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Use of Low Linear Density Polyethylene as Mineral Admixture

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Abstract:-- **Now a day's use of plastic is increases enormously but it has very low biodegradability and presence in large quantities. Thus best solution for disposing of plastic waste is recycling of it to produce new materials like concrete or mortar because of cost effectiveness and ecological advantages. Thus experimental study was carried out to use low linear density Polyethylene (LLDPE) as a replacing material (mineral admixture) for cement in concrete. compressive strength and split tensile strength of concrete were determined in laboratory. low linear density Polyethylene with percentage addition of 0, 3,6,9 and 12% by weight of cement is replaced and mechanical properties were studied. all specimen were tested after a curing period of 7, 21 and 28 days. The result indicated that, the use of low linear density Polyethylene in concrete increase both compressive as well as split tensile strength.**

Keywords: Low Linear Density Polyethylene (LLDPE), Water Cement ratio (w/c), Workability, Compressive Strength, Split Tensile Strength.

I. INTRODUCTION

Plastic, proved to be one of the most noteworthy revolutionary materials developed in the twentieth century with numerous applications in several industries, such as plastic packaging industry, building and construction , automobile, electrical etc. [1] A large growth in the consumption of plastic have been observed all over the globe. the plastic waste is now a serious environmental threat due to the low biodegradability and the presence in large quantities.[2,3] plastic is composed of several toxic chemicals and therefore plastic pollute soil , air and water. since plastic is no biodegradable material land filling plastic would mean preserving toxic material forever. [2]. thus there are several recycling possibilities, the re use of plastic to produce a new plastic material, to produce other material namely concrete because of cost effectiveness, ecological advantages and sustainable alternative to dispose of this type of west. [1]. This paper aim an experimental study to evaluate fresh and hardened properties of concrete produce by using LLDPE.

II. EXPERIMENTAL PROGRAMME

2.1 Materials: Ordinary Portland cement (53 Grade) confirming to IS: 12269-1987 [4]. Natural river sand passing through 4.75 mm IS sieve confirming to grading zone II as per IS-383 1970 [5] with fineness modulus 2.53 and was of specific gravity 2.673 with water absorption 2.13 %. Coarse aggregate having size range passing through 20 mm and retained on 12.5mm Is sieves as well as crushed granite stone with a specific gravity of 2.85 having water absorption 1.5% was used. Fly ash Pozzocrete P-60 grade of reputed company used as mineral admixtures. The naphthalene based super plasticizer was used to obtain the required workability. Low Linear Density Polyethylene (LLDPE) was used for replacement to cementitious material with following properties depicted in Table-1.

Table-1. Properties of Low Linear Density Polyethylene

Sr. No	Properties	Value	Unit
1	Density	915	kg/m3
2	Tensile Strength	30	MPa
3	Water Absorption	0.01	%
4	Flexural Modulus	350	MPa

2.2 Mix proportioning: The experimental stage of this study was designed such that the mechanical properties of concrete made by incorporating low linear density Polyethylene could be determined. For that experimental program was design based on a reference concrete mix containing 0 % LLDPE addition. on the basis of literature survey the percentage addition of low linear density Polyethylene 3%, 6% ,9% and 12% were fixed for the present study. This research involves the use of low linear density Polyethylene as a mineral admixture in presence of Fly Ash as a replacement of cementitious material by weight of cement, at definite proportions to study the compressive strength and split tensile strength of concrete. It consists of casting concrete mixes, dosage of superplastisizer and

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workability of concrete was kept constant. water cementitious material ratio (w/c) of 0.3 decided and implemented for casting. after the test on material and its properties, the proportioning of concrete mix was carried out in accordance to IS 10262:2009[6]. Mix proportioning for per cubic meter of concrete is shown in [Table-2].

Table - 2 : Material for per cubic meter of concrete mixtures.

Sr. No	Mix Designation	W/C	Cement (Kg)	LLDPE (Kg)	Fly Ash (Kg)	Water (kg)	Aggregate (Kg)		Chemical Admixture (kg)
							C.A. 12.5 mm	F.A.	
1	Mix-01-R	0.3	500.76	0	55.64	172	893.37	880.25	5.57
2	Mix-02	0.3	485.74	15.02	63.07	172	893.37	880.25	5.57
3	Mix-03	0.3	470.71	30.04	63.07	172	893.37	880.25	5.57
4	Mix-04	0.3	455.69	45.06	63.07	172	893.37	880.25	5.57
4	Mix-05	0.3	440.66	60.1	63.07	172	893.37	880.25	5.57

III. TESTING OF CONCRETE:

Concrete cube of size 150x150x150 mm were tested for compressive strength at the age of 7days, 21days and 28 days as per the IS 516:1959. To obtained the split tensile strength, cylindrical specimen of size 150 mm diameter and 300mm length were tested as per the provision laid in IS 5816: 1999. The workability of concrete was measured by means of conventional slump test.

IV. RESULTS AND DISCUSSION

Compressive Strength Test Results

The mix designations and percentage addition of low linear density Polyethylene along with test results of each mix are presented in Table 3. Column No 2 shows designation of the mixes, while w/cm ratio by mass, percentage addition of low linear density Polyethylene is shown in Column No 3 and 4 respectively for each mix. In Table 3 , Column No 5,6 and 7 gives the overall results of 7days, 21days and 28 days compressive strength of concrete produced by using varied percentage addition of low linear density Polyethylene. The variations of compressive strength at the age of 7days, 21days and 28days at different percentage addition of low linear density Polyethylene can be depicted in the form of graph as shown in Figure- 1. Compared to the compressive strength of reference mix concrete (0 % of LLDPE) and concrete mix having 6 % of LLDPE gives higher compressive strength. the results shown in column 5,6 and 7 indicated that the optimum amount of LLDPE which gives maximum compressive strength is 6%. the mix having LLDPE content 12% shows less compressive strength compared to reference mix. results reveal that the rate of gain of strength developments is increased with increase in LLDPE contents up to 6% and after this compressive strength get reduced even less than reference mix concrete.

Table - 3: Compressive Strength results with varied percentage addition of LLDPE.

Sr. No	Mix Designation	W/C	LLDPE	Compressive Strength, N/mm²		
			(%)	7 Days	21 Days	28 Days
1	2	3	4	5	6	7
1	Mix-01-R	0.3	0	32.95	44.02	44.48
2	Mix-02	0.3	3	32.24	43.28	43.52
3	Mix-03	0.3	6	33.39	44.21	45.07
4	Mix-04	0.3	9	30.49	30.77	41.16
5	Mix-05	0.3	12	22.57	27.19	30.46

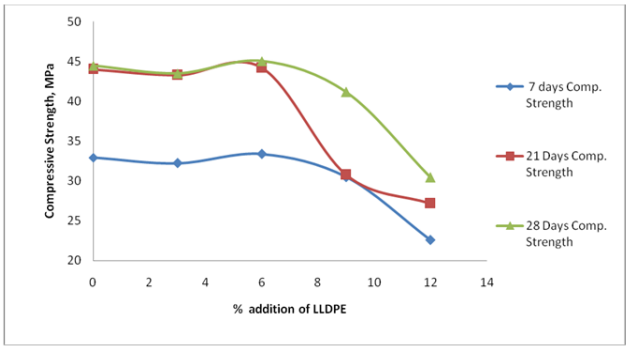

Figure-1. Variation of compressive strength of concrete with different percentage of LLDPE.

Split Tensile Strength Test Results

Table- 4 gives the overall results of Split tensile strength of concrete produced by using varied percentage addition of low linear density Polyethylene. The variations of Split tensile strength at the age of 7days, 21days and 28days at different percentage addition of SAP can be depicted in the form of graph as shown in Figure- 2. results indicated that the rate of gain of strength developments is increased with increase in LLDPE contents up to 6% and after this split tensile strength get reduced even less than reference mix concrete.

Table - 4: Split Tensile strength results with varied percentage addition of LLDPE.

Sr. No	Mix Designation	W/C	LLDPE	Split Tensile strength , N/mm²		
			(%)	7 Days	21 Days	28 Days
1	2	3	4	5	6	7
1	Mix-01-R	0.3	0	3.24	3.86	4.374
2	Mix-02	0.3	3	3.21	3.84	4.33
3	Mix-03	0.3	6	4.23	4.28	5.71
4	Mix-04	0.3	9	2.78	2.82	3.75
5	Mix-05	0.3	12	2.69	2.65	3.63

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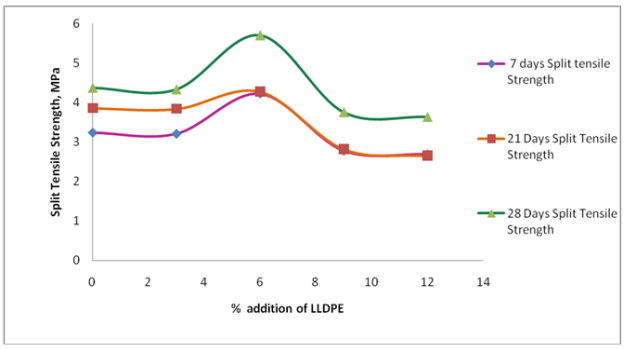

Figure-2. Variation of Split Tensile Strength of concrete with different percentage of LLDPE.

V. CONCLUSIONS

Following Conclusions may be drawn in the present study based on the results:

(1) The results indicated that the rate of gain of strength developments is increased with increase in LLDPE contents up to 6% and after this both compressive strength as well as split tensile strength get reduced even less than reference mix concrete.
(2) The addition of 6 % LLDPE mix concrete results reveals 30% increased split tensile strength than reference mix concrete.
(3) Results shows that as the proportions of percentage addition of LLDPE increases it demands higher dose of superplastisizer.

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