International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 04 | Apr -2017 www.irjet.net p-ISSN: 2395-0072

Effect of Natural Rubber Latex as admixtures in concrete

Paul shaji[1], Aswathi K P[2], Hanna P[3], Jose K George[4], Shameer K[5]

[1]Assistant Professor, Dept. Of Civil Engineering, Mar Athanasius College of Engineering, Kerala, India
[2345]Student, Dept. Of Civil Engineering, Mar Athanasius College of Engineering, Kerala, India

---

Abstract - *Nowadays the concrete properties are upgraded regarding the fresh and hardened properties by inclusion of new material other than ingredients of concrete, from reducing porosity by compaction, improves the strength of the concrete. In order to increase the usage of latex modified concrete, greater understand about natural rubber latex modified concrete with locally available materials such as cement, fine aggregate, coarse aggregate is essential. This paper illustrates the effect of natural rubber latex addition to the concrete in small increment in the strength. Also the material available locally is also encourages to investigate the properties of natural rubber latex modified concrete. Natural rubber latex is added in small percentages for normal strength concrete.*

Key Words: PPC, Slump cone, Compaction Factor apparatus, Natural Rubber Latex,

1. INTRODUCTION

The Para rubber which is the only tree can produce the natural rubber latex. The term latex is nothing but a polymer with water based liquid. The word latex by itself does not refer to natural rubber latex. And the dispersion of organic polymer in the concrete at the time of mixing is also known as latex. Rubber trees are initially grown in South America, and then Kew garden, UK, then in Sri Lanka, Indonesia, and Singapore .In India first it was grown in Kerala. Nowadays the growth of rubber tree are grown in Karnataka also, so it could be interested experimental to study on natural rubber latex with regarding concrete. Since natural rubber latex improves the compression strength of the concrete and also increase the flexural and tensile strength of the concrete when it is added in small percentages. Since natural rubber latex is formed by a simple monomer combines by reaction that reaction is known as polymerization. The natural rubber latex is added as a polymer admixture to the concrete.

The internal structure of polymer modified cement paste and concrete has been provided by Walters in the year 1990 and pointed out that latex modified cement mortars and concretes are attractive because the latex addition substantially increases the flexural strength and the compressive strength.

2. MATERIAL CHARACTERISTICS

The properties of each material in the concrete mix were studied early stage itself by conducting different test specified by the relevant IS Codes.

2.1 Cement

Cement is the most important ingredient in a concrete mixture which acts as a binder between the fine aggregate and the coarse aggregate. It fills the voids in between the sand and coarse aggregate particles to form a compact mass. The cement used for the work is Portland Pozzolana cement. To determine the properties of cement, tests for specific gravity, standard consistency and initial setting time were done. Results are given in Table 1.

Table -1:

Properties of Portland Pozzolana Cement	
Test	**Results**
Specific gravity	3.0
Standard consistency	31%
Initial Setting Time	90 minutes

2.2 Fine Aggregate

The fine aggregated used for the study was manufactured sand which was free from deleterious materials. Tests were done based on different test as per IS 383. Sieve analysis was done to determine the grain size distribution of fine aggregate. The properties of fine aggregates are shown in Table 2 and the sieve analysis details are shown in Table 3.

Table -2:

Properties of fine aggregate	
Test	**Results**
Specific gravity	2.617
Water absorption	1.5 %
Zone	1

Table -3:

Sieve analysis of fine aggregates						
Sieve size	**Sieve opening in mm**	**Sieve opening in microns**	**Weight retained**	**% weight retained**	**Cumulative percentage**	**% finer**
480	4.75	4750	0	0	0	100
240	2.36	2360	58	5.8	5.8	94.2
120	1.18	1180	482	48.2	54	46
60	0.6	600	343	34.3	88.3	11.7
30	0.3	300	92	9.2	97.5	2.5
15	0.15	150	19	1.9	99.4	0.6
Pan			6	0.6	100	0

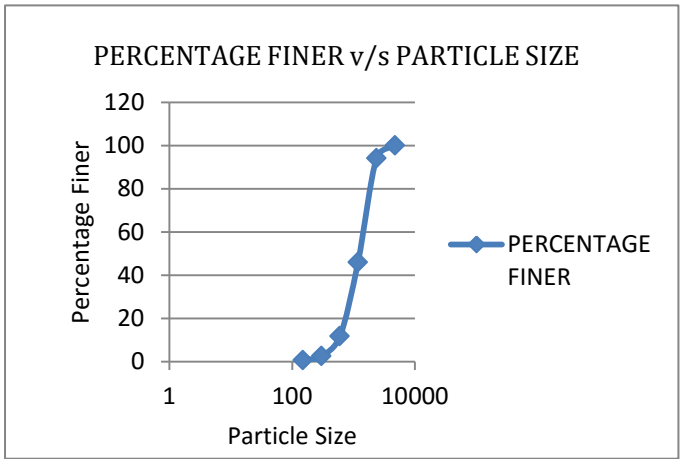

Chart -1: Particle size distribution curve for the fine aggregate

2.3 Coarse Aggregate

The coarse aggregate used for the work is 20mm size free from organic matters. Laboratory tests were conducted on coarse aggregate to determine the physical properties as per IS 383. The properties of coarse aggregate are shown in Table 4.

Table -4:

Properties of Coarse aggregate	
Test	**Results**
Specific gravity	2.77
Water absorption	0.5%

2.4 Water

Water is an important ingredient of concrete as it actively participates in chemical reaction with cement. Potable water is generally considered as being acceptable. Hence clean drinking water available was used for casting as well as curing of the test samples.

3. PROPERTIES OF FRESH CONCRETE

3.1 Workability of fresh concrete

Fresh concrete is the freshly mixed material which can be moulded into any shape. Workability is defined as the ease with which the concrete can be compacted or can be also defined as the amount of useful internal work necessary to produce full compaction. Slump test and compaction factor test was done to measure the workability of concrete.

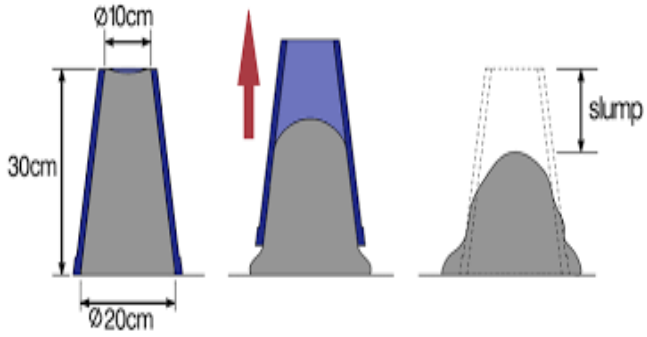

Fig -1: Slump Cone

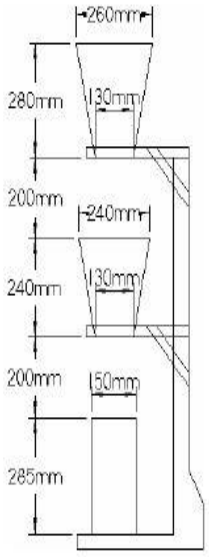

Fig -2: Compaction Factor Apparatus

4. PROPERTIES OF HARDENED CONCRETE

4.1 Compressive strength test

The compression test is the most common test conducted on hardened concrete. The cubes of size 150x150x150 mm were prepared using mould with standard specifications. The tests were conducted for 28days using compressive strength test machine. The compressive strength was determined by dividing the ultimate applied load by the cross sectional area of the cube.

Compressive strength = P/A,

Where, P = load in Newton

A= area of cross section of the cubes in mm^2

5. EXPERIMENTAL STUDY

5.1 Test Specimens and Test Procedure

Cube specimens of size 150mm X 150mm X 150mm were cast. To obtain uniform consistency the concrete has been mixed thoroughly in a mixer. Cubes were well compacted using vibrators. The specimens were de molded after 24 hours of casting and the specimens were cured for 7and 28days. The calculated proportions of a mix are mixed in dry state and then the polymer is added as an admixture along with water. Cubes are tested for determining workability and compressive strength.

Table -5:

Quantity of materials used	
Material	**Quantity (kg)**
Cement	9.720
Fine aggregate	16.841
Coarse aggregate	27.607
Water	5.032

6. RESULTS AND DISCUSSIONS

6.1 Compaction Factor

Usually compaction factor test conducted to find the workability of the concrete, if the compaction value is nearer to1 that concrete has good workability, here Compaction factor value was decreased when the natural rubber latex was added to the concrete at the ratio of 0.9% addition of natural rubber latex by the weight of cement the compaction factor value gives the satisfactory results, since the compaction factor value was nearer to the controlled mix.

Table -6:

Compaction Factor Value	
Latex Content (by weight of cement)	**Compaction Factor**
0%	0.910
0.5%	0.815
0.8%	0.860
0.9%	0.885
1.0%	0.845
1.5%	0.830

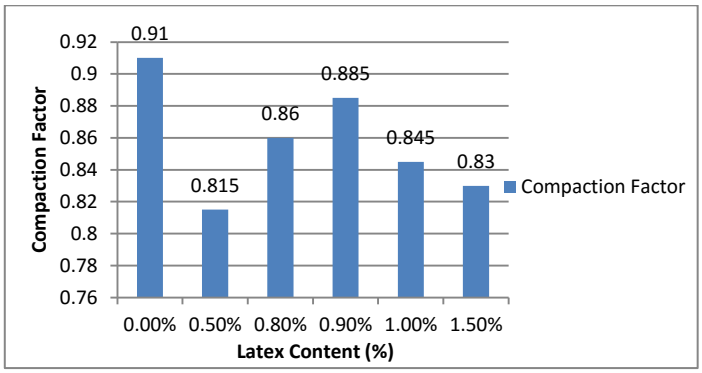

Chart -2: Latex content Vs Compaction Factor

6.3 Compressive Strength

For the concrete the compression strength is the main criteria to know the mechanical properties of the concrete, here the compressive strength of concrete is conducted for the various percentages of the natural rubber latex added concrete, compression strength of the natural rubber latex added concrete was increased for the lower percentage of the natural rubber latex, up to the 0.9% of the natural rubber latex compression strength is increased there after compression strength of the natural rubber latex added concrete is decreases therefore the optimum percentage of the natural rubber latex for the compression is 0.9%.

Table -7:

Compressive Strength Value	
Latex Content (by weight of cement)	**Compressive Strength(N/mm^2)**
0%	27.830
0.5%	28.659
0.8%	30.534
0.9%	32.628
1.0%	31.828
1.5%	28.263

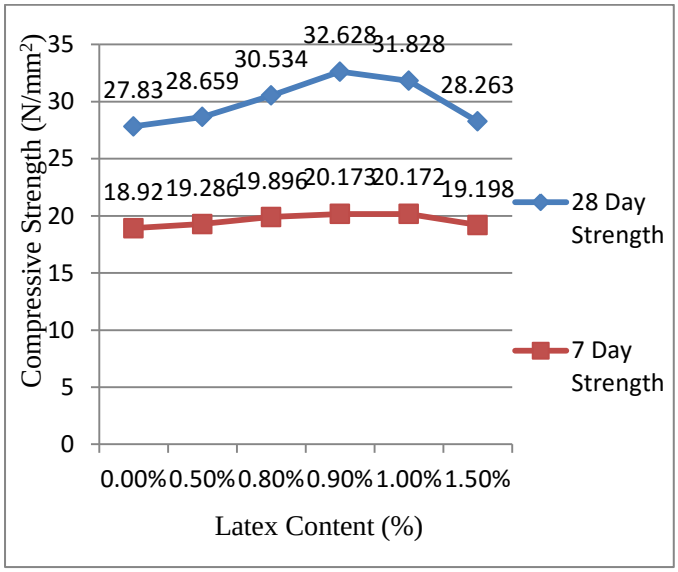

Chart -3: Latex content Vs Compressive Strength

7. CONCLUSIONS

Following conclusions were drawn from this experimental work.

- Experimental work has various percentages of natural rubber latex added to the parent mix at the time of mixing along with water which gives the optimum percentage of natural rubber latex as 0.9% by the weight of cement for the normal strength concrete.
- Natural rubber latex increases the strength of normal strength concrete up to 0.9% and then after decreases as increasing latex content.
- Compaction factor for parent mix is found to be relatively higher. When natural rubber latex is added to parent mix compaction factor which was initially less increased up to 0.9% and then decreased.

REFERENCES

[1] Shuyi Yao and Yong Ge, "Effect of Styrene Butadiene Rubber Latex on Mortar and Concrete Properties", Advanced Engineering Forum, Vol. 5, 2012, pp.283-288

[2] M. S. Shobha, Dr. C. Shashidhar, Dr. H. Sudarsana Rao, "Strength Studies Of Natural Rubber Latex Modified High Performance Concrete", International Journal of Engineering Research & Technology, Vol. 2, Issue 5,2013, pp.1836-1852.

[3] Dr.Vaishali.G.Ghorpade, Sri. K. Munirathnam and Dr.H. Sudarsana Rao, "Effect of natural rubber latex on strength and workability of fibre reinforced high-performance - concrete with metakaolin admixture", International Journal of Engineering Research and Applications, Vol. 3, Issue 3,2013, pp.827-831.

[4] Vinaya K L, Sanjith J, Ranjith A and Kiran B M, "Effect of natural rubber latex on Normal strength concrete", International Journal of Advance Research In Science And Engineering,Vol. No.3, Issue No.9,2014,pp.334-355

[5] Murat Dogan and AlperBideci, "Effect of Styrene Butadiene Copolymer (SBR) admixture on high strength concrete", Journal of Construction and Building Materials, 2016, pp.378-385