Utilization of Pet (Polyethylene Terephthalate) Bottle Waste for Self Compacted Concrete in Replacement of Fine Aggregate

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Abstract- **Leaving the waste material to the environment directly cause environmental problems. Rapid Industrialization and Urbanization is causing serious environmental problems to the environment. One of the major concerns amongst these is safe and sound disposal of solid wastes. The treatment of effluents from the production of industries results in sludge generation from the treatment plant which poses a huge challenge for its disposal. Therefore, an attempt is made to initialize them in an effective way. In this experimental investigation, an attempt has been made to investigate the behaviour of concrete and its mechanical properties with replacement of cement with CETP sludge. The outcomes show there is a possibility in accommodating the sludge in concrete by solidification. This report is meant for discussion of beneficial utilization of CETP sludge waste with conventional building material in Construction application. From this study, the use of the CETP sludge will be identified for structural and non-structural applications by conducting future experimental studies. To evaluate the effect of dry sludge on concrete performance, its physical and mechanical properties were studied. In this research an attempt is taken to bring into play the sludge waste in various proportions so that the final product property of concrete mixture is same as the control mix. Waste sludge material will be replace cement in various percentages such as 20%, 15%, 10%, 5%, and 0%. Reference concrete mix is to be also made for comparative reasons. Test will be conducted on fresh and harden concrete. Cube, cylinder and beam will be casted for grade M30 for the determination of workability, compressive strength, tensile strength and flexure strength.**

Index Terms- Cement, F.A-Fine Aggregate, C.A.-Coarse Aggregate, PET WASTE, GLASS fiber compressive strength, flexure strength test, split tensile strength.

1. INTRODUCTION

The world's population continues to grow, so does the amount of garbage that people produce. On going lifestyles require easily disposable products, such as soda cans or bottles of water, but the accumulation of these products has led to increasing amounts of plastic pollution around the world. As plastic is composed of major toxic pollutants, it has the potential to cause great harm to the environment in the form of air, water and land pollution.

Put simply, plastic pollution is when plastic has gathered in an area and has begun to negatively impact the natural environment and create problems for plants, wildlife and even human population. Often this includes killing plant life and posing dangers to local animals. Plastic is an incredibly useful material, but it is also made from toxic compounds known to cause illness, and because it is meant for durability, it is not biodegradable

1.1Aim of Research

This work was directed toward establishing the use PET WASTE in concrete mixtures. The successful use of Pet plastic west will help in reducing the Hazard of plastic to environmental and human being the overall objective of the work is to investigate the feasibility of incorporating Pet plastic in concrete mixtures. As per study of research paper the use of pet plastic to concrete by replacement of sand [more than 5%] decreases the mechanical property of concrete and use of glass fiber as additive increases the mechanical property of concrete , aim of research to maintain or improve the mechanical property of pet replaced fine aggregate concrete by use of glass fiber

1.2 Statement of the Problem

The following tasks were done to achieve the research objective:

- Collecting of the relevant information and documents related to pet plastic, and self compacting admixture for self compacting concrete
- Undertake a comprehensive literature review on relevant subjects focused on the using of Pet plastic for self Compaction of concrete.
- develop a suitable experimental program to study the use pet plastic in self compacting concrete mixtures
- Admixture use for self compaction of concrete Admixture use to maintain and improvement of strength of concrete
- Analysis the experimental tests result and draw conclusions

1.3 Objective of the Research

- To study the influence of PET PASTIC AS REPLACEMANT OF FINE AGGREGATE on fresh and hardened concrete properties.
- To determine the optimum PET PLASTIC to FINE AGGREGATE ratio which can be used in concrete mix

2. LIST OF MATERIALS

- Cement
- Fine aggregate
- Course aggregate
- Water
- Pet- material as percentage replacement of fine aggregate
- Admixture- Glenium c303scc for self compaction
- Glass fiber as an additive in concrete to improve or maintain the concrete mechanical strength
- Cement
- Ordinary Portland cement of 53 grade as per IS 12269-1987 standards will be used in this experimental works. The cement is tested in lab for its physical characteristics and found to be confirming to the requirements as per IS 12269-1987.

3. DESIGN MIX METHODOLOGY

- The concrete mix design was proposed by using IS10262:2009.The grade of concrete used was M30 with water to cement ratio 0.45. The mix design proportions for 1 m3 of concrete. When cement ratio get decreases then the percentage of the sludge girt increases. In which ratio is constant & also F.A (kg/m3), C.A (kg/m3), Water (kg/m3) is constant

3.1 Target Strength

- The majority of the construction works in study area are residential buildings with multiple floors and they are not more than three floors. The minimum grade of concrete recommended is M30 (IS: 456-2000) and a target strength of 38.25 MPa is fixed in this work. Also, this work is carried out to find the influence of brackish water in strength of concrete in the study area.
- The design mix proportions for the required target strength is as follows,
- Cement: Sand: Coarse Aggregate: w/c = (1: 1.87: 3.37:0.45)
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Quantity Required for M30 Grade Concrete

Pet [%of F.A]	Pet (kg/m³)	W/C ratio	Cement (kg/m³)	F.A (kg/m³)	C.A (kg/m³)	Water (kg/m³)	Fiber glass (0.1%of total kg)
0%	0	0.45	380	711	1283	171	2.55
5%	43.5	0.45	380	667.5	1283	171	2.55
10%	71	0.45	380	640	1283	171	2.55
15%	107	0.45	380	604	1283	171	2.55
20%	142	0.45	380	569	1283	171	2.55
30%	213	0.45	380	498	1283	171	2.55
40%	361	0.45	380	427	1283	171	2.55

FOR 0.861 M3 CC- REQUIRMENT OF MATERIAL

Trial Mix NO.	% OF Ns	CUBE	BEAM	CYLINDER	TOTAL QTY (m3)	CEMENT (380Kg/m3) (kg.)	FINEAGGREGATE 711 Kg/m3)		COARSE AGGREGATE (1283 Kg/m3)	Water (171 Kg/m3)
							SAND	PET		
1	0%	9	9	9	0.122	46.36	86.74	0	156.52	20.83
2	5%	9	9	9	0.122	46.36	81.43	5.30	156.52	20.83
3	10%	9	9	9	0.122	46.36	78.08	8.66	156.52	20.83
4	15%	9	9	9	0.122	46.36	73.68	13.05	156.52	20.83
5	20%	9	9	9	0.122	46.36	69.40	17.34	156.52	20.83
6	30%	9	9	9	0.122	46.36	60.71	26.02	156.52	20.83
7	40%	9	9	9	0.122	46.36	52.04	34.69	156.52	20.83
Total Kg.						324.52	502.08	105.06	1095.64	145.81

4. LITERATURE REVIEW

General Many research works are completed and also are in progress to reuse and recycle the CETP waste into useful products. In this article a preliminary effort has been initiated to study feasibility of incorporating CETP sludge in concrete in construction applications

4.1 Review of research papers

4.1.1 The Effect of Adding PET (Polyethylene Terephthalate) Plastic Waste on SCC (Self-Compacting Concrete) to Fresh Concrete Behavior and Mechanical Characteristics.

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CONCLUSION

- Replacement of sand with PET plastic waste up to 10% level will increase the filling ability and passing ability of fresh concrete SCC.
- SCC mechanical characteristics are: compressive strength, tensile strength, and elastic modulus will decrease with increasing PET level. The higher the PET level will be the greater the decrease in mechanical characteristics.
- At temperatures of 250°C, the mechanical characteristics of harden concrete have not shown any change, while at 600 ° C it decreases significantly and occurs in both SCC types i.e. SCC without PET and SCC with PET.
- At a temperature treatment of 600°C, the decrease in mechanical characteristics of SCC with PET will be greater than that of SCC without PET because in addition to dehydration of C-S-H gel, but also the emergence of voids in the concrete that weakens its strength. These voids arise as a result of the decomposition and evaporation of PET plastic.

4.1.2 The combined effects of waste Polyethylene Terephthalate (PET) particles and pozzolanic materials on the properties of self compacting concrete.

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CONCLUSION

1. WPSCC mixes containing silica fume require higher amount of super plasticizer than SCC mixes. However, WPSCC mixes containing ash need lower super plasticizer than WPSCC mixes containing silica fume.
2. PET particles have negative effects on the rheological(workability) properties of fresh SCC.
3. The segregation of samples was observed for samples with 15 wt.% PET replacement ratio. To prevent segregation, special attention is recommended for samples with more than 10 wt.% PET replacement ratio
4. Using PET aggregates in SCC reduces concrete density due to its low specific gravity. Therefore,

it is useful in reducing the dead load of buildings.

4.1.3 Self-Consolidating Concretes Containing Waste PET Bottles as Sand Replacement

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CONCLUSION

- In order not to get loss of workability the maximum amount of PET replacement level should be limited to 5%. When exceeding 5% of PET content, significant increase in the amount of chemical admixture is required. Moreover, the flow and viscosity behavior of SCC is affected significantly. The results indicated that for PET replacement levels of 6% and higher, VF-funnel flow time over passed 25 sec.
- The increment in the compressive strength of FRC was not influenced by the volume of the added fibers. However, the inclusion of PET particles up to 5% resulted in undistinguishable improvement in the splitting tensile strength capacity. However, beyond this value slight decrease was also observed. Therefore, it can be concluded that by adjusting concrete mix parameters, production of high performance SCC containing 5% PET granules is possible with satisfactory outputs.

4.1.4 Concrete Incorporated with Optimum Percentages of Recycled Polyethylene Terephthalate (PET) Bottle Fiber

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CONCLUSION

• In a nutshell, the compressive strength of the concrete showed a fluctuating condition as the percentage of recycled PET fibers added into the concrete increased. However, the test results for all percentages of fiber concrete showed no significant difference compared to normal concrete. The overall results for the compressive strength test showed that every batch of concrete mix passed the target strength of concrete which was 35N/mm2 and 1.0% of PET concrete showed the best value of compressive strength test among the other fiber concrete. As for splitting tensile strength test, the tensile strength increases about 10% when 1.0% of PET fibers was added to concrete compared to normal concrete. Based on the tests that had been conducted in this research, the optimum percentage of recycled PET fibers to be added into concrete was 1.0%.

4.1.5 STRENGTH PROPERTIES OF GLASS FIBRE CONCRETE

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5. CONCLUSIONS

1. A reduction in bleeding is observed by addition of glass fibres in the glass fibre concrete mixes;
2. A reduction in bleeding improves the surface integrity of concrete, improves its homogeneity and reduces the probability of cracks;
3. The percentage increase of compressive strength of various grades of glass fibre concrete mixes compared with 28 days compressive strength is observed from 20 to 25% d) The percentage increase of flexural and split tensile strength of various grades of glass fibre concrete mixes compared with 28 days is observed from 15 to 20%

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Department of Civil Engineering, University of Guilan, Rasht, Iran b Young Researchers and Elite Club, Jouybar Branch, Islamic Azad University, Jouybar, Iran

[3] American Institute of Physics https://doi.org/10.1063/1.5022928 Self-Consolidating Concretes Containing Waste PET Bottles as Sand Replacement.
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[4] International Journal of Integrated Engineering, Vol. 10 No.1 (2018) p. 1-8 Concrete Incorporated with Optimum Percentages of Recycled Polyethylene Terephthalate (PET) Bottle Fiber
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Strength properties of glass fibre concrete
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