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Grenner Concrete Using Agro Industrial Waste Partial Replacement of Cement

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ABSTRACT: The utilization of industrial and agricultural waste produced by industrial processes has been the focus of waste reduction research for economic, environmental and technical reasons. Sugar – cane bag asses is a fibrous waste – product of the sugar refining industry, along with ethanol vapor. This waste product (sugar – cane Bag asses Ash) is already causing serious environmental pollution, which calls for urgent ways of handling the waste. Bagasse ash has mainly contained silica and aluminum ion. In this project, the Bagasse ashhas been chemically and physically characterized, and partially replaced in the ratio of 0%,5%, 10%, 15%, and 25% by weight of cement in concrete. Ordinary Portland cement was replaced by ground bagasse ash at different percentage ratios. The compressive strengths of different mortars with bagasses ash addition were also investigated. M30 concrete mixes with bagasse ash replacements of0%, 5%, 10%, 15%, and 25% of the Ordinary Portland cement were prepared with water – cement ratio of 0.42 and cement content of 378 kg/m3for the control mix. Wet concrete tests like slump cone test, as well as hardened concrete test like compressive strength, split tensile strength and flexural strength at the age of7days, 28 days and 90 days were carried out. The test results indicated that up to 10%replacement of cement by bagasses ash results in better or similar concrete properties andfurther environmental and economic advantages can also be exploited by using bagasse as has partial replacement material.

INTRODUCTION

This Concrete is the most important material for any construction work like building construction and cement concrete pavement. There are some modifications performed in concrete by the introduction of fly ash in the concrete. Fly ash is cementitious material so cement is partly replaced by flyash in concrete. Fly ash is a waste product of thermal power plants in large quantities. To fulfil the need for electricity large amount of coal is burned in the thermal power plant which produces a million tonnes of fly ash. Fly ash contains SiO_2, CaO, and Al_2O_3. Fly ashes are classified into Class C and class F. Class C ashes are generally derived from Sub- bituminous coal, which contains more than 20% of CaO. ClassF ashes are derived from bituminous and anthracite coal which contain less than 10% CaO. The compressive strength of fly ash mix concrete is lower in the early time, but due to pozzolanic reaction strength increase over a large longer period. Fly ash increase the workability of concrete, but when the percentage of fly ash increase in concrete then the compression strength of concrete decreases. the property of fly ash increases the strength and durability when used in Portland cement up to a limited amount. Many experiments are being conducted to replace cement in concrete with fly ash. At every percentage of replacement, the compressive strength of the concrete cube is checked and each result is effective and applicable. Fly ash can be used up to (40-45) % in concrete. Fly ash is a by-product of burning coal in thermal power plants. It is composed of fine, powdery particles that are

carried away with the exhaust gases and collected by electrostatic precipitators or bag filters. Fly ash is widely used as a supplementary cementitious material in concrete due to its pozzolanic properties. When fly ash is added to concrete, it reacts with calcium hydroxide in the presence of water to form a cementations compound, which can improve the strength, durability, and workability of the concrete.
Fly ash is typically classified into two categories: Class F and Class C. Class F fly ash is produced from burning anthracite or bituminous coal and has a lower calcium oxide content, while Class C fly ash is produced from burning sub-bituminous coal and has a higher calcium oxide content. Particle Size of Fly ash particles are typically fine, ranging from less than one micron to several hundred microns in size. The particle size distribution can affect the pozzolanic properties of fly ash.

LITERATURE REVIEW

R.E. Philleo.[1] studied fresh and hardened properties of fly ash in concrete and revealed that fly ash has a significant effect on the properties of fresh and hardened concrete the workability of the fly ash concretes was found to be much better, and the water requirement was lower, the rate and volume of the bleeding water were either higher or about the same, and the setting was slower, depending on the type and properties of the fly ash and the mix proportion.
Marthong C and Agrawal T.P(2012) [2] have stated that the normal consistency increases with an increase in the grade of cement and fly ash content. Setting time and soundness decreases with the increase in the grade of cement. The use of fly ash improves the workability of concrete and workability increases with the decrease in the grade of cement. Bleeding infly ash concrete is significantly reduced and other properties like cohesiveness, pumping characteristics, and surface finish are improved.
M.L Gambhir [3] Compressive strength of concrete increases with the grade of cement. As the fly ash content increases in all grades of Ordinary Portland Cement (OPC), there is a reduction in the strength of the concrete. The rate of strength gain of concrete with age is almost similar in all three grades of OPC. Concrete with 20% fly ash content closer to that of ordinary concrete at the age e of 90 days. In all grades of OPC, fly ash concrete is more durable as compared to OPC concrete, and fly ash up to 40% replacement increases with the grade of cement. Shrinkage of fly ash concrete is like pure cement concrete in all grades of OPC. According to Bendapudi S.C.K and Saha P (2011) [4], a primary goal is a reduction in the use of Portland cement, which is easily achieved by partially replacing it with various cementitious materials. The best known of such materials is fly ash, a residue of coal combustion, which is an excellent cementitious material. In India alone, we produce about 75 million tons of fly ash per year, the disposal of which has become a serious environmental problem.
The effective utilization of fly ash in concrete making is, therefore, attracting serious consideration from concrete technologists and government departments. The new Indian Standard on concrete mix proportions (IS 10262-2009) is already incorporated fly ash as a supplementary material to cement. Fly ash replacement of cement is effective for improving the resistance of concrete to sulphate attack expansion.
Ujjwal Bhattacharjee et al [5] demonstrated a simple framework for estimating the utilization potential of fly ash in India. The use of fly ash in cement production, road embankment construction, and brick manufacturing has been considered. The results for the projected levels of fly ash utilization show that, despite assuming quite optimistic levels of fly ash, the overall fly ash utilization is less than 25% of the total fly ash produced.

Tarun, R. [6] performed mix proportions with 20% and 50% of class C fly ash and 40% of class fly ash for the replacement of Portland cement. The test results (fresh concrete properties, compressive strength, flexural strength, tensile strength, freezing, and thawing durability) show that high volumes of class C and class F fly ash can be used to produce high-quality concrete pavement with excellent performance.

Henry A. Foner et al [7] revealed that the physical, chemical, mineralogical, and technical properties of fly ash show excellent pozzolanic properties, and this fly ash can give higher quality raw material. The fly ash acts as excellent pozzolan in the addition of cement in large construction of dams, ports, etc. This is especially relevant in light of the current "Peace Process" in the Middle East. Fly ash is replaced for cement, fine aggregates, and coarse aggregates, as a constituent of raw materials for lightweight and lightweight aerated concrete.

METHODOLOGY TESTS ON CONCRETE

SLUMP CONE TEST
COMPACTION FACTOR TEST
CHARACTERISTICS COMPRESSIVE STRENGTH TEST
FLEXURAL STRENGTH TEST

1. SLUMP CONE TEST:

The concrete slump test determines the consistency of fresh concrete before it hardens. It is used to test the workability of freshly made concrete and, as a result, the ease with which concrete flows. It can also be used to detect an incorrectly mixed batch. The test is popular because of the simplicity of the apparatus used and the simple procedure.

2. COMPACTION FACTOR TEST:

The compacting factor test is intended for use primarily in laboratories, but it can also be used in the field. It is more precise and sensitive than the slump test and is especially useful for very low-workability concrete mixes. It is typically used when concrete is to be compacted by vibration.

3. CHARACTERISTICS TEST FOR COMPRESSIVESTRENGTH:

According to Indian Standards, the compressive strength of concrete is given in terms of the characteristic compressive strength of 150 mm size cubes tested at 28 days (fck) The characteristic strength of concrete is defined as the strength below which no more than 5% of the test results are expected to fall. The specimen is usually 150mm x 150mm x 150mm in size, and is made by pouring the concrete into a mold and allowing it to cure for a specified period of time. The testing machine applies a compressive load to the specimen at a constant rate until it fails, and the maximum load that the specimen can withstand is recorded as its compressive strength.

4. FLEXURAL STRENGTH TEST:

flexural strength is an indirect measure of the tensile strength of concrete. It is a measure of the maximum stress on the tension face of an unreinforced concrete beam or slab atthe point of failure in bending. It is measured by loading (150x 150 x 600) mm concrete beam with span length of at least three times the depth.

TESTS OF COURSE AGGREGATE:

Specific Gravity, Fineness Module, and, Water Absorption Test. TESTS OF FINE AGGREGATE: Specific Gravity, Fineness Module, bulk density, and Water Absorption Test.
TESTS OF FLY ASH:
Specific Gravity, Fineness Module, bulk density, and Water Absorption Test. TESTS OF CEMENT: Specific Gravity, Finesse Test, Consistency, Initial and Final Setting Time, Compressive Strength, and Soundness Test.

CONCLUSION

Improved Strength and Durability: Fly ash is a pozzolanic material, which means it reacts with water to form cementitious compounds. These compounds improve the strength and durability of concrete, making it more resistant to damage caused by chemicals, freeze-thaw cycles, and abrasion.
Cost-Effective: The use of fly ash can significantly reduce the cost of construction materials as it is often cheaper than Portland cement. It also reduces the amount of cement needed in concrete mixes, which further reduces the cost.
Environmental Benefits: The use of fly ash reduces the amount of waste that goes into landfills, thereby reducing the environmental impact of coal combustion. It also reduces the need for virgin materials, which can help conserve natural resources.
Reduced Carbon Footprint: The production of Portland cement, the most commonly used cement in construction, is a significant source of carbon emissions. The use of fly ash as a replacement for cement in concrete reduces the carbon footprint of construction projects. Improved Workability: Fly ash can improve the workability of concrete mixes, making it easier to handle and place.

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