



Utilization of plastic waste and rubber in concrete by partial replacement of coarse aggregate

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ABSTRACT

About 6.5 billion tons of discarded plastic and rubber wastes are generated every year globally, and the disposal of these wastes poses a great threat to the environment due to their long period for degradation. Therefore, a direct recycling and reusing of these wastes as green construction material can potentially reduce the environmental burden. Considering plastic and rubber are both synthesized polymer materials containing similar basic elements with distinct structures, this paper aims to comparatively review the functions and impacts of plastic and rubber wastes used as eco-friendly aggregates on the fresh and hardened properties as well as the durability performance in mortar and concrete. The type and source of plastic and rubber wastes used as aggregate, as well as their effects in terms of aggregate size, replacement content, and shape and treatment method are highlighted.

In general, the presence of plastic aggregate decreases the workability of concrete, while the effect of rubber aggregate is mainly governed by the size and replacement content. The objective of this paper is to investigate the use of rubber pieces as coarse aggregate in the concrete. Concrete tested with varying percentages of rubber from 0 to 15% of normal aggregates. Compressive strength, of concrete is measured and comparative analysis is made.

Key words: Waste plastic, Recycled Rubber, Fine Aggregates.

INTRODUCTION

Concrete is made by means of the composition of cement, coarse aggregate and fine aggregate. Among all kinds of construction materials concrete is the most frequently used material. Due to which there is decrease in the natural aggregates. There are several techniques which were proposed for the consumption of waste tyre, one of them is the use of rubber in the concrete as full or partial replacement of coarse aggregates or fine aggregates. Alteration of building materials has an important role in the building sector. Various numbers of attempts have been thus made in the construction material field to get into use refused waste products like damaged used tyres, into valuable and gainful items. Success in this case will have a great contribution towards the decline of waste material dumping problems by utilization of the waste materials as a raw matter for other construction requirements. As dumping and burning of waste and discarded rubber is a very difficult and pollution producing process.

The intension of this experimental study is to using Plastic and rubber as aggregate in cement concrete. A review of recent research has shown that it is possible to use industrial waste material in the concrete preparation as replacement of

aggregate. The waste Plastic and recycled rubber was used as an alternative of coarse aggregate and its properties were investigated. So in such cases waste materials are used to modify the mechanical and Durability properties of concrete to make it suitable for any situation. It reduces the cost, save energy, promoting ecological balance and conservation of natural resources. Extensive investigations on wastage recycling are being implemented to minimize the environmental damages. Investigation shows that used tyre do not decompose under environmental condition, so burning is the only the choice for their decomposition, which causes harmful pollution. On the basis of experiments, we can use these crumb rubber tyres in concrete as coarse aggregate. However, this may decrease the compressive strength of concrete which will be compensated by adding nano-silica to the rubber containing concrete.



Fig. 1 Recycled Rubber



Fig. 2 Plastic Waste

Problem Statement

The hazard due to plastic and rubber waste is increasing day by day. Thus, affecting the environment. The objectives of this project is to determine how Waste Plastic and Recycled Rubber can be used in construction industry(12).

Project Objectives

The objective of this study is to test the properties of concrete when shredded or crumbed rubber used as aggregate by partial replacement of natural aggregates. The parameters of this investigation include the compressive strength of concrete specimens cubes of 150mm X150mm X150mm size. M25 grade concrete is used for testing and percentages of rubber aggregates are 0%,5%, 10% and15% of normal aggregates. The natural aggregates are replaced by rubber aggregates on the volume basis. The strength performance of modified concrete specimens was compared with the conventional concrete. The parameters of this investigation include the compressive strength and workability of concrete.

LITERATURE SURVEY

In 2016, Tiwari et al. presented a review assessing different industrial waste products such as bottom ash, waste foundry sand, copper slag, plastic waste, recycled rubber waste and crushed glass aggregate as a replacement of fine aggregates in concrete (Tiwari et al. 2016).

Guand Ozbak- kaloglu summarized the studies on recycling techniques of plastic waste and the effect of its addition on the characteristics and morphology of concrete (Gu and Ozbak kaloglu 2016).

In 2018, Toghroli et al. reviewed the usage of recycled waste materials in pavement concrete. The reviewed waste materials include recycled crushed glass, steel slag, steel fibre, tyres, plastics and recycled asphalt (Toghroli et al. 2018).

Babafemi et al. presented a review on the properties of concrete incorporated with waste recycled plastic. It has shown the effect of recycled waste plastic on the mechanical properties and durability (Babafemi et al. 2018).

Singh et al. critically reviewed the use of polyethylene terephthalate (PET) and marble dust in composite for construction (Singh et al. 2021).

MATERIALS USED IN THIS STUDY

1. Cement
2. Fine Aggregates
3. Coarse Aggregates
4. Recycled Rubber
5. Plastic Waste
6. Water

CONCLUSION

As per the case study we conclude that, we can use Recycled Rubber and Waste Plastic as partial replacement of aggregates in concrete for sustainable development.

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