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Study of Characteristic Strength of Concrete by Partial Replacing Cement with Ceramic Waste Powder A Review

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ABSTRACT

In the construction industry, ceramic wall tiles are utilized as building materials. diverse raw materials, including clay, potash, dolomite, feldspar, talc, and diverse compounds, including sodium silicate, sodium triopoly, and phosphate (STPP), are used to make ceramic tiles. Due to this manufacturing variation, the temperature in the kiln fluctuates from 200°C to 1200°C, and the material possesses pozzolanic reactivity. During various manufacturing processes, 5–10% of the production in the ceramics industry is lost. (this waste percentage goes down if the technology is installed in new units.) The waste from the ceramic factory was dumped nearby, resulting in environmental pollution that harmed the nearby fields and residences. Therefore, incorporating ceramic waste powder in concrete would help save energy and safeguard the environment in a variety of ways. There will be a reduction in the price of disposing of ceramic trash in landfills. Natural resources and raw materials will be replaced. which indirectly contributes to the reduction of greenhouse gases(co2). In the process of making cement, a lot of carbon dioxide is emitted. In this investigation, cement in concrete is incrementally replaced with ceramic waste powder from the ceramic wall tile business in the range of 0% to 10%.20%, 30%, and 40% of cement by weight are used to make M25 grade concrete. This research is based on secondary as well as primary data. This investigation highlighted nature of concrete strength variation with increasing the ceramic waste. The maximum strength gain when 30% of cement is replacing by ceramic waste.

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I. INTRODUCTION

Each year thousands of tones of wastes are disposed of in landfills which effects occupation and degradation of valuable land. Due to fast industrialization, urbanization, and infrastructure expansion in developing nations like India, the depletion of natural resources is a typical occurrence. India produces 100 million tons of ceramics annually. In the ceramics sector, waste material makes up 15% to 30% of overall production. Currently, there is no recycling of this garbage in any way. Even though designated sites have been marked for dumping, the Ceramic Industries continue to dump the powder near their unit in any neighbouring pit or empty spaces. This causes significant environmental and dust pollution, especially after the powder dries up, and occupies a significant amount of land, thus it is imperative to swiftly dispose of ceramic waste and use it in the building business. Ceramic businesses are under pressure to find a solution for the disposal of the trash that is accumulating daily. Modern concrete technology has the potential to use fewer natural resources. They are being compelled to concentrate on resource recovery, repurposing, and other alternatives. The use of replacement materials results in lower costs, less energy use, possibly superior goods, and less environmental dangers.

1.2. Cement

cement is a fine, grey powder that solidifies into a stiff chemical mineral structure when it reacts with water, giving concrete its strength. About 1.6 billion tonnes of cement clinker were produced globally. Concrete is the second most consumed substance on earth after water when it is combined with aggregates. As a foundation for new construction, manufacturing, and infrastructures—which are the foundation of development—cement consumption is correlated with a nation's economic progress. As a result, cement production has dramatically expanded in those emerging nations.

Types of Cement

Depending on its composition, how it is made (by grinding, burning, etc.), and the relative proportions of the various components, there are several varieties of cement. Portland cement, one of these varieties and the most used one, is itself broken into numerous types. The other popular form of cement is Portland pozzolana cement, which includes pozzolanic elements in certain quantity. Portland cement is one of the most widely used cement and is the most important hydraulic cement. It can also be used to make plaster and mortar. All forms of structural concrete, including walls, floors, bridges, tunnels, etc.

1.2. Hydration of Cement

When Portland cement and water are combined, the chemical reactions between the cement's and the water's component compounds cause the concrete to harden. Hydration isthe name given to the chemical reaction between water and cement that creates new compounds known as hydration products. Rate of hydration of the concretes differs from cement to cement depending on the fineness, the rate of cooling of the clinker and other factors like presence of impurities and other cement compounds.

Physical Properties of Cement

The physical characteristics of cement are constrained by specifications. When analysing the results of cement testing, it can be beneficial to understand the relevance of certain of the physical qualities. Tests of the physical properties of the cements should be used to evaluate the properties of the cement, rather than the concrete like finess consistency and setting time. Numerous cement qualities are impacted by its fineness.

1.2. Concrete

The most often utilized material in modern building is concrete. The present construction system is founded on it. Concrete constructions have a significant impact on a variety of human activities, including those that require us to live and work in buildings, travel on roads, collect water and electricity from dams, and more. Concrete's versatility is due to its capacity to be cast into any desired forms and arrangements. It is made of coarse granular material known as aggregate or filler that is embedded in a hard matrix of material (cement or binder with water). The cement or binder fills the space between the aggregates and binds them together. Concrete solidifies and hardens when the ingredients are combined with water as a result of a chemical process between the water and cement known as hydration, which eventually binds the aggregates together to produce a stone-like structure.

II. LITERATURE REVIEW

AD Raval et al. (2013)

One of the most active study fields in a variety of fields, including civil engineering and building materials, is ceramic waste. Ceramic waste powder is settled by sedimentation and then discarded, endangering both human health and agriculture in addition to causing environmental damage. Use of the ceramic waste powder in many industrial fields, particularly in the building, farming, glass, and paper industries, will thereby contribute to environmental protection. It is crucial to create environmentally friendly concrete from ceramic waste. In this research project, ceramic waste powder has been used in place of (OPC) cement in the following proportions: 0%, 10%, 20%, 30%, 40%, and 50% by weight of M-25 grade concrete. Concrete mixtures were created, evaluated, and compared to traditional concrete in terms of compressive strength. These tests were run to assess the mechanical qualities throughout the course of 7, 14, and 28 days. As a result, replacing cement with ceramic waste increased compressive strength by up to 30%. This study focuses on the experimental analysis of concrete strength and the best replacement percentage for cement using ceramic waste at 0%, 10%, 20%, 30%, 40%, and 50%.

Amr S EI-Dieb et al. (2018)

Over 22 billion tonnes of ceramic waste powder (CWP), which is created during the final polishing of ceramic tiles, are generated globally each year. Environmental issues from the disposal of CWP in landfills will be severe. (i.e, soil, air, and groundwater pollution). Chemically, CWP is distinguished by being primarily made of silica ($SiO2$) and alumina. ($Al2O3$). More than 80% of the CWP is made up of these two minerals. To create environmentally friendly concretes, CWP has the potential to be employed as an element that replaces Portland cement either totally or in part. The purpose of this chapter is to provide an overview of the effects of employing CWP in the creation of eco-friendly concretes, with an emphasis on the development of zero-cement alkali-activated concrete and its use as a partial cement substitute in self-compacting concrete (SCC) and conventional vibrated concrete (CVC).

Pincha Torkittikul et al. (2010)

The purpose of this research was to determine whether it was feasible to make mortar and concrete from of ceramic waste and fly ash. To create fine aggregates, ceramic waste fragments from a nearby industry were crushed and sieved. The measured concrete properties show that while the workability of fly ash concrete with 100% ceramic waste as fine aggregate decreased with increasing ceramic waste content for Portland cement concrete and fly ash

concrete, it remained adequate, in contrast to the Portland cement control concrete with 100% ceramic waste where close to zero slump was observed The compressive strength of the concrete made from ceramic waste was observed to decrease as the ceramic waste percentage was raised above 50%, peaking at 50% for the control concrete. This was a direct result of the concrete being less usable. However, as the percentage of ceramic waste was increased up to 100%, the compressive strength of the fly ash concrete also rose. As a result, the advantages of employing ceramic waste as fine aggregate in concrete that contains fly ash were confirmed.
Said Jalali et al.(2010)

In this article, an experimental investigation of the characteristics and toughness of concrete including ceramic wastes is presented. A number of concrete mixtures with a goal mean compressive strength of 30 MPa were created using ceramic powder to substitute 20% of the cement (W/B = 0.6). Both a concrete mix with natural sand and coarse ceramic aggregates (W/B = 0.5) and a concrete mix with ceramic sand and granite aggregates were made. Mechanical tests, water performance, permeability, chloride diffusion, and accelerated ageing tests are used to evaluate the mechanical and durability performance of concrete made from advantages will result from using ceramic waste in place of cement and aggregate in concrete. ceramic waste. Results show that concrete with some of the cement substituted with ceramic powder performs more durably, although having a minor drop in strength. In terms of compressive strength, capillarity water absorption, oxygen permeability, and chloride diffusion, results also reveal that concrete mixtures with ceramic particles outperform control concrete mixtures. Significant environmental.

III. REFERENCES

[1]. IS 383 1970 Indian Standard Specification for coarse and fine aggregates from natural sources for concrete Bureau of Indian Standards New Delhi.
[2]. IS 12269 1987 Indian Standard Specification for 53 Grade Ordinary Cement Bureau of Indian Standards New Delhi.
[3]. 516 1959 (1989) Indian Standard method of tests for strength of concrete Bureau of Indian Standards New Delhi.
[4]. RM Senthamarai, P Devdas Manoharan (2005) Cement &Concrete composites 27(9-10), 910-913
[5]. Torkittikul, Arnon chaip anich (2010) Cement & Concrete Composite 32(6) 440- 449
[6]. Abdullah, Kr Hussian (2006) Journal of engineering research &education
[7]. A D Raval, Din Patel, Pj Pitroda (2013) International Journal of Engineering Trends, 2324-2329

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