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BEHAVIOUR OF M20 GRADE CEMENT CONCRETE BY PARTIAL REPLACEMENT OF CEMENT BY RICE HUSK ASH (RHA)

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Abstract:

The world at the end of the 20th century that has just been left behind was very different to the world that its people inherited at the beginning of that century. The latter half of the last century saw unprecedented technological changes and innovations in science and engineering in the field of communications, medicine, transportation and information technology, and in the wide range and use of materials. The construction industry has been no exception to these changes when one looks at the exciting achievements in the design and construction of buildings, bridges, offshore structures, dams, and monuments, such as the Channel Tunnel and the Millennium Wheel. There is no doubt that these dramatic changes to the scientific, engineering and industrial face of the world have brought about great social benefits in terms of wealth, good living and leisure, at least to those living in the industrialized nations of the world. But this process of the evolution of the industrial and information technology era has also, however, been followed, particularly during the last four to five decades, by unprecedented social changes, unpredictable upheavals in world economy, uncompromising social attitudes, and unacceptable pollution and damage to our natural environment. In global terms, the social and societal transformations that have occurred can be categorized in terms of technological revolutions, population growth, worldwide urbanization, and uncontrolled pollution and creation of waste.

Keywords: Urbanization, Natural, Millennium wheel, Offshore.

1. INTRODUCTION

How does concrete fit into this complex world scenario of the construction industry? The answers are simple but wide-ranging. Whatever be its limitations, concrete as a construction material is still rightly perceived and identified as the provider of a nation's infrastructure and indirectly, to its economic progress and stability, and indeed, to the quality of life. It is so easily and readily prepared and fabricated into all sorts of conceivable shapes and structural systems in the realms of infrastructure, habitation, transportation, work and play. Its great simplicity lies in that its constituents are most readily available anywhere in the world; the great beauty of concrete, and probably the major cause of its poor performance, on the other hand, is the fact that both the choice of the constituents, and the proportioning of its constituents are entirely in the hands of the engineer and the technologist. The most outstanding quality of the material is its inherent alkalinity, providing a passivating mechanism and a safe, non-corroding environment for the steel reinforcement embedded in it. Long experience and a good understanding of its material properties have confirmed this view, and shown us that concrete can be a reliable and durable construction material when it is built in sheltered conditions, or not exposed to aggressive environments or agents. Indeed, there is considerable evidence that even when exposed to moderately aggressive environments, concrete can be designed to give long trouble-free service life provided care and control are exercised at every stage of its production and fabrication, and this is followed by well-planned inspection and maintenance schemes. Engineers cannot afford to ignore the impact of construction technology on our surroundings - and this applies to our environment at a regional, national and global scale. The construction industry has a direct and visible influence on world resources, energy consumption, and on carbon dioxide emissions. Compared to metals, glass and polymers, concrete has an excellent ecological profile. For a given engineering property such as strength, elastic modulus or durability, concrete production consumes least amount of materials and energy, produces the least amount of harmful byproducts, and causes the least damage to the environment. In spite of this, we have to accept that Portland cement is both resource and energy - intensive. Every tonne of cement requires about 1.5 tonnes of raw material, and about 4000 to 7500 MJ of energy for production. The cost of energy to produce a tonne of cement is estimated to account for 40 - 45% of the total plant production cost. Much more importantly, every tonne of cement releases 1.0 to 1.2 tonnes of CO_2 into the environment by the time the material is put in place. In the world we live in, the use of resources and energy, and the degree of atmospheric pollution that it inflicts are most important.

2. RELATED WORK

It is now well established that the record of concrete as a material of everlasting durability has been greatly impaired, for no fault of its own, by the material and structural degradation that has, nevertheless, become common in many parts of the world (3-9).

Fig.1.Planting of rice fields

The major reasons for this apparent fall from grace are numerous - partly out of the perceived (or sometimes planted) image of concrete as a material of enduring quality that needs no maintenance, and as a medium that will not deteriorate; and partly by the assumption that somehow the impermeability of concrete and protection of the embedded steel against external aggressive agencies will be automatically and adequately provided for by the cover thickness and the presumed quality of concrete. Experience has shown that neither can be assumed as a normal and natural consequence of the process of concrete fabrication. As a specific example, some 40% of more than 500,000 highway bridges are rated as structurally deficient or functionally obsolete. Some $100 billion is the estimated requirement to eliminate current backlog of bridge deficiencies, and maintain repair levels. It can be readily seen that there is a fundamental problem in the construction industry - with choice of materials, design, construction, maintenance, repair and rehabilitation.

3. PROPOSED SYSTEM

RHA is used by the steel industry in the production of high quality flat steel. Flat steel is a plate product or a hot rolled strip product, typically used for automotive body panels and domestic 'white goods' products. This type of steel is generally produced by continuous casting, which has replaced the older ingot method. In the ingot method molten steel was poured into a large mould where it would be allowed to cool and solidify to form an ingot. The ingot would then be rolled in primary mills, in the first stage of its transformation into a usable steel product. In developed countries. Concrete is produced by mixing Portland cement with fine aggregate (sand), coarse aggregate (gravel or crushed stone) and water. Approximately 11% of ready mix concrete is Portland cement.

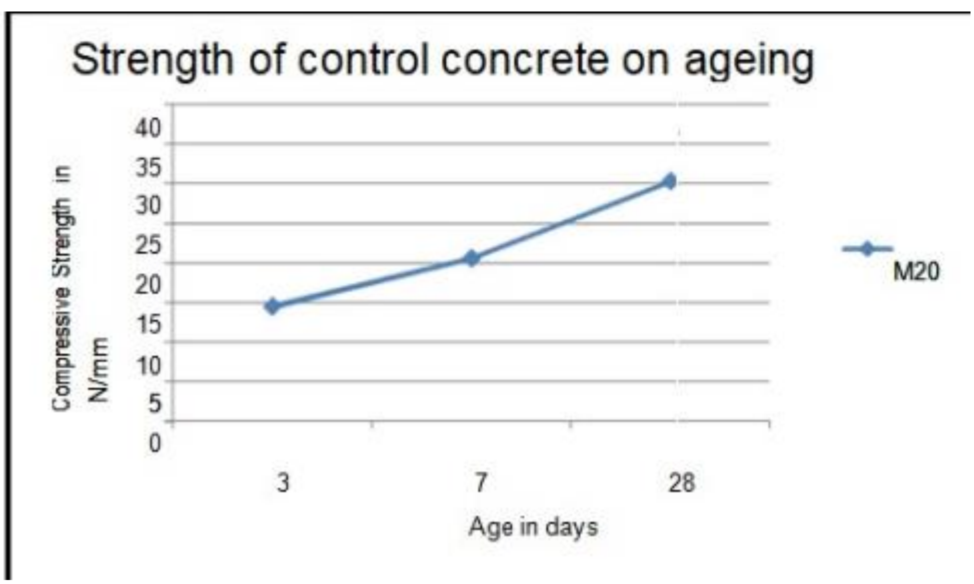

Fig.2.Strength control of concrete

It is the binding agent that holds sand and other aggregates together in a hard, stone-like mass. Cement is made by heating limestone and other ingredients to 1450°C in a kiln to produce clinker; this involves the dissociation 11 of calcium carbonate under heat, resulting in lime (calcium hydroxide) and CO2. The lime then combines with other materials to form clinker, while the CO2 is released to the environment. The pulverized/ground clinker mixed with gypsum is called Portland cement. Small amounts of admixtures are often added. Admixtures are either naturally occurring compounds or chemicals produced in an industrial process, which improve the properties of the cement. Most admixtures are pozzolans. Portland cement produces an excess of lime. Adding a pozzolan, such as RHA, this combines with lime in the presence of water, results in a stable and more amorphous hydrate (calcium silicate). This is stronger, less permeable and more resistant to chemical attack. A wide variety of environmental circumstances such as reactive aggregate, high sulphate soils, freeze-thaw conditions, and exposure to salt water, de-icing chemicals, and acids are deleterious to concrete.

4. ANALYSIS

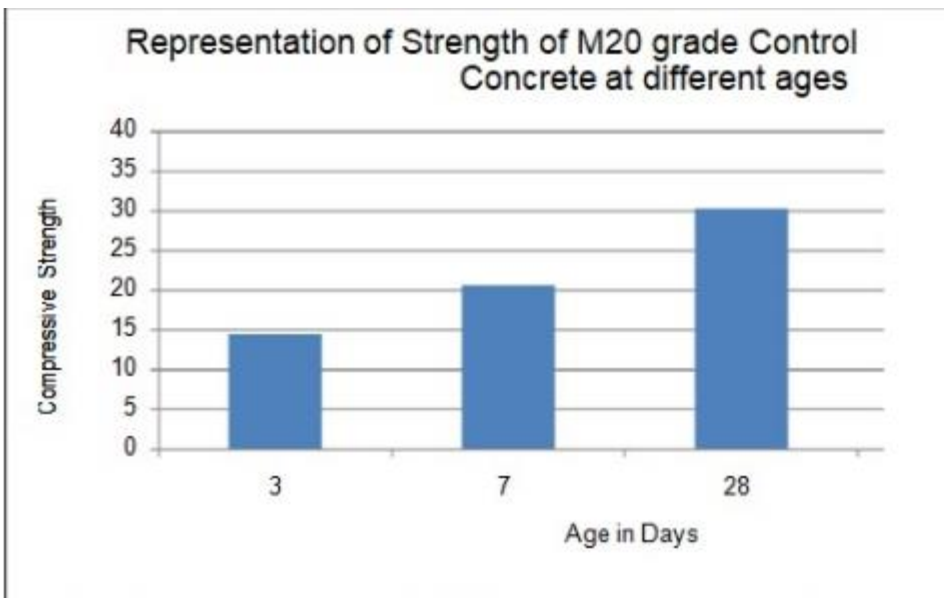

Fig.3.Comparison of strength

The use of RHA as a water purifier is generally known, although only one documented study could be found. Greenwich University is researching small scale paddy milling in Bangladesh and Vietnam, an objective is to find end-uses for the ash, and the possibility of using it for water purification. Tests so far have indicated that RHA is inefficient in removing arsenic from water. AgriTech in USA have produced a proto type plant for manufacturing activated carbon from RHA, and the major market for this is in water purification.

CONCLUSION

At all the cement replacement levels of Rice husk ash; there is gradual increase in compressive strength from 3 days to 7 days. However there is significant increase in compressive strength from 7 days to 28 days followed by gradual increase from 28 days to 56 days. At the initial ages, with the increase in the percentage replacement of both Rice husk ash, the flexural strength of Rice husk ash concrete is found to be decrease gradually till 7.5% replacement. However as the age advances, there is a significant decrease in the flexural strength of Rice Husk ash concrete. The technical and economic advantages of incorporating Rice Husk Ash in concrete should be exploited by the construction and rice industries, more so for the rice growing nations of Asia.

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