the flexural strength of the beams, it was observed that failure occurred in the loading span situated between the two supports. The relevant formula applied for this evaluation was  $3PL/4bd^2$ .
- It was noted that the compressive strength of the concrete exhibited an initial increase at the 2.5% plastic content, after which further increments in plastic content resulted in a reduction in strength.
- The optimum compressive strength was determined to be achieved at a plastic content of 2.5%.
- The tensile strength recorded in the cylinders demonstrated superior performance in comparison to other measured strengths.
- The results pertaining to flexural strength were found to be consistent with those observed for compressive strength.

**Kiran Tota Maharaj (2022)** - The substitution of 10% of fines with waste plastic aggregate resulted in a compressive strength that was determined to be 1.63% below the stipulated requirement of 40 MPa. Further more, the failure modes observed during slump and compression testing were deemed satisfactory, indicating that this proportion of waste plastic aggregate may be viable for use in non-primary structures, including roads, pavements, and facades

### 3. CONCLUSION

The current research was conducted in light of the significant production of non-biodegradable plastic waste and the rapid depletion of natural aggregate resources. One potential solution to address these issues involves the utilization of plastic waste in the production of beneficial materials, such as concrete. This experimental study aimed to evaluate the feasibility and viability of partially substituting conventional crushed coarse aggregate with recycled plastic, as well as the incorporation of plastic within the cement content for concrete manufacturing. The findings derived from a comprehensive literature review suggest the following conclusions:

- The significant accumulation of non-biodegradable plastic waste presents a critical challenge pertaining to waste disposal. The intrinsic properties of plastic render it a suitable material for incorporation into concrete production, thereby providing a potential solution to this disposal dilemma. The utilization of plastic in the construction of low-cost residential communities, along with its application in concrete manufacturing, has been demonstrated to enhance the mechanical properties of concrete. Furthermore, both approaches offer economic advantages.
- The integration of plastic into concrete production not only contributes to cost-effective manufacturing processes but also addresses the environmental challenge of waste disposal. Numerous studies have indicated that both recycled plastic and plastic waste can be employed in concrete independently. However, it is essential to explore the combined utilization of these materials to thoroughly assess their effectiveness and impact on the properties of concrete.

### 4. REFERENCE

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