

# Effect of Influence of Metakaolin and Shredded Plastic Waste on Strength and Durability Properties of M20 Grade Concrete

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**Abstract:** The production of cement liberates the equal amount of CO<sub>2</sub> into the environment. This will results in various social and environmental problems. There is a need in determining the new cement materials from waste or industrial waste. Second, the extraction of natural aggregates from natural resources poses other environmental problems. So in this article, the experimental programme is conducted to determine the strength and durability performance of cement partially replaced with Metakaolin (MK) (0%, 2.5%, 5%, 7.5% and 10%) and coarse aggregate substituted by shredded plastic waste (SPW) at 0.5% by weight. The main objective of this article was limited to analyzing the strength parameters along with the durability parameters.

**Keywords:** Metakaolin, Shredded Plastic Waste, Mechanical Strength and Durability Parameters.

## I. INTRODUCTION

Cement is a broadly used construction material due to its ease of mixing and placing. During the production of cement, large amount of CO<sub>2</sub> are released, a rather harmful greenhouse gas [Choate, W.T. (2003)]. 7% of global greenhouse gas emissions are incorporated by the cement production industry. To reduce the effect of greenhouse gases on the environment, several substitute materials are used for cement. Among all the other cementitious materials, MK is white in color and has strong pozzolanic activity derived from kaolinite rocks [Siddique, R. (2008)].

The use of natural aggregates leads to exploitation of natural resources in the large manner and creates various social and environmental problems [Malik et al (2013)]. The demand for the new building is consistently increasing at steady state as the population increases. So the need for the eco-friendly aggregates has become a challenge. By considering these aspects, the future of the construction sector looks bleak.

In India, the amount of solid waste is increasing rapidly due to population growth. Among solid wastes, plastics account for 8% by weight of total solid waste [Asoka, P et al (2007)]. In order to solve the problem of disposal of large quantities of plastic and to solve the growing demand for aggregates in concrete, application of plastic waste material in concrete can be considered a viable application.

Based on the detailed investigation on the literatures, it was concluded that the cement can be replaced by MK which has the higher pozzolanic properties than other substitute

materials. Disposal waste plastics directly on the environment creates various problems and takes hundreds of years to decompose naturally. As per the previous literatures, it is possible to use the waste plastics as a coarse aggregate in the concrete. In this study, it was proposed that, the cement was partially substituted by MK up to 10% at an intervals of 2.5% and shredded plastic wastes are replaces the coarse aggregate by 0.5% and detailed investigations has been carried out on various properties of concrete.

## II. MATERIALS USED

The list of materials used in this study is as follows.

- Cement (OPC 53 grade)
- Metakaolin
- Fine aggregate (River sand)
- Shredded plastic waste
- Coarse aggregate (Gravel)
- Super Plasticizers.

### A. Cement

For this study, an OPC grade of 53 was used, thus confirming IS: 12269 – 2004 and the basic properties of cement were illustrated in Table 1.

Table 1: Properties of Cement

Properties	Results
Standard consistency	30%
Specific gravity	3.12
Fineness of cement	6.07
Setting Time (min) Initial	37
Final	585



Fig.1: Cement

Revised Manuscript Received on July 15, 2019.

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