EXPERIMENTAL STUDIES ON CONCRETE CONTAINING – GLASS POWDER AND FLY ASH-REVIEW

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ABSTRACT-Concrete is a construction material which is used more than any other man made material in the world, Efforts have be made in the concrete industry to use waste glass and fly ash as partial replacement of coarse aggregate, fine aggregate and cement. This project mainly emphasis on the efforts using waste glass and fly ash in concrete and comparing with conventional concrete. This paper examines the possibility of using Glass Powder and Fly Ash as a partial replacement of cement for a new concrete. Fly ash was partially replaced at various levels. Compressive strength and Tensile strength up to 56 days of age were compared with those of conventional concrete, and concrete containing glass powder.

KEYWORDS: **Glass Powder, Fly Ash, compression strength**

INTRODUCTION

Concrete is a compound material made from sand, gravel and cement and is used in building construction. The cement is a mixture of various minerals which when mixed with water, hydrate and rapidly become hard binding the sand and gravel into a solid mass. The other major part of concrete besides the cement is the aggregate. Aggregates include sand, crushed stone, gravel, slag, ashes, burned shale, and burned clay. Fine aggregate (fine refers to the size of aggregate) is used in making concrete slabs and smooth surfaces. Coarse aggregate is used for massive structures or sections of cement .The oldest known surviving concrete is to be found in the former Yugoslavia and was thought to have been laid in 5,600 BC using red lime as the cement.

The interest of the construction community in using waste or recycled materials in concrete is increasing because of the emphasis placed on sustainable construction, the waste glass from in and around the small shops is packed as a waste and sent to landfill. The plain sheet glasses can be recycled, but it is costly to remove the color of colored glasses and recycle again. During the last decades it has been recognized that Use of waste glass in the concrete construction, as the production cost of concrete will go down. Glass is a unique inert material that could be recycled many times without changing its chemical properties . Besides using waste glass as cullet in glass manufacturing, waste glass is crushed into specified sizes for use as aggregates in applications like water filtration, grit plastering, sand cover for sport turf and sand replacement in concrete.

GLASS

Glass is produced in many forms, including packaging of container glass (bottles, jars), flat glass(windows, windscreens), bulb glass (light globes), cathode ray tube glass (TV screens, monitors etc), all of which have a limited life in the form they are produced and need to be reused/recycled in order to avoid environmental problems that would be created if they were to be stockpiled or sent to landfill. This paper deals with the recycling aspects of container glass, and the term “glass” hereafter refers to this type only.

RECYCLING OF GLASS

Post-consumer glass containers have traditionally been disposed of either in domestic refuse, which ends up in landfill, collected in designated collection spots for reuse/recycling, or collected from kerbside and then transported to collection sites. The major aim of environmental authorities is to reduce, as far as possible, the disposal of post-consumer glass in landfill and diversion to economically viable glass product streams.

Fig 1 glass powder

Glass is a unique inert material that could be recycled many times without changing its chemical properties. In other words, bottles can be crushed into cullet, then melted and made into new bottles without significant changes to the glass properties. Most of the glass produced is in the form of containers, and the bulk of what is collected post-consumer is again used for making containers.The efficiency of this process depends on the method of collecting and sorting glass of different colours. If different colour glass (clear, green, amber) could be separated, then they could be used manufacturing similar colour glass containers. However, when the glass colours get mixed, they become unsuitable for use as containers, and are then used for other purposes, or sent to landfill.

FLY ASH

The term "fly ash" is often used to describe any fine paniculate material precipitated from the stack gases of industrial furnaces burning solid fuels. The characteristics and properties of different fly ashes depend on the nature of the fuel and the size of furnace used.

Two classes of fly ash defined by ASTM C618 are Class F fly ash and Class C fly ash. The chief difference between these classes is the amount of calcium, silica, alumina, and iron content in the ash. The chemical properties of the fly ash are largely influenced by the chemical content of the coal burned (i.e., anthracite, bituminous, and lignite).

CLASS F FLY ASH

The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. This fly ash is pozzolanic in nature, and contains less than 10% lime (CaO). Possessing pozzolanic properties, the glassy silica and alumina of Class F fly ash requires a cementing agent, such as Portland cement, quicklime, or hydrated lime, with the presence of water in order to react and produce cementitious compounds.

FLY ASH IN CONCRETE

C.Freeda Christy et.al(2010), From this literature, the results of the cement mortar of mix proportion 1:3,1:4.5 and 1:6 cement mortar in which cement is partially replaced with Class-F fly ash as 0%,10%,20%,25% and 30% by weight of cement. Richer the mix, higher the compressive strength has been obtained even with partial replacement of fly ash with cement. Test result indicate the significant improvement in the strength properties of mortar with fly ash as partial replacement with fine aggregate and with the cement in the cement mortar 1:6.

HIGH VOLUME OF FLY ASH IN CONCRETE

S.M.Guptha et.al(2010), The application of concrete in construction is as old as the days of Greek and roman civilization. But for numerous reasons, the concrete construction industry is not sustainable. It consumes a lot of virgin materials and the principal raw material of concrete i.e. cement is responsible for green house gas emissions causing a threat to environment through global warming. The paradigm has shifted from one property to other of concrete with advancement in technology. The construction techniques have been modernized with focus on high strength, dense and uniform surface texture, more reliable quality, improved durability and faster construction. This paper discusses the development of high volume fly ash concrete for construction with reference to its predecessors like HSC and HPC.

FLY ASH IN CONCRETE

Amit Mittal et .all (2005), The study of fly ash in concrete as partial replacement of cement is gaining immense importance today , mainly on account of the improvements in the long term durability of concrete combined with ecological benefits. Technological improvements in thermal power plant operations and fly ash collection system have resulted in improving the consistency of fly ash. The partial replacement of cement by fly ash,20%, 30%,40%,50% replacement levels. This paper the effect of fly ash on workability , setting time, density, air content, compressive strength, modulus of elasticity, shrinkage and permeability by rapid chloride permeability are studied.

UTILIZATION OF WASTE POZZUOLANA PRODUCTS IN FLY ASH

Suresh.s et.al(2011), During the 20th century there has been an increase the consumption of mineral admixtures by the cement and concrete industries. This rate is expected to increase and the increasing demand for cement and concrete is met by partial cement replacement. The presence of mineral admixtures in concrete is known to impart significant improvements in workability and durability. This study focuses on utilization of waste Pozzuolana products such as fly ash as an alternative to OPC to produce ternary blended cement with an objective to increase the optimum percentage of replacement of pozzuolana to OPC without affecting the concrete properties. CO2 curing is carried out to reduce the curing duration without affecting the compressive strength and trying to achieving the 28 days compressive strength in a short period of 18 hours.

CREEP BEHAVIOUR OF CONCRETE WITH GLASS WASTE MICROFILLER

Andina sprince et.al,(2011), This paper deals every year there are several hundred tons of waste glass produce in latvia ,so re-used as a fine raw material and it presents a possibility to save natural , non – renewable materials . The use of glass powder in concrete production can make the construction industry more environmentally friendly . This paper examines the possibility of using glass powder as partial replacement of cement. Specimens of 20% and 40% cement replacement were compared with standard concrete specimens.

USE OF WASTE GLASS IN CEMENT-BASED MATERIALS

Rachida IDIR et.al,(2009), This paper presents as demand of recycled glass has considerably decreased in recent years, particularly for mixed-glass. Glass is cheaper to store than to recycle, as conditioners required expenses for the recycling process . There are several alternatives for the reuse of composite – glass. To provide a sustainable solution to glass storage, a potential and incentive way would be reuse this type of glass in concrete.

USE OF SHEET GLASS POWDER AS AGGREGATE REPLACEMENT IN CONCRETE

Narayanan Neithalath(2009), This paper deals with studies on the use of waste glass powder as an effective ingredient in concrete. Studies on cement pastes including mechanical property tests and thermal analysis were used to understand the influence of the glass powder on the cement hydration process and to arrive at an optimal dosage range. Cast-in-place concrete and block mixtures were proportioned with varying dosages of glass powder, and tests for mechanical properties, alkali-silica reaction, and water absorption were carried out. Though the complete effect of cement dilution was not overcome by the chosen dosage of glass powder, the strength results were comparable to that of control concrete.

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