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Intensification of Soil properties influence by Synthetic Fibre and Pond Ash

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Abstract – Thermal power plant delivered pond ash which is a waste material. In India, Installed limit of power segment is 186 Giga watt (fifth biggest in world) and 65% of introduced limit is constitute by thermal power plant. Thermal power plant utilized 80% of coal for creating power which prompt coal ash generation. Indian coal having the low caloric esteem it prompts coal fiery remains generation rate is all the more, in this way, creation of coal ash is every year in India is around 130 million tons. Spending of huge amount on operation and maintenance of ash pond hence it is required to increment the utilization level of ash pond. However, it is possible to know the engineering behaviour of pond ash. Utilization of pond ash in the field of pavement, abutment, retaining wall, bridge etc, required to be reinforced. In this investigation ,utilizing the pond ash in soil by taking percentage as 10%, 20%, 30%, 40 % and then adding the percentage of nylon fibre in soil such as 2%,4%,6%,8% and 10% efforts are made to reinforce the pond ash with fibre which is nylon fibre in variant substitution percentage such as 2%,4%,6%,8% and 10%.The strength behaviour is examined by conducting CBR(un soaked) test.

Key Words: Black Cotton Soil, Pond ash, Nylon fibre, OMC, MDD, CBR.

1. INTRODUCTION

Thermal power plant produced pond ash which is a waste material. Pond ash strength is low examination with material of earth and having the angle of friction is less and pond ash shape is sub rounded. In India, Installed capacity of electricity sector is 186 Giga watt (5th largest in world) and 65% of installed capacity is constitute by thermal power plant. Thermal power plant used 80% of coal for generating power which lead to coal ash production. Indian coal having the low caloric value it leads to coal ash production percentage is more, thus, production of coal ash is annually in India is about 130 million tons.

By products are the waste material produced by thermal power plant which effects the environment. Now a days disposal of them is major concern it needs a more area and having many environmental issues. Mechanical or electrostatic precipitator delivered fly cinder. Gathering of base cinder from the base of boilers and blend of fly cinder and base cinder is called pond ash. Generation of pond ash is more contrasted with fly cinder and base cinder. Usage of pond ash in other arena to diminish the condition of potential risks.

Self-draining capability display in pond ash and also its weight very less compare with the natural soil before used in other fields. It is vital to know pond ash characteristics strength. Substantial measure of soil required for any developments, for example, abutments, embankments, retaining structures and earthen dam etc. Less accessibility of normal soil then scientists thought to using the power plants waste product, natural soil replaced by waste product as a replacement. Using of by product reduces the natural soil scarcity.

Now a days in India usage of pond ash is negligible in others field. It is used as commercially about 35%. Maximum extent to usage of pond ash for preservation of natural soil. In low lying areas filler material as taken as. Pond ash utilization is rare and for using purpose having the knowledge to physical properties and characteristics.

Pond ash strength is low examination with material of earth and having the angle of friction is less and pond ash shape is sub rounded. Pond ash and reinforcement which increases the geotechnical properties. It is fundamental to know the characteristics strength and reinforcement is very required.

2. EXPERIMENTAL DETAILS

A. Materials:

Black cotton soil; Utilized materials in the investigation are BC soil, Collected BC Soil from near Karanja Dam, district Bidar the soil is greyish black in color the physical properties of soil is tabulated in table 1.

Table -1: Physical properties of Black Cotton Soil

Sl No.	Property	Values
1	Specific gravity	2.45
2	Consistency Limits	
	a. Liquid Limit (%)	74.9
	b. Plastic Limit (%)	42.9

	c. Plasticity Index (%)	32
3	Compaction Properties	
	a. Maximum Dry Density (g/cc)	1.404
	b. Optimum Moisture Content %	23.04
4	Grain Size Distribution	
	a.Coefficient of Curvature	0.86
	b.Coefficient of Uniformity	6.15
5	CBR (Unsoaked) (%)	1.55
6	Differential Free Swell Index (%)	33.25

Pond ash; Collection of pond ash from Raichur Thermal Power Plant, Karnataka. India.

Table-2: shows the chemical composition of Pond ash

Parameter	Value in Percentage
Sio_2	59-61
Al_2O_3	28-28.8
Fe_2O_3	2.70-5.52
Na_2O	0.24-0.50
K_2O	1.26-1.76
CaO	0.7-1
MgO	1.40-1.90
LOI	0.5-2.5

Nylon Fibre; The fibre used in this research work is collected from islampur,Sangli District, Maharashtra, India.

Table-3: shows the physical properties of Nylon Fibre

Sl.No	Property	Value
1	Fibre Cross Section	Trilobal
2	Fibre lenght	18mm
3	Filament	3
4	Sp. Gravity	1.13
5	Color	Brilliantly White
6	Melting point	220 Degree Centigrade
7	Chemical resistance	Very good against alkalis,hydrocarbon

B. Preparation of sample:

Black cotton soil with Pond ash and Nylon fibre is tested for stabilizing clay soil ,pond ash it will be replaced with 10%, 20%, 30 %, 40% by black cotton soil and the geotechnical parameters will be tested in the laboratory by conducting standard compaction test, CBR. Addition of Nylon fibre with 2%, 4%, 6%, 8% & 10% into black soil and the geotechnical parameters will be tested in the laboratory by conducting standard compaction test, CBR test. Adding optimum percentage of pond ash who achieved more dry density then adding with Nylon fibre with 2%, 4%, 6%, 8% & 10% into black soil and the geotechnical parameters will be tested in the laboratory by conducting standard compaction test, CBR test. And after all, results were observed and the variation of properties of soil is observed.

C. Experimental work:

Following tests were carried out specific gravity test, moisture content test, atterberge limits where carried out for only black soil, standard proctor test, California bearing ratio test.

3. RESULTS AND DISCUSSION

A. OMC and MDD results for treated for different blending proportions of the soil:

Table 4: Describing result for OMC and MDD for varying percentage of pond ash

Sl.No	Particular	MDD in g/cc	OMC in %
1	0% Pond ash	1.40	23.04
2	10% Pond ash	1.46	16.66
3	20% Pond ash	1.53	18.2
4	30% Pond ash	1.5	19.10
5	40% Pond ash	1.48	20

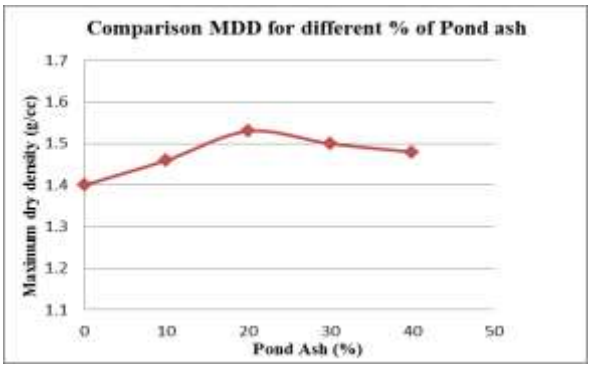

Fig 1; indicating the results for MDD for different % of Pond ash

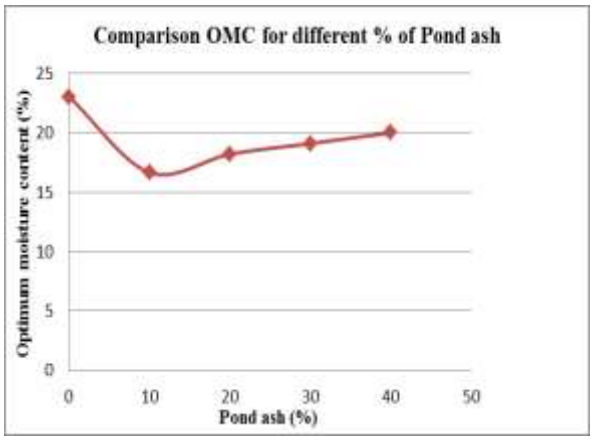

Fig 2; indicating the results for OMC for different % of Pond ash

Above figure (1) & (2) display the addition of 20% of pond ash gives the Maximum Dry Density 1.53g/cc for 18.2% of Optimum Water Content after this diminishing the dry density of rising of water content.

Table 5: Describing result for OMC and MDD for optimum 20% of pond ash varying percentage of Nylon fibre

Sl.No	Particular	MDD in g/cc	OMC in %
1	2% Nylon fibre	1.55	17.7
2	4% Nylon fibre	1.57	21.05
3	6% Nylon fibre	1.68	19.1
4	8% Nylon fibre	1.63	15.03
5	10% Nylon fibre	1.59	20
6	Optimum 20% PA +2% Nylon fibre	1.65	19.04
7	Optimum 20% PA +4% Nylon fibre	1.77	15.8
8	Optimum 20% PA +6% Nylon fibre	1.74	17.8
9	Optimum 20% PA +8% Nylon fibre	1.73	21.6
10	Optimum 20% PA +10% Nylon fibre	1.69	14.6

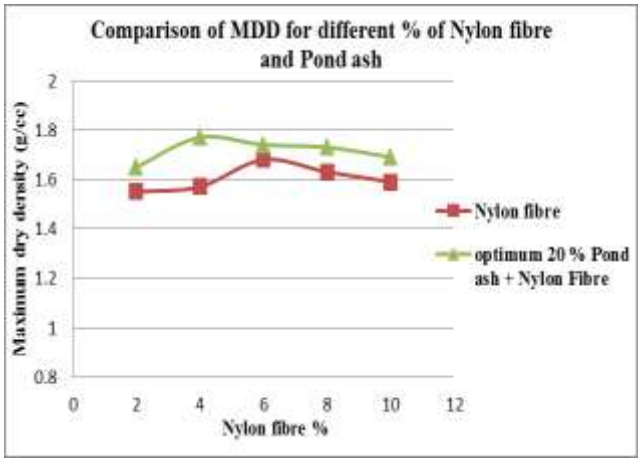

Fig 3; indicating the results for MDD for different % of Nylon fibre and Pond ash

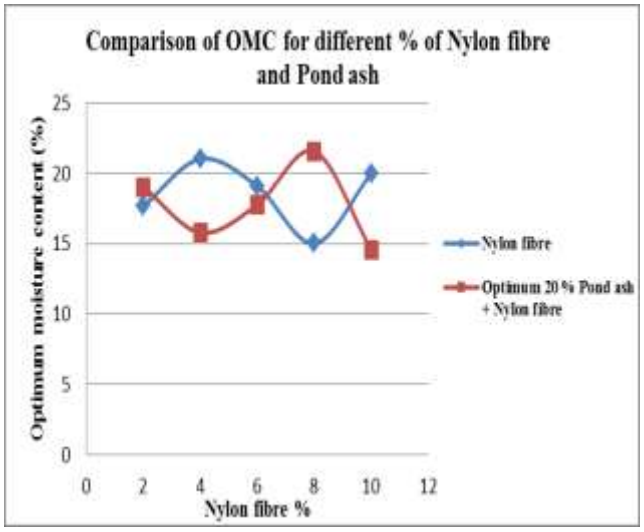

Fig 4; indicating the results for OMC for different % of Nylon fibre and Pond ash

From the above figures shows the addition 20% pond ash which gives the Maximum Dry Density 1.53g/cc for 18.2% of Optimum Water Content after this diminishing the dry density of rising of water content. Then addition of 6% of Nylon fibre into the black cotton soil gives the Maximum Dry Density 1.68g/cc for 19.10% of Optimum Water Content after this diminishing the dry density rising of water content. Combination of the addition of 20% of optimum pond ash with 4% of Nylon fibre gives the Maximum Dry Density 1.77g/cc for 15.8% of Optimum Water Content after this diminishing the dry density rising of water content. Combination of both Nylon fibre and optimum 20% of Pond ash which achieve the highest maximum dry density among all.

B.California bearing ratio test results:

Table 6: Showing the results of CBR test for variant percentage of Pond ash

POND ASH %	CBR VALUE 2.5 MM PENETRATION (%)	CBR VALUE 5 MM PENETRATION (%)
0	1.55	1.38
10	2.07	1.72
20	3.62	3.1
30	3.11	2.76
40	2.59	2.07

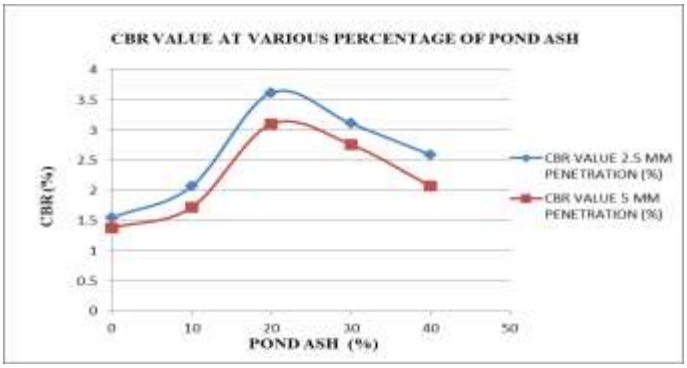

Fig 5; indicating the results of variant CBR value with variant percentage of pond ash

Fig 5; Display the addition of 20% of pond ash in soil gives highest value of CBR at 2.5 penetration is 3.62% and gives at 5mm penetration is 3.11% achieved as compared to other percentage of pond ash as taken.

Table 7: Showing the results of CBR test for variant percentage of Nylon fibre

FIBRE CONTENT %	CBR VALUE 2.5 MM PENETRATION (%)	CBR VALUE 5 MM PENETRATION (%)
0	1.55	1.38
2	2.59	2.42
4	3.62	3.11
6	4.66	3.8
8	4.14	3.45
10	3.11	2.76

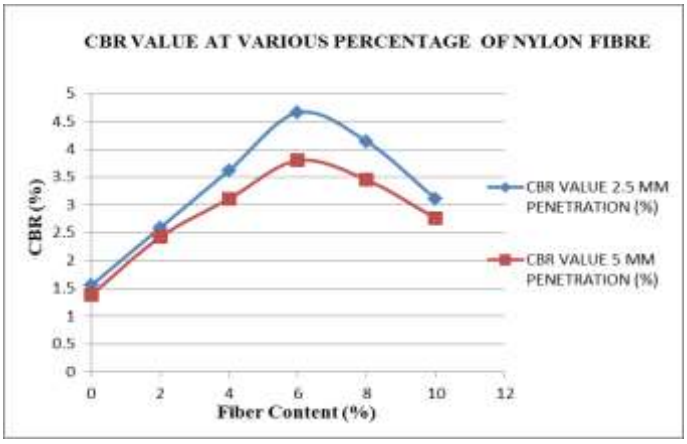

Fig 6; indicating the results of variant CBR value with variant percentage of Nylon fibre.

Fig 6; Display the addition of 6% of Nylon Fibre in soil gives the highest CBR value at 2.5 penetration is 4.66% and gives at 5mm penetration is 3.8% achieved as compared to other percentage of Nylon Fibre taken.

Table 8: Showing the results of CBR test for variant percentage of Nylon fibre

20% POND ASH + FIBRE CONTENT (%)	CBR VALUE 2.5 MM PENETRATION (%)	CBR VALUE 5 MM PENETRATION (%)
0	1.55	1.38
2	3.62	3.45
4	5.18	4.83
6	4.14	3.8
8	3.62	3.1
10	2.59	2.27

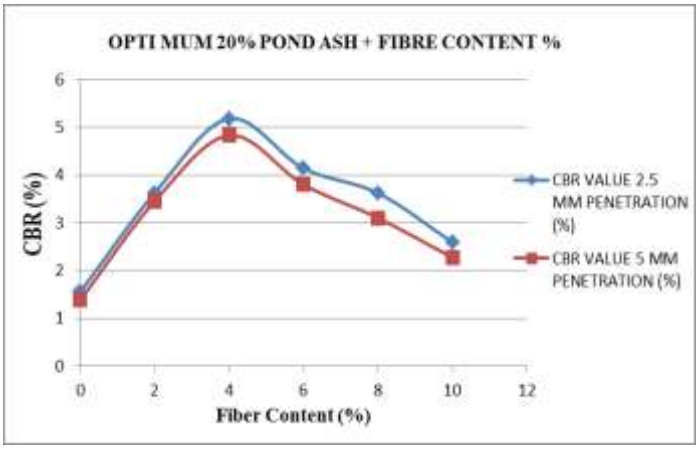

Fig 7; indicating the results of variant CBR value with variant percentage of Nylon fibre.

Fig 7; Display the addition of 6% of Nylon Fibre in soil gives the highest CBR value at 2.5 penetration is 4.66% and gives at 5mm penetration is 3.8% achieved as compared to other percentage of Nylon Fibre taken.

From the above figures shows when adding 20% of pond ash in soil gives highest value of CBR at 2.5 penetration is 3.62% and gives at 5mm penetration is 3.11% achieved as compared to other percentage of pond ash as taken. When adding the 6% of Nylon fibre in soil gives the highest CBR value at 2.5 penetration is 4.66% and gives at 5mm penetration is 3.8% achieved as compared to other percentage of Nylon fibre taken. Addition of 4% of Nylon Fibre with optimum 20 % Pond ash in soil gives the highest CBR value at 2.5 penetration is 5.18% and gives at 5mm penetration is 4.83% achieved as compared to other percentage of Nylon fibre taken. Combination of Nylon fibre and Pond ash which achieve highest CBR value among all.

4. CONCLUSIONS

The addition of Nylon fibre and Pond ash has impact the properties on index property & characteristics of BC soil. The conclusions drawn from these examinations are as per the following:-

- The CBR (unsoaked) estimation of the soil is 1.5 and after blending of ash pond in the soil, there is noteworthy change in CBR esteem. The pond ash of 20% addition raised the CBR esteem from 1.5 to 3.62, yet assist addition of pond ash caused diminish in CBR value. Thus, the optimum amount of pond ash i.e., after which the CBR esteem begins diminishing, is 20%.

- The BC soil is blended with nylon fibre at variant percentage as 2%,4%,6%,8% and 10%.the outcomes are acquired as below.

- When addition of 6% of nylon fibre content blended with soil, the most extreme esteem of CBR is accomplished which is 4.66. It is 3.1times more prominent than CBR estimation of soil.

- CBR (unsoaked) estimation blended soil increments up to 6% fibre content and after this esteem it begins diminishing.

- In this manner for the BC soil utilized as a part of the present investigation, Nylon Fibre content at 6% achieve greatest unsoaked CBR.

- The optimum amount of pond ash is blended with Nylon fibre at variant percentage of fibre in soil the outcomes acquired are.

- Addition of 4% of nylon fibre content with pond ash 20% in blended soil, the peak esteem of CBR is achieve which is 5.18. & it is 3.45 times more prominent than CBR estimation of soil.

- CBR (unsoaked) estimation of ash pond blended soil increments up to 4% fibre content and after this esteem it begins diminishing.

- In this manner for the BC soil utilized as a part of the present investigation, the ideal amount of pond ash and Nylon Fibre are 20 % and 4% respectively achieve greatest unsoaked CBR.

5. FUTURE SCOPE

In view of the examination did in this investigation, the extent of future work the scope for future work is distinguished and discussed as given below.

- Similarly laboratory facility studies might be taken up on various sorts of pond ash and fibre material.

- The present examination was done on Black cotton soil of low compressibility and ideal estimation of Nylon fibre and pond ash is computed.

- Additionally study might be taken up on other weak soils like silt and so on and different filaments might be utilized to study the impact of them on the properties of soils.

- Consolidated impact of different admixtures like lime, bitumen, chemicals and so forth with various sort of filaments can be considered.

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