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A Study of Self-Association and Properties of the Pumice Concrete Dissertation

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Abstract: This research is to find environmental reuse of waste product also to find substitute of cement where these industries are located so that is nearby areas these products could not cause pollution, water logging and diseases to mankind. In this work, the effect of pumice light weight aggregate replacement on the properties of self-compacting concrete is studied. Slump test, Compressive strength, flexural strength and Split tensile strength are performed to study the effect of pumice light weight aggregate on the properties of the fresh and hardened concrete.
Keywords: Pumice Concrete, Self compacting concrete, *Compressive* ***strength, Tensile Strength.***

I. INTRODUCTION

The concept of concrete retention was proposed in 1986 by Professor Hajime Okamura, but was first developed in 1988 in Japan by Professor Ozawa (1989) at the University of Tokyo. Concrete composite concrete (SCC) does not require vibration and compaction thickness. It is able to flow under your weight and achieve full integration between tight metal reinforcement. Compared to conventional concrete SCC is stronger and stronger. the use of composite concrete (SCC) has gained widespread acceptance in the precast industry and in-situ construction due to reduced construction time, build noise by removing vibrations and good chance of using complex forms and members with more compact strength etc leading to better final product completion and durability. According to IS: 456-2000 [Code of Practice for Plain and Reinforced Concrete], concrete from 25 to 55 MPa is called standard concrete and more than 55 MPa is referred to as high-strength concrete with more than 120/11 MPa is called high-strength concrete.

The use of high-strength concrete is abundant in buildings, long-distance bridges and buildings in rough terrain. Building materials made of high-strength concrete are often strongly reinforced. During hardening the reinforced concrete creates problems in laying concrete. Solid-reinforced concrete problems can be solved by using concrete that can be easily laid and spread between dense reinforced concrete structures. Thick and well-distributed and dense concrete can be secured using such type of concrete. Usually the SCC compressive strength range is 60-100 N / mm2. However, according to the requirements of concrete grades can be used. The SCC was developed at the University of Tokyo in Japan in 1980 through the use of dense reinforcing structures in regions with severe earthquakes. Strengthening of buildings is a very important lesson in Japan and the skilled workers are required to mix concrete with structural strength. The SCC first reported in 1989. This requirement led to the establishment of the SCC. The development of the SCC was first reported in 1989. SCC is a new type of High Performance Concrete (HPC) with excellent deformity and resistance to flow and flowing with your weight in a tight grip.

The present investigation has been undertaken to study of pumice stone to improve properties of self compacting concrete when coarse aggregate is replaced by pumice stone in 10%, 20%, 30% and 40%.

II. LITERATURE REVIEW

Shriram H. Mahure (2014) had been studying the concrete structures you work on using Fly ash as a partial replacement of cement by different percentages over filling. New features are determined by inserting Slump value, V-fan value and L-box value and reinforced properties are determined by adding Compressive strength, Flexural strength and Split tensile strength of the specimens. It is evident that the new concrete structures show an acceptable value of up to 30% of fly ash conversion and improved concrete structures are significantly improved compared to conventional mixing.

Sherif.A.Khafaga (2014) have investigated the new and complex concrete structures you are using and used composite concrete composites as both composite and good composite. Concrete was prepared by incorporating 25%, 50% and 75% aggregate aggregates. The study consisted of thirteen concrete mixes showing significant variables and their effects on the new and complex structures of the SCC being produced. The results showed that the recycled SCC properties have only a slight difference, in their properties from the SCC. Reusable concrete compounds as both coarse and fine-grained compounds can be used successfully in SCC production.

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M.Iyappan (2014) had investigated new and difficult concrete structures to assemble when Portland cement was replaced with nano silica. In addition concrete structures such as acid-resistant using HCL were also tested at 3% different levels of silica. He concluded that adding 2% and 4% nano silica leads to improved structures while 6% instead of nano silica leads to a reduction in solid concrete structures. He also found that 4% conversion of nano silica leads to better acid resistance to concrete.

Shriram.H (2013) he had studied the concrete structures he works using ashes as a partial replacement of cement. You have done fall flow tests, V-fan tests and L-box tests to find new concrete test and pressure pressure structures, solid strength tests, flexural strength tests to find strong concrete structures. He concluded that the new concrete structures show an acceptable value up to 20% of the dust exchange rate and more than 20% reduced prices. He also concluded that with the transfer of fire to dust solid concrete areas such as compressive strength, flexural strength and dissolved strength were added by the age of 91 days compared to the strength of 28 days.

Abbas Al-Ameeri (2013) he had investigated about the concrete alone where the steel was replaced in part. He studied new structures containing flow forces, passing forces and viscosity and listed fortified structures such as compressive strength, differential strength strength and flexural strength of specimens. He concluded that with increasing fiber content the performance of concrete decreases. He also concluded that with a high percentage of 0.75% to 1% altering steel wires, compressive strength, split strength strength and the strength of the flexible concrete adhesive conditions have been improved.

O. Gencel (2011) had studied about the fresh and hardened properties of SCC with fly ash reinforced with the type of monofilament polypropylene fibers. The water/cement ratio, fly ash content and admixtures were kept constant to determine the fresh and hardened properties of concrete. To evaluate the fluidity, filling ability and segregation risk of the fresh concrete, tests like Slump flow, J ring, V funnel and air content tests were conducted and to determine the hardened properties of concrete tests like compressive strength, splitting tensile strength, flexural strength, pulse velocity and elasticity modulus test were conducted. If there is uniform distribution of fibres, the problems in mixing and batching of concrete are minimized. He finally concluded that the usage of Polypropylene fibers in concrete upgraded the fresh and mechanical properties of SCC significantly.

III. MATERIAL USED

A. Basic Materials

1) Cement: The use of cement for experimental studies was Ultra tech cement 43 grade OPC as specified in Indian Standard Code IS: 8112-1989. The gravitational force of cement was 3.10.

Table: Physical Properties of Cement

(a) Sr. No.	(b) Characteristics	(c) Experimental value	(d) Specified value as per IS:8112- 1989
(e) 1	(f) Consistency of cement (%)	(g) 33%	(h) ---
(i) 2	(j) Specific gravity	(k) 3.10	(l) 3.15
(m) 3	(n) Initial setting time (minutes)	(o) 63	(p) >30 As Per (q) IS 4031- (r) 1968
(s) 4	(t) Final setting time (minutes)	(u) 495	(v) <600 As per (w) IS 4031- (x) 1968
(y) 5	(z) Compressive strength (N/mm^2) (I) 3days (II) 7days (III) 28days	(aa) (bb) (cc) 20.45 (dd) 23.87 (ee) 33.50	(ff) (gg) (hh) >23 (ii) >33 (jj) >43
(kk) 6	(ll) Soundness (mm)	(mm) 1.00	(nn) 10
(oo) 7	(pp) Fineness of Cement	(qq) 5.5%	(rr) 10% As Per (ss) IS 269-1976

2) *Coarse Aggregates:* The coarse aggregate used were a mixture of two locally available crushed stone of 20 mm and 10 mm size in 70:30 proportion. Coarse aggregate of maximum size 20mm and minimum 10 mm is used throughout the concrete. The specific gravity of coarse aggregate is 3.09.
3) *Fine Aggregates:* Fine aggregate is used in this experimental study for concrete is river sand conforming to zone- II. The specific gravity of fine aggregates 2.65.
4) *Pumice Aggregate:* Pumice Lightweight aggregate (PLA) is used as the lightweight aggregate which of size 8 to 12mm. PUMICE is free from impurities.

Figure: Image of pumice aggregate

5) *Properties of Pumice Aggregate:* The physical properties of pumice aggregates are mentioned below in the table 3.1

Table 3.1: Physical Properties of Pumice Aggregates

Property	Pumice
Fineness Modulus	5.83
Specific gravity	1.06
Bulk density	409 kg/ m^3
Water absorption	31 %

IV. METHODOLOGY

A. *Mix Design*

In this work M20 & M30 Grade of Concrete were considered. The mix was designed by using Nan-Su method of mix design. The mix proportions corresponding to M20 are 1:3.45:2.60:1.20:0.43 and M30 are 1:3:2.30:1:0.3.Coarse aggregate was replaced by the pumice aggregate by 10%, 20%, 30%and 40% in volume fractions.SP-430 was used as a superplasticizer1%and 1.5% of the weight of cement. The constituents of mix proportion were shown in the Table.

Table: Showing Mix proportions and quantity of materials used for M20 Mix

S. No.	Material	Quantity kg/m^3	Quantity for 6 cubes in Kg
1	Cement	260	5.27
2	Fly Ash	312	6.318
3	Fine Aggregate	897	18.16
4	Coarse Aggregate	676	13.69
5	Water	229	4.63
6	Super Plasticizer	2.6	0.0527
	Density	2376.60	

Table: Showing Mix proportions and quantity of materials used for M20 (10% Replacement of C.A. By Pumice Aggregate)

S. No.	Material	Quantity kg/m^3	Quantity for 6 cubes in Kg
1	Cement	260	5.27
2	Fly Ash	312	6.318
3	Fine Aggregate	897	18.16
4	Coarse Aggregate	608.4	12.32
5	Pumice Aggregate	30.75	0.622
6	Water	229	4.63
7	Super Plasticizer	2.6	0.0527
	Density	2340	

Similarly other mixed design is done for M-20 grade and M-30 grade for 10%, 20%, 30% and 40% replacement of Coarse aggregate by Pumice concrete.

B. Moulds

To determine the compression strength of the self-compacting concrete, cubes of 150mm×150mm×150mm size were used. Cylindrical moulds are used to determine split tensile strength, having the dimension 150mm diameter and 300mm length. For flexural strength test, Prisms of 100mm×100mm×500mm size were used.

Figure: Casting of Concrete

V. RESULTS

In this chapter, the experimental results are presented and discussed. The effects of various important parameters on the slump test, compressive strength, split tensile strength and flexural strength of pumice aggregate self-compacting concrete and self-compacting concrete using pumice aggregate.

Tests were performed after 7 and 28 days of proper curing of concrete.

A. Compressive Strength

Table: Strengths of self compacting concrete M20 of different mixes.

S. No	Pumice Aggregate %	Compressive Strength (MPa)	
		7 days	28days
Mix1	0	18.40	27.40
Mix2	10	18.15	27.35
Mix3	20	18.00	26.65
Mix4	30	15.30	21.72
Mix5	40	14.90	20.83

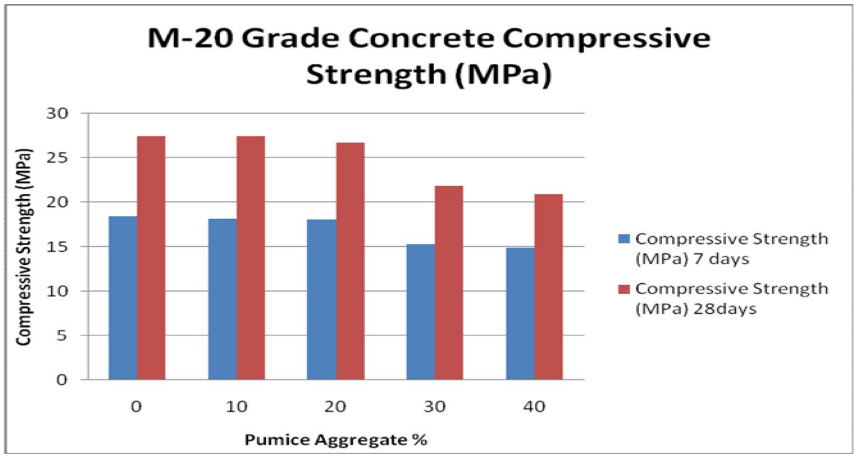

Figure: Variation of M20 Compressive Strength with variation of pumice aggregate

Table: Strengths of self compacting concrete M30 of different mixes.

S. No	Pumice Aggregate %	Compressive Strength (MPa)	
		7 days	28days
Mix1	0	24.10	39.20
Mix2	10	23.57	37.94
Mix3	20	23.13	35.83
Mix4	30	21.47	30.38
Mix5	40	19.65	28.67

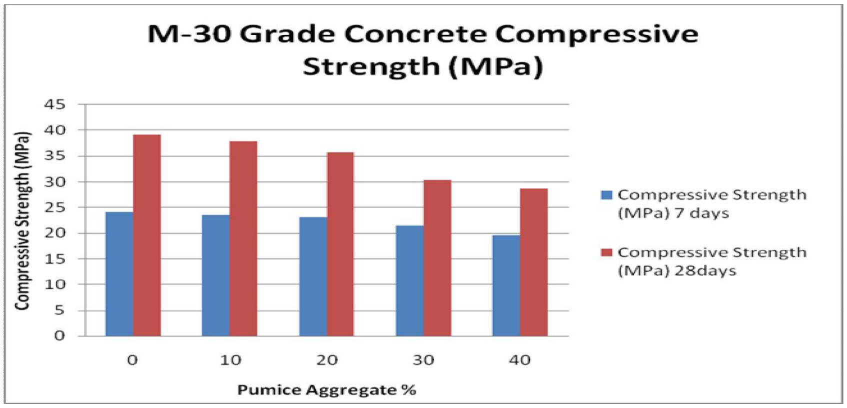

Figure: Variation of M30 Compressive Strength with variation of pumice aggregate

B. *Split Tensile Strength*

Table: Tensile strength of self compacting concrete M20 of different mixes.

S. No	Pumice Aggregate %	Split Tensile Strength (MPa)	
		7days	28days
Mix1	0	4.52	6.29
Mix2	10	4.23	6.12
Mix3	20	4.14	5.97
Mix4	30	3.39	5.26
Mix5	40	3.23	4.92

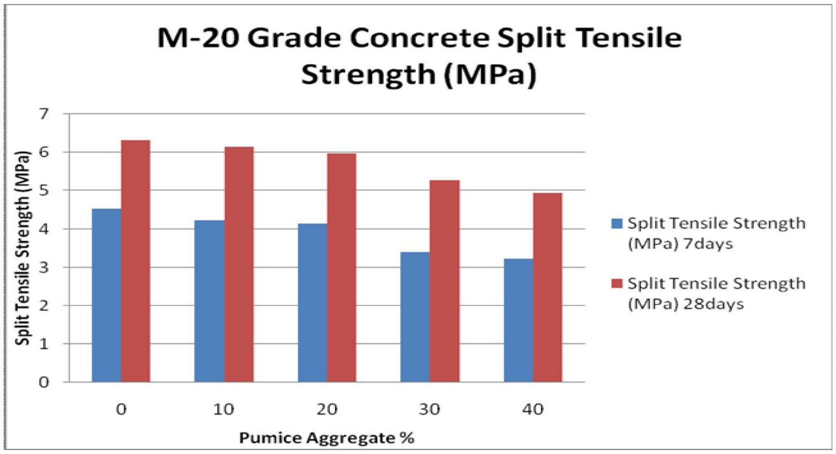

Figure: Variation of M20 Split Tensile Strength

Table: Variation of M30 Split Tensile Strength with variation of pumice aggregates

S. No	Pumice Aggregate %	Split Tensile Strength (MPa)	
		7 days	28 days
Mix1	0	6.85	8.57
Mix2	10	6.57	8.28
Mix3	20	6.33	8.05
Mix4	30	6.10	7.69
Mix5	40	5.72	7.28

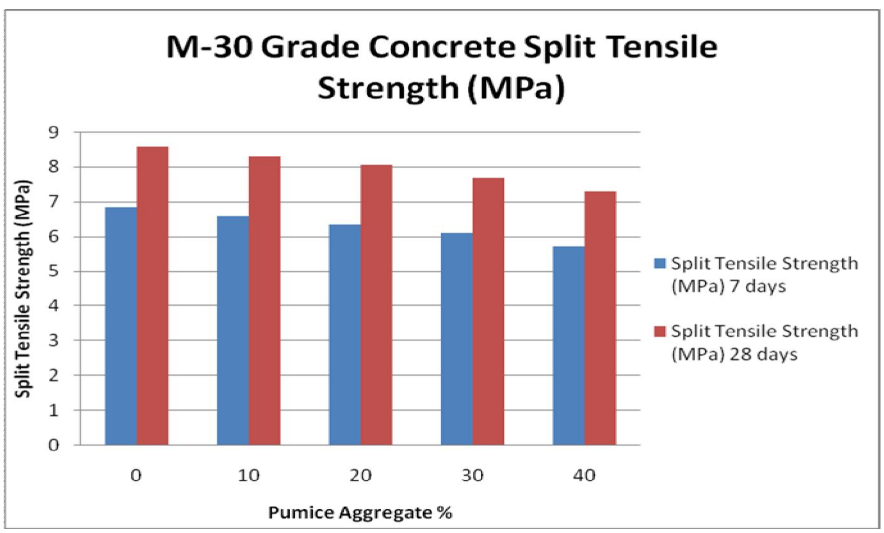

Figure: Variation of M30 Split Tensile Strength with variation of pumice aggregates

VI. CONCLUSIONS

A. The increase in pumice aggregate showed decrease in compressive strength, split tensile strength.

B. The pumice coarse aggregate light weight self-compacting concrete, compressive strength are optimum for 20% replacement of pumice aggregate.

C. Due to porous structure of pumice aggregate, they absorb more water and thus cause reduction in workability. This can be overcome by using super plasticizers.

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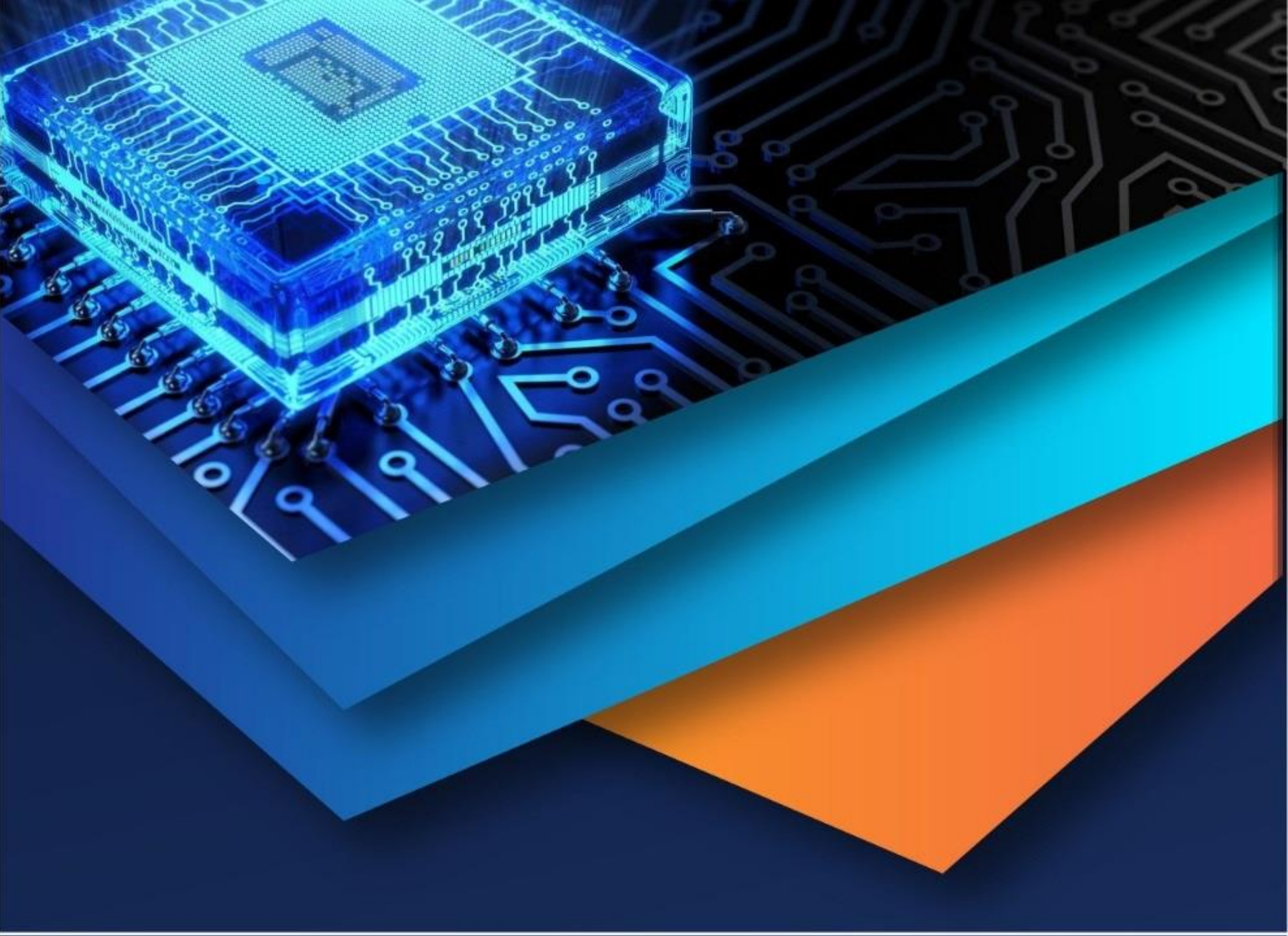

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