INFLUENCE OF POLYPROPYLENE FIBERS ON GEOTECHNICAL PROPERTIES OF POND ASH

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Abstract: Pond ash is an unwanted product from thermal power stations. Way of reducing the pollution of pond ash disposal determinations is recycled and reused in different engineering applications. The quality of pond ash can affect the quality and strength of engineering applications. This research paper using fiber reinforcement techniques to improve the geotechnical properties of pond ash. Polypropylene fiber is used to reinforce for stabilization of pond ash. In this research, some laboratory tests as compaction test, CBR tests, and direct shear tests are conducted. Polypropylene fiber used in different length 12mm and 24 mm with different content i.e. 0.5%,1%,2% and 3% .As per results found that there is a significant effect of polypropylene fiber on the geotechnical properties of Pond Ash.

Keywords **– Pond Ash, Polypropylene Fiber, Angle of Internal Friction, Shear Strength, CBR.**

I. INTRODUCTION

The main aim of this research is to utilize Pond Ash, so that reduce the effect on the environment on an account of dumping of such large quantities and in the construction of roadways, embankments and many more will be economical. Soil reinforcement is an effective technique for improving the strength and immovability of soils. Recently it is more in use. In this research, randomly distributed polypropylene fiber is used for the stabilization of pond ash. For steadiness in field problems like embankments and other structure fills, road subbase and subgrades construction, running tracks, earthen dams, etc of pond ash is nee to improve geotechnical characteristics like dry density, shear strength, bearing capacity, angle of internal friction, and reduces moisture content.
In this paper Polypropylene fiber used in different length 12mm and 24 mm with different content i.e. 0.5%,1%,2% and 3% by dry weight of pond ash

II. LITRATURE REVIEWS

a)**Prabhakar and Shridhar (2002)[1]** In this research randomly oriented sisal fiber as reinforcement c- Φ soil at four different percentage 0.25, 0.5, 0.75 and 1% by weight of raw soil and four different length of fiber 10,15,20 and 25 mm is used and found momentous improvement in shear strength parameters of the soil.

b) **Shenbaga. R. Kaniraj, V. Gayathri:Geotextiles and Geomembranes 21 ,January (2003)** [2] Experimental study was meted out to analyze the influence of haphazardly minded fiber inclusions on the geotechnical behavior of 2 Indian fly ashes. Polyester fibers of various sorts and a continuing fiber content of 1 Chronicles (by dry weight) were utilized in the experiments. The stuff content of the fibers was 100 percent recycled plastic waste. This paper presents the results of compaction tests, triaxial shear tests, and different geotechnical characterization tests meted out on the raw and fiber-reinforced fly ashes. The fiber inclusions hyperbolic the strength of the raw ash specimens and altered their brittle behavior into ductile behavior.

c **) S.S. Razvi1,Medha Jogdande, Rupali Borde, Jadhav Monali, Pathan Aamer Khan, Shaikh Muktar(2017)[9]-** This study proves Fly ash and fiber additive maybe successfully used to enhance the engineering properties of soil and also CBR value. It has been observed that CBR value increases with fly ash and fiber content 1%, 1.5%,2% for soil and that values increases significantly after addition of 1.5% fly – ash and fiber content.

III. MATERIAL USED

a) POND ASH

The pond manufactured from Kota thermal power station. The material was by produce from coal thermal electricity production power plant dumping area. Index properties of pond ash are shown in Table **1:**

Table 1: Index properties of pond ash

S.No.	Properties	Value
1	Specific Gravity	1.74
2	Liquid Limit	24.14
3	Plastic Limit	Non - Plastic
4	Grain Size Distribution	
	Gravel	0%
	Sand	59.47%
	Silt + Clay	40.53%
5	Coefficient of Uniformity (Cu)	6.8
6	Coefficient of Curvature (Cc)	1
7	OMC (%)	18.75
8	MDD (gm/cc)	1.3010
9	CBR unsoaked (%)	4.40%
10	C	0.19
11	Φ (in degree)	11.734

b) POLYPROPYLENE FIBER

The polypropylene fiber is normally tough and flexible material. Recon 3s fiber was used in this study it produced by Reliance Industries Limited manufactured by (Reliance industries limited Hoshiyarpur manufacturing division Dharmshala Road, V.P.O. Chohal, Punjab, India) .In this investigation the different fiber length (12mm and 24mm) was used for further experiments. Some physical and engineering properties of recron 3s synthetic fiber are shown in table 2

Table 2: Properties of fibre

S.NO.	Physical Properties	Values
1.	Material	Polypropylene Fiber
2.	Shape	Straight
3.	Color	White
4.	Specific Gravity	0.91 gm/cc
5.	Length	12mm,24mm
6.	Diameter	25-40 micron (approx.)
7.	Aspect Ratio	860,1000(approx.)
8.	Thermal& electric Conductivity	Low
9.	Alkali Resistance	100% Alkali proof
10.	Acid and Salt Resistance	High
11.	Young's Modulus	>400 Mpa

IV. EXPERIMENTAL PROGRAMME

a) STANDARD PROCTOR TEST (IS: 2720 – PART VII: 1980)

The standard Proctor test is carried out to determine the OMC & MDD of soil. A soil sample about 3 kg of oven-dried, passing through 4.75 mm sieve is taken. The soil sample is compacted In a mould having 4 inches internal diameter & capacity of 1/30 cubic foot. It has a detachable base plate & a collar. The moist soil having in the mould is compacted in three layers by 25 blows of 2.6 kg rammer with a free fall height of 310 mm. the blows of the rammer are uniformly distributed over the soil sample so compaction of soil is done properly. When compaction is done, the collar is removed & determine the weight of mould with a base plate. This procedure is repeated up to 4 to 5 times and draw the curve between moisture content & dry density. The peak value of the curve shows the optimum moisture content (OMC) & maximum dry density (MDD).

b) CALIFORNIA BEARING RATIO TEST (IS: 2720 – PART VI: 1987)

It is a load deformation test performed in the laboratory or the field whose results are then used with an empirical design chart to determine thickness of flexible pavement, base and other layers for a given vehicle loading. In order to study the effect on CBR value of Pond Ash, CBR test were conducted in accordance with IS 2720(PART -16) (1987) and IRC 37 (1970)

c) DIRECT SHEAR TEST

In order to know the Shear Strength Parameters (C and Ø) of Reinforced Fly Ash and Sand, Direct Shear Test (UU test) in Accordance with IS 2720 (Part-13) (1986) were conducted in laboratory for each selected fibre parameters i.e. percentage fiber content an different length of fibre .

V. RESULTS AND DISCUSSION

A. EFFECT ON COMPACTION TEST

It is observed that maximum dry density is increases with increases in fiber and optimum moisture content is decreses with increases in fibre content of pond ash. Moisture- Density relationship of pond ash significantly affected by sand and fiber content mixtures. When mix of pond ash and randomly distributed fibers with different (0.5%,1%,2% and 3%) fiber content and length 12mm and 24 mm is prepared then the MDD is an increase from 1.301 gm/cc to 1.454 gm/cc and 1.301gm/cc to 1.51 gm/cc respectively and on the other hand,OMC is decreased from 18.75% to 16.71% and 18.75% to 15.80% respectively.

Table 3 : Comparison of OMC & MDD of Pond ash

Percentage of Fiber with Pond ash	OMC%		MDD (gm/cc)	
	Fiber Length 12mm	Fiber Length 24 mm	Fiber Length 12 mm	Fiber Length 24mm
Pond Ash	18.75	18.75	1.301	1.301
Pond Ash+ 0.5% Fiber	18.18	17.5	1.307	1.326
Pond Ash + 1% Fiber	17.91	16.88	1.310	1.424
Pond Ash + 2% Fiber	17.18	16.10	1.403	1.46
Pond Ash + 3% Fiber	16.71	15.80	1.454	1.51

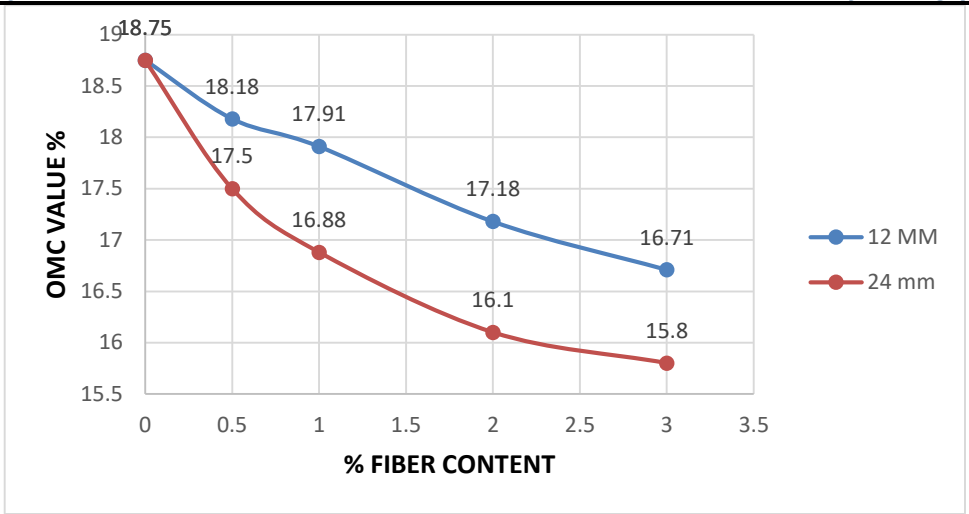

Figure 1: Variation of OMC vs Different fiber content and length in Pond ash

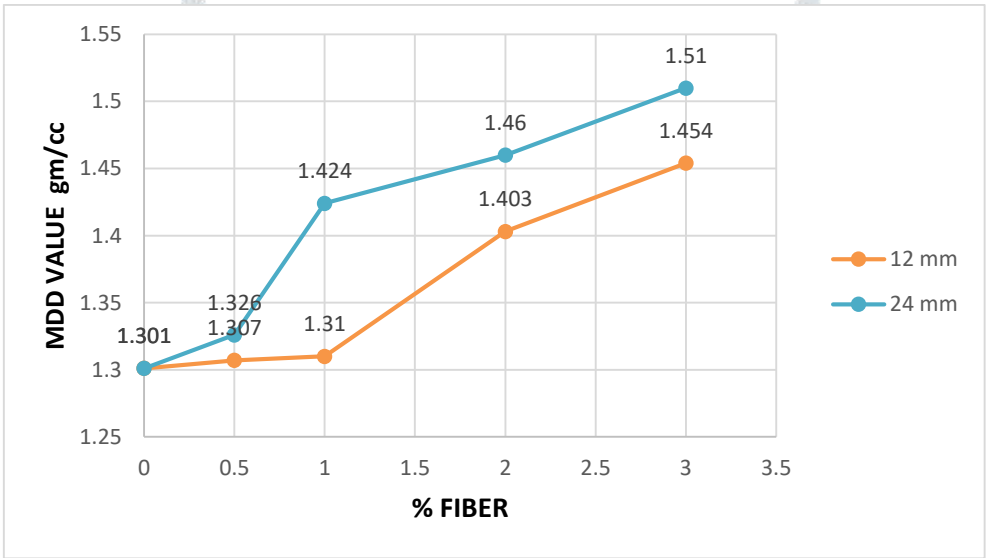

Figure 2: Variation of MDD vs Different fiber content and length in Pond Ash

B. EFFECT ON CBR TEST

It was observed that the CBR (unsoaked) value in Pond ash samples is 4.4%. Fiber is mixed with Pond ash in different proportions and different fiber lengths. When 3% Fiber of 12 mm length is added to an Pond ash, the CBR value increases by 145 percent to 10.78% CBR and When 3% Fiber of 24 mm length is added to an Pond ash, the CBR value increases by 169.09 percent to 11.84% CBR.

TABLE 4: CBR Test (Unsoaked) Results Obtained for Pond ash and with Diff. Percentage or Fiber length

Test Specimen	CBR Value%		%Increment	
	Fiber Length 12 mm	Fiber Length 24 mm	12mm	24mm
Pond Ash	4.4	4.4	-	-
Pond Ash+0.5%Fiber	7.14	8.96	62.27	103.63
Pond Ash + 1% Fiber	8.27	9.72	87.95	120.90
Pond Ash + 2% Fiber	9.64	10.55	119.09	139.77
Pond Ash + 3% Fiber	10.78	11.84	145	169.09

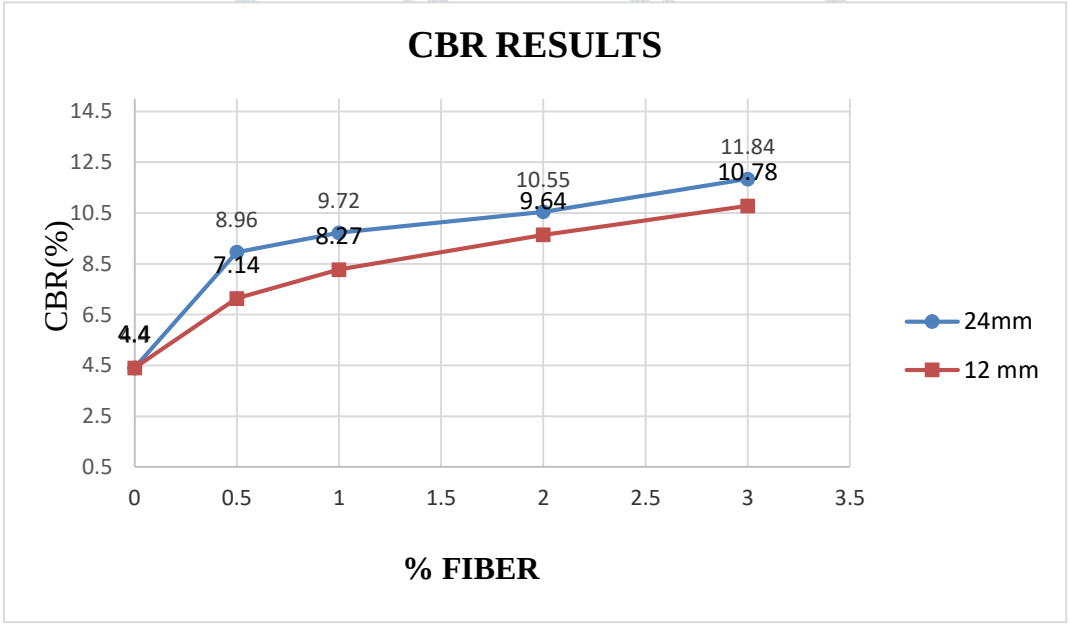

FIGURE 3: CBR (Unsoaked) Test Results Obtained by Pond ash with different proportion and length of Polypropylene Fiber

C. EFFECT ON DST TEST

It is observed that the value of Φ is increases with in increases in proportion of pond ash – fiber mixtures. The angle of internal friction (Φ) is increases from 11.734° to 23.733°, 27.931° respectively with increases in proportion of pond ash –Fiber mixtures and lengths. Table 4.7 shows the variation of angle of internal friction with different percentage and length of polypropylene Fiber mixture with pond ash. C value is increases with increase in fiber content as compared to C of pond ash with 12mm and 24 mm fiber length, it increases 0.19kg/cm^2 to 0.26kg/cm^2 and 0.27kg/cm^2 respectively.

Table 5: Comparison of angle of internal friction (Φ) of Pond ash

Percentage of Fiber with Pond ash	Angle of Internal Friction (Φ) (in degree)		% Increment In (Φ)		C value	
	Fiber Length 12 mm	Fiber Length 24 mm	12 mm	24mm	12 mm	24mm
Pond Ash	11.734	11.734	-	-	0.19	0.19
Pond Ash+0.5%Fiber	18.435	20.556	57.10	75.18	0.20	0.21
Pond Ash + 1% Fiber	21.844	23.981	86.15	104.37	0.23	0.23
Pond Ash + 2% Fiber	22.479	25.569	91.57	117.90	0.24	0.25
Pond Ash + 3% Fiber	23.733	27.931	102.25	138.034	0.26	0.27

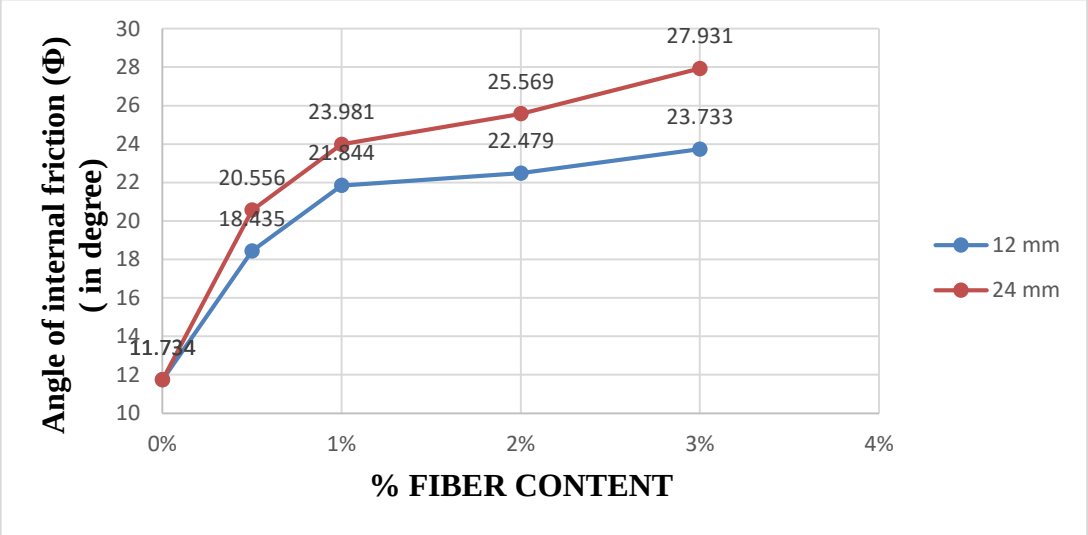

Figure 4: Variation of (Φ) value vs Different fiber content in pond ash

VI. CONCLUSIONS

A. Moisture density relationship of pond ash is significantly affected by adding of randomly distributed fibre. Maximum increase value of MDD is 1.51 gm/cc and maximum decrease value of OMC is 15.80% in pond ash with 3% fibre content and 24 mm fibre length.

B. By adding randomly distributed fibres with pond ash, the CBR vale is significantly improved. pond ash with 3% fibre content and 24mm fibre length gives maximum increased CBR value is 11.84% .

C. In direct shear test, angle of interbnanal friction (Φ) of pond ash is consequently improved by adding of randomly oriented fiber. The upper increment value of (Φ), IS 27.931° due to addition of 3% fibre content and 24 mm length with pond ash

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VIII. REFRENCES

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