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BRIEF INVESTIGATION OF CONCRETE BY USING ASHES TO ATTAIN ULTRA HIGH STRENGTH CONCRETE - SURVEY

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ABSTRACT

Concrete is the most widely used material in building construction. Within the last few decades, research has been conducted on what is known as Ultra High Strength Concrete (UHSC). The term includes a broad range of materials such as defect-free, dense particle, engineered composite, multi-scale particle, and fiber-reinforced cementitious materials with enhanced properties and characteristics. Here silica fume, fly ash and rice husk ash are used to attain the ultra-high strength concrete of M80. Silica fume, also known as micro silica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. Fly ash usually refers to ash produced during combustion of coal. Rice husk is produced in the first step in the milling process when the husk is removed form the grain in the husking stage of the rice mill.The aim of the project is to conduct experimental analysis of high strength concrete. By using the silica fume, fly ash and rice husk ash at various proportions. From the optimum percentage of the admixtures a beam is casted. The scope of this project is to attain the high strength concrete of M80 by using the agricultural and industrial wastes such as Silica fume, Fly ash and Rice husk ash.

1. INTRODUCTION

1.1. GENERAL

Currently, there is a critical need for advanced building materials for the U.S. domestic infrastructure, not only for new high-strength construction, but also to repair and enhance the performance of existing structures. These materials are required to be increasingly more energy-efficient, environmentally friendly, sustainable, affordable, and resilient. They need to meet multi-hazard/-performance design criteria and be easily produced and incorporated into construction methods and practice. Furthermore, these materials must be cost effective through a structure's life cycle. Concrete is the most widely used material in building construction. Within the last few decades, research has been conducted on what is known as Ultra-High Strength Concrete (UHSC). The term includes a broad range of materials such as defect-free, dense particle, engineeredcomposite, multi-scale particle, and fiber-reinforced cementitious materials with enhanced properties and characteristics.

1.2. ULTRA-HIGH STRENGTH CONCRETE

The definition of UHSC is a class of "concrete" materials with an unconfined compressive strength over 20,000 psi (140 MPa) that usually has high binder content and special
fine aggregates. For comparison, the unconfined compressive strength of conventional concrete is from 3,000 to 6,000 psi (20 – 40 MPa). Steam curing may be employed to attain strengths approaching 30,000 psi (210 MPa) and higher UHSC may contain fibers to achieve non-brittle behaviour and, if possible, to dispense with passive (non-prestressed) steel reinforcement. If viewed solely on the cost per cubic yard of material, the cost of UHSC materials can be over ten times greater than the cost of conventional strength concrete. Conventional concrete has widespread usage in construction although it is a commodity that does not necessarily perform well in the long-term or when subjected to man-made or natural hazards. Advanced
Materials, such as UHSC, show exceptional potential to improve infrastructure performance, and need to be transitioned from the research and development phase to common construction use.

1.3. SCOPE AND OBJECTIVE

In this project, we are going to do the ultra-high strength concrete for mix design of M80.
To find out the optimum percentage of replacement of cement by mineral admixtures- mass cone volume.To use industrial by-products and waste materials like fly ash, silica fume and rice husk ash.To reduce impact of these waste products on environment.To suggest a cost effective alternate for cement.

1.4. CONTENTS OF ULTRA-HIGH STRENGTH CONCRETE

The following are the contents of Ultra-high strength concrete are

- Cement (OPC 53 grade)
- Silica fume
- Fly ash
- Rice husk ash
- Master Glenium8233
- Coarse aggregate (20mm to 4.75mm sieve)
- Fine aggregate (4.75mm to 75µ sieve)

2. EXPERIMENTAL WORK

2.1. INTRODUCTION

In this work, Cement is partially replaced by using the silica fume, fly ash and the rice husk ask and the master Glenium8233 are together to form Ultra-High strength concrete.

2.2. SPECIFIC GRAVITY

Cement	=	3.15
Fine Aggregate	=	2.61
Coarse Aggregate	=	2.73

2.3. RODED DENSITY

Fine Aggregate	=	1780kg/m^3
Coarse Aggregate	=	1682kg/m^3

2.4. SIEVE ANALYSIS

Fine Aggregate	=	3.63

2.5. SLUMP VALUE

The optimum percentage is 2.5%

2.6. MIX PROPORTIONS

Cement = 489.6 kg/m^3

Fine aggregate = 730.8 kg/m^3

Coarse aggregate = 1143.76 kg/m^3

Water = 122.4 kg/m^3

So the final ratio becomes

Cement: Fine agg (kg/m^3): Coarse agg (kg/m^3): Water (l/m^3)

1: 1.49: 2.34: 0.24

2.7. TRIAL MIX RATIOS

Types of Mix	Addition of Rice husk ash	Addition of Silica fume	Addition of fly ash (%)	Cement (%)

	(%)	(%)		
Mix 1	10	5	15	70
Mix 2	10	10	10	70
Mix 3	10	15	5	70
Mix 4	10	20	-	70
Mix 5	10	-	20	70
Mix 6	-	-	-	100

3. TEST RESULTS

3.1. Theoretical value

Split Tensile Strength	7.602Mpa
Flexural strength	6.2Mpa

3.2. Experimental value

Specimen (Cube)	Compressive strength(7^{th} day) (Mpa)	Compressive strength (28^{th} day) (Mpa)	Split tensile Strength (28^{th} day) (Mpa)	Flexural strength (28^{th} day) (Mpa)
Mix1	35.5	76.02	4.076	8.63
	42.35	66.03	4.161	8.18
Mix2	24.71	44.0	1.415	6.15
	26.44	47.33	1.472	6.34
Mix3	13.9	22.4	1.812	5.16
	17.51	31.24	1.854	4.95
	23.6	36.68	2.56	5.67

Mix4	**18.53**	**33.27**	**2.98**	**5.38**
Mix5	**34.5**	**58.65**	**3.67**	**6.13**
	38.3	**56.38**	**2.98**	**5.67**
Mix6	**41.38**	**70.45**	**3.83**	**6.54**
	33.2	**63.31**	**3.54**	**5.87**

4. CONCLUSION

The following are the conclusions obtained after the study are, out of the three mixes, Mix 1 (Silica fume 5%, Rice husk ash 10% and Fly ash 15%) had obtained more strength when compared to the other two mixes (Mix 2, Mix 3, Mix 4 and Mix 5). Further works to be done, so from the optimum percentage a beam can be casted and tested. The results are to be analysed.

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