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Experimental Study On Concrete With Plastic Waste And Master Gelinium

T.Subramani[1], Febin Skaria Jacob[2], Limil Antoney[3], Rahul Pillai Suresh[4], S.Priyanka[5]

[1]Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

[2,3,4,5]UG Student, , Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

ABSTRACT

The use of plastic is increasing day by day, although steps were taken to reduce its consumption. This creates substantial garbage every day which is much unhealthy. A healthy and sustainable reuse of plastics offers a host of advantages. The suitability of recycled plastics as coarse aggregate in concrete and its advantages are discussed here. The initial questions arising of the bond strength and the heat of hydration regarding plastic aggregate were solved. Tests were conducted to determine the properties of plastic aggregate such as density, specific gravity and aggregate crushing value. The percentage substitution that gave higher compressive strength was used for determining the other properties such as modulus of elasticity, split tensile strength and flexural strength. Higher compressive strength was found with replaced concrete.

Keywords: Concrete, Bond strength, Compression strength and Flexural strength.

1. INTRODUCTION

As the world population grows, the amount of wastes being generated. Plastic is everywhere in today's lifestyle. It is used for packaging, serving, and even disposing of all the necessary kinds of consumer goods. With the industrial revolution, production of goods and plastic seemed to be a cheaper and effective raw material. Today, the sector of the economy being from agriculture, building construction, automobile, and communication has been virtually reformed by the use of plastics. Usage of this non-biodegradable (according to recent studies, plastics is unchanged for 4500 years on earth) product is growing according to the usage. Recent Studies have linked the improper disposal of plastic to problems as breast cancer, genital abnormalities, reproductive problems in humans and animals, and even a decline in human sperm count. If a ban is put on the use of plastics on grounds, the real cost would be much higher, and the chances of damage or contamination is much greater in the world. The risks to the family health and safety would increase, but it is more concerned with the judicious use and re-use of plastic-waste.

1.1 Types of Plastics

- Thermoses.
- Elastomers.
- Thermoplastics.

1.2 Using Of Plastics

Polymers have a number of properties, which exploited alone or together, make a significant and expanding contribution to constructional needs.

- It is Durable and corrosive resistant.
- Good Insulation property for cold, heat and sound saving energy then reducing noise pollution.
- It is more economical and has a longer life.
- free Maintenance (such as painting is minimized)
- very Hygienic and clean
- Ease processing / installation
- Light weight material

1.3 Sources of Plastic Waste

Plastic recycling plays a important role in India and about 60% of plastic waste is recycled. In India People have realised that recycling of plastic waste have huge economic value and provides employment opportunities which results in economic growth of the country. Indian construction industry provides plenty of employment opportunities and accounts for major portion of the capital outlay in consecutive 5-year plan. The massive projected investment in this industrial sector continues to show a growing trend. Plastic waste is bulk in volume and unsuitable for disposal by incineration or composting which result in polluting the environment badly, so the people are facing number of problems which results in hazardous diseases. Apart from mounting problems, other reasons to recycle the waste are:

- To reduce the extraction of raw materials.
- To reduce the transportation cost.
- To reduce the environmental impact and improved profits.

1.4 Objective of Study

- To find the properties of Coarse Aggregate, Fine Aggregates and Cement.
- To find the physical properties of Waste Plastics
- To conduct mix design as per IS: SP 23-1982(1).
- To find out the Optimum Modifier Content (OMC).
- To cast both the plain and modified cement concrete cubes, Cylinders, Prisms and subjected to fatigue loading.
- To study the effect of temperature on both the plain and modified cement concrete.

2. METHODOLOGY

Figure 1 shows the methodology.

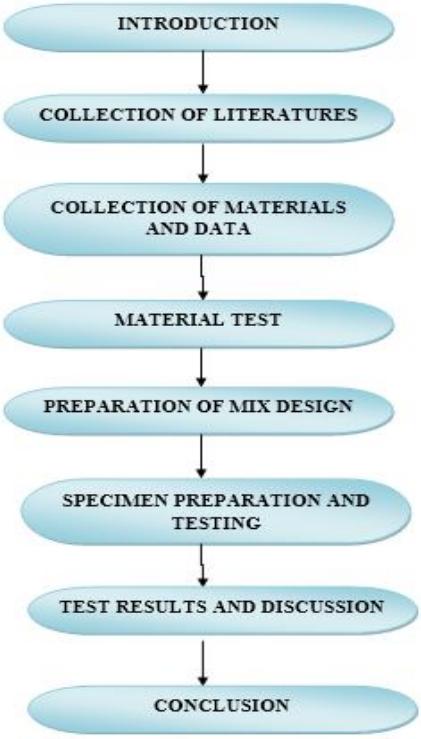

Figure 1 Methodology

3. MATERIAL COLLECTION AND PROPERITIES

3.1 Cement

Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used

with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete. Table 1 shows the Physical properties of cement.

Table 1: Physical properties of cement

Physical Properties	**Values of OPC used**	**Requirements as per IS 8112-1989**
Standard Consistency	29.2%	-
Initial Setting Time	45 Minutes	Minimum of 30 minutes
Final Setting	Time 265 Minutes	Maximum of 600 minutes
Specific gravity	3.15	-

3.2 Fine Aggregate

Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 9.5mm sieve. As with coarse aggregates these can be from Primary, Secondary or Recycled sources. Table 2 shows the physical properties of Fine aggregates.

Table 2: Properties of Fine aggregates

PROPERTIES	**VALUE**
Specific Gravity	2.85
Fineness modulus	2.58
Water absorption	1%
Density	1754.3kg/m^3
Surface Texture	Smooth

3.3 Course Aggregate

Aggregates are inert granular materials such as sand, gravel, or crushed stone that, along with water and Portland cement, are an essential ingredient in concrete. For a good concrete mix, aggregates need to be clean, hard, strong particles free of absorbed chemicals or coatings of clay and other fine materials that could cause the deterioration of concrete. Table 3 shows the coarse aggregates.

Table 3: Properties of coarse aggregates

PROPERTIES	**VALUE**
Specific weight (g/cm^3)	2.70
Sieve 200	1.29%
H_2O absorption	1.15
Fineness modulus	3.24
Specific gravity	2.66
Size	Passing through 4.75mm sieve

3.4 Plastic Course Aggregate

The artificial aggregate used in the investigation is plastic aggregate made from various type of plastics as follows HDPE, LDPE, PET by heating process. The plastic used for manufacturing of coarse aggregate was 80% PET and rest 20% was HDPE and LDPE, which got washed to remove foreign particles and then crushed before heating process. The size of aggregate used in investigation has been 10mm and 20 mm.

3.5 Master Glenium

Admixture is used for increasing the workability and compressive. As the plastic content increases the workability and compressive strength decreases as well tensile and flexural strength. Thus, the requirement of admixture arises which maintain the workability and compressive strength of concrete. so the admixture used in the study is super plasticizer. In the present study super plasticizer polycarboxy late ether was used to improve the workability and compressive strength of waste plastic mix concrete. The specific gravity of Super plasticizer is 1.02.

3.6 Features And Benefits:

Master Glenium ACE 8590 offers the following benefits:

- High water reduction capacity over conventional super plasticizers
- Low permeability and high durability concrete
- Flow ability for ease of placement and compaction
- Optimize curing cycle by shortening curing time or decreasing curing temperature
- Eliminate energy required for placing, consolidation and curing
- Improved surface appearance and concrete quality

4. MIX DESIGN

4.1 Mix Proportion

Table 4 shows the mix design.

Table 4: Mix design

Cement (kg)/m3	**FA (kg)/m3**	**CA (kg)/m3**	**Water (kg)/m3**
547.37	656.42	1141.99	191.58

5. TEST RESULT

5.1 Compression and Split Tensile Test Result

Table 5 shows the compression and split tensile test results.

Table 5: Compression and Split tensile test results

S.NO	**NAME OF THE TEST**	**SPECIMEN**	**DAYS**	**DATE OF TESTING**	**LOAD IN (kN)**		**STRENGTH IN (N/mm^2)**	
					CC	**Adding 1% fibre + 15% RCA**	**CC**	**Adding 1% fibre + 15% RCA**
1	COMPRESSION	CUBE	7	27/02/2019	351.0	371.2	15.6	16.5
			14	06/03/2019	506.2	526.5	22.5	23.4
			28	20/03/2019	591.7	612.0	26.3	27.2
2	SPLIT TENSILE	CYLINDER	7	27/02/2019	113.0	127.2	1.6	1.8
			14	06/03/2019	155.5	176.7	2.2	2.5
			28	20/03/2019	190.8	204.9	2.7	2.9

Figure 2 shows the compression strength test – bar chart.

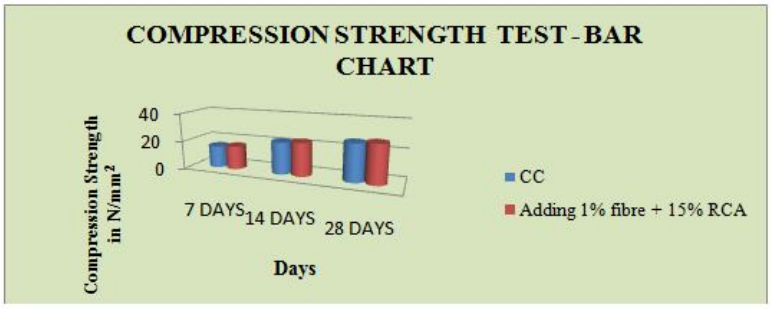

Figure 2 Compression strength test graph

Figure 3 shows the split tensile strength test graph.

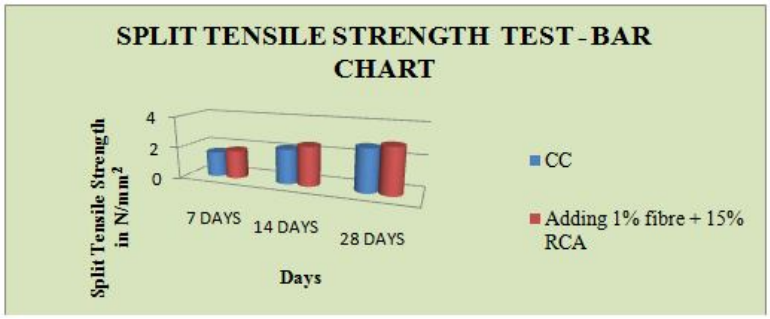

Figure 3 Split Tensile strength test graph

5.2 Slump Cone Test

Table 6 shows the slump cone test results.

Table 6: Slump cone test

S.NO	% OF REPLACEMENT	SLUMP VALUE (mm)
1	**CC**	100
2	**Adding 1% fibre + 15% RCA**	80

6. CONCLUSION

Based on the test results , following conclusions are drawn

- Concrete produced by replacing natural aggregate by recycled coarse aggregate with addition of 1% of waste plastic fibers by weight of cement imparts higher compressive and split tensile strengths.
- The compressive strength of 15% replaced recycled coarse aggregate concrete with 1% of waste plastic fibers is 3.5% more than reference mix (0% replaced mix).
- The split tensile strength of is 15% replaced concrete with 1% of waste plastic fibers is 7.4% more than reference mix (0% replaced mix).
- The results of this experimental work establishes that natural coarse aggregates can be partially replaced with recycled coarse aggregates and with the addition of waste plastic fibers (1% by weight of cement) does not have any adverse impact on the strength of the concrete.
- Hence, the optimum percentage of using recycled coarse aggregate is 15% with addition of 1% of waste plastic fiber by weight of cement.

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AUTHOR

Prof. Dr. T. Subramani Working as Professor and Dean of Civil Engineering in Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. Having more than 28 years of Teaching experience in Various Engineering Colleges. He is serving as reviewer for many International Journals and also published 250 papers in International Journals. He has presented more than 107 papers in conferences, especially 77 in International and 30 National Level. He has authored 07 books. Guided more than 259 students in PG projects. Currently he is guiding 03 Ph.D., Research Scholars. He is serving as examiner and Valuer for B.E & M.E Degree Theory and Practical Examinations for Madras University, Periyar University, Anna University, Annamalai University and Vinayaka Missions Research Foundation [Deemed to be University]. He is Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. He is serving as Chairman of Board Of Studies (Civil Engineering), Vinayaka Missions Research Foundation [Deemed to be University], also a member of Board of studies in Periyar University. He is Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies like MISTE, MIGS, MIRC,ISRMTT, UWA, Salem District Small and Tiny Association (SADISSTIA), SPC – Salem Productivity Council. He has delivered much technical talk in various field. He is a Chartered Civil Engineer and Approved Valuer for many banks. He is a Licensed Building Surveyor in Salem City Municipal Corporation-Salem, and Licensed Civil Engineer in Salem Local Planning Authority- Salem. He is the recipient of many prestigious awards.

Febin Skaria Jacob is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India.. His hobbies are playing Volleyball, drawing, Reading books.

Limil Antoney is perusing his B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India.. His hobbies are playing Basketball, Hockey and Cricket.

Rahul Pillai Suresh is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. His hobbies are playing Volleyball, drawing, Reading books.

S.Priyanka is persuing B.E. Degree in the branch of Civil Engineering in Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. She published 30 papers in International Journals. She has presented more than 13 papers in conferences, especially 8 in International and 5 National Level. She has well knowledge in AUTOCAD drawing and STAAD Pro