

# **Influence of Pond Ash mixed with Cement Kiln Dust and PP Fiber on Construction of Embankment**

Pankaj Sharma<sup>1</sup>, J. Sudheer Kumar<sup>2</sup>

PG Student, Department of Civil Engineering, DAVIET, Jalandhar, Punjab, India<sup>1</sup>

Assistant Professor, Department of Civil Engineering, DAVIET, Jalandhar, Punjab, India<sup>2</sup>

**ABSTRACT:** Pond ash and cement kiln dust are the solid residue by products of thermal power project and Cement Industry. They are usually disposed as a waste in disposal sites. These materials can be used for ground improvement and highway embankment construction, not only provides a promising solution to the disposal problem, but also an economic alternative to the use of traditional materials. The problem of disposing pond ash can be reduced by utilizing it in large quantities in various engineering works. In the present study, Pond ash mixed with various proportion cement kiln dust and 0.5%, 1% and 1.5% Polypropylene fiber. Engineering properties of above mixture are investigated. The permeability of pond ash got decreased with addition of cement kiln dust from  $8.087 \times 10^{-3}$  cm/s to  $5.344 \times 10^{-3}$  cm/s. The Maximum dry density for pure pond ash is 1.376 g/cc at 30% of optimum moisture content, whereas maximum dry density for pond ash mixed cement kiln dust upto 30% with increment of 5% is 1.562g/cc at 27% OMC. Mixtures of pond ash and cement kiln dust with different ratios were prepared for testing. The results indicates enhancement of properties that is compaction and permeability. The above mixture added with polypropylene fiber and investigated CBR value, results shown that CBR value of pure pond ash is 15%, when mixed with cement kiln dust and polypropylene fiber CBR value increases upto 27.53 %. Approximately 83% of CBR value is increased. The mix of pond ash, cement kiln dust and pp fibre can be used for embankment construction and it can be used as sub-base layer of the highway pavements.

**KEYWORDS:** *ckd, pp fiber, permeability, compaction, cbr value.*

## **I. INTRODUCTION**

Pond ash is by- product of thermal power plants, which is one of waste product. When fly ash and bottom ash mixed together, and ejected in form of slurry and stored in lagoons, that deposit is called pond ash. Cement kiln dust is also a waste product produced by cement industry. Disposal of these industrial waste products produced from various industries is a big problem. These wastes are non-decomposable and so required a lot of land for the disposal of waste. These waste cause air and water pollution. If waste product like pond ash or cement kiln dust mixed with air and water, it can cause serious disease like Asthma, Cancer etc. These waste causes smog when mixed with air and lead to low visibility which may increases the number of road accident. Pond ash is like cohesion less soil and cement kiln dust has pozzolanic properties. Therefore, pond ash and cement kiln dust mixed with polypropylene fiber may be used for construction of highway embankment. In present research paper analyzed the influence of cement kiln dust and polypropylene fiber to improve the engineering properties of the pond ash. The properties studied are Permeability, Compaction and California bearing ratio of the mix.

## **II. EXPERIMENTAL METHODOLOGY**

### **2.1 Materials**

Pond ash was collected from Guru Nanak Dev Thermal Power Plant, Bathinda (Punjab), India. And Cement Kiln dust was collected from ACC cement factory, Barmana (Himachal Pradesh), India. Polypropylene fiber collected from Mahalaxmi industries, Jalandhar (Punjab), India.. Laboratory tests were measured effect of cement kiln dust on

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permeability of pond ash. Optimum moisture content and maximum dry density for pond ash and cement kiln dust. And California bearing ratio (CBR) test for Pond ash and Cement kiln dust mixed with Polypropylene fiber.

## 2.2 Testing Methods:

### 2.2.1 Permeability test:

The tests were performed as per Indian standard specification 2720-1982 (part17).

### 2.2.2 Compaction test:

The tests were performed as per Indian standard specification IS: 2720, Part-VII..

2.2.3 California Bearing Ratio: The tests were performed as per IS: 2720, Part-16.

## III. RESULTS AND DISCUSSION

To understand the effect of CKD with PA on the permeability, compaction and CBR value, tests are performed. The following results were observed.

### 3.1. Permeability test:

The permeability of pure pond ash is  $8.66 \times 10^{-3}$  cm/s, with addition of cement kiln dust upto 20% with increment of 5% permeability of pond ash decreases to  $5.48 \times 10^{-3}$  cm/s. So, it is clear that with increase in percentage of CKD, the permeability of pond ash gets decreases, results are published in fig.1

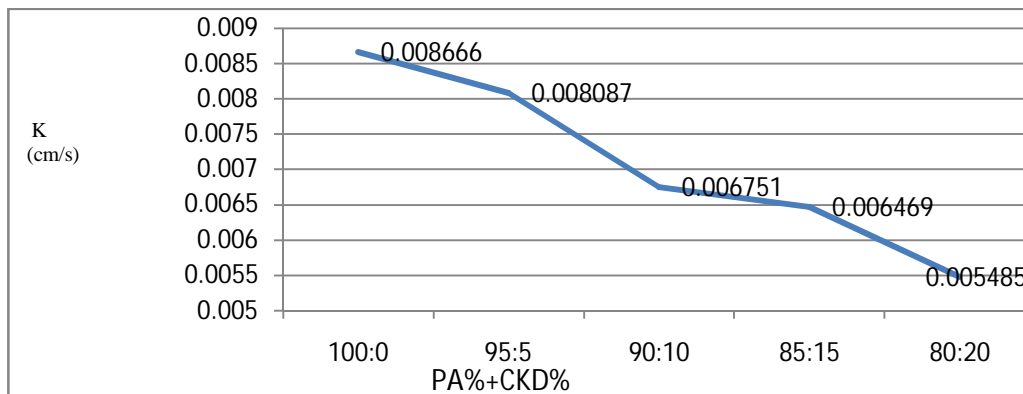


Fig.1 Variation of Permeability of Pond ash mixed with CKD (%).

### 3.2. Compaction test:

Dry density of pure pond ash is  $14.55 \text{ kN/m}^3$  and OMC value is 23%. With the addition of cement kiln dust upto 30% at increment of 5%, the MDD and OMC values were increased. Maximum dry density achieved  $15.88 \text{ kN/m}^3$  and OMC is 27% for 75 % of PA with 25% of CKD. MDD and OMC of various percentages of pond ash and cement kiln dust shown in fig.2.

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Table 1 Experimental results

Proportion used (PA:CKD)	OMC (%)	MDD (kN/m <sup>3</sup> )
100:0	23	14.55
95:5	25	14.8
90:10	24	14.9
85:15	25	15.73
80:20	26	15.82
<b>75:25</b>	<b>27</b>	<b>15.88</b>
70:30	25	15.69

The results shows that maximum dry density is 15.88 kN/m<sup>3</sup> for optimum mix proportion i.e.75% of PA and 25% of CKD.

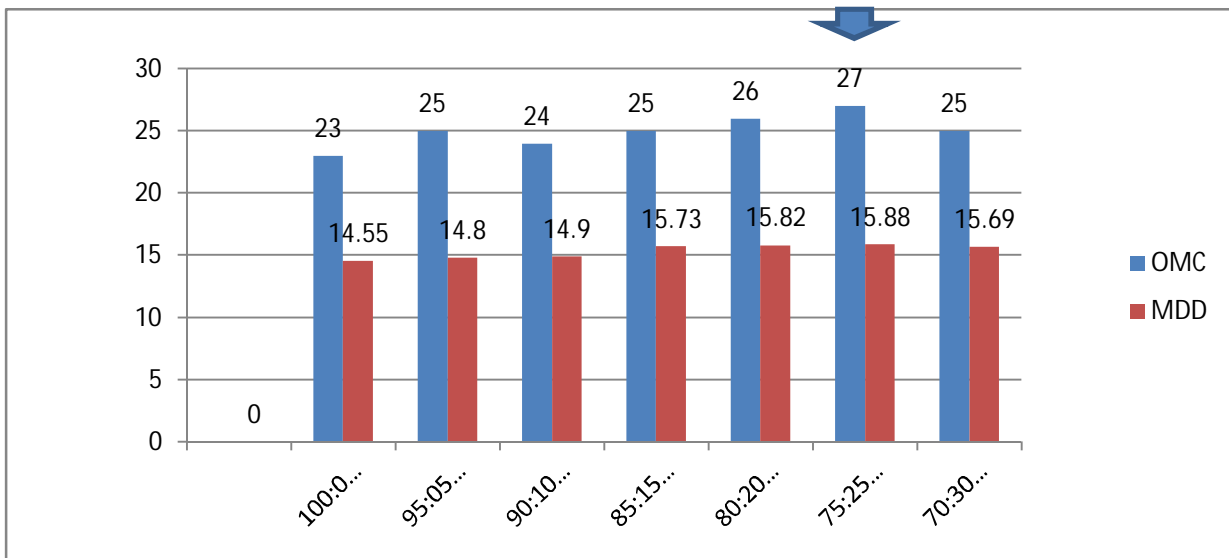


Fig.2 MDD and OMC of various percentages of pond ash and cement kiln dust.

This composition behaves like cohesion less soil, the dry density decreases with increase in the water content at the initial stage of curve. This shows the bulking nature of material.

Further addition of water the meniscus is destroyed and the particles are able to move to take a closer packing, resulting in increase in dry density. The density reaches the maximum value when the pond ash and cement kiln dust is fully saturated. On further addition of water the dry density again decrease.

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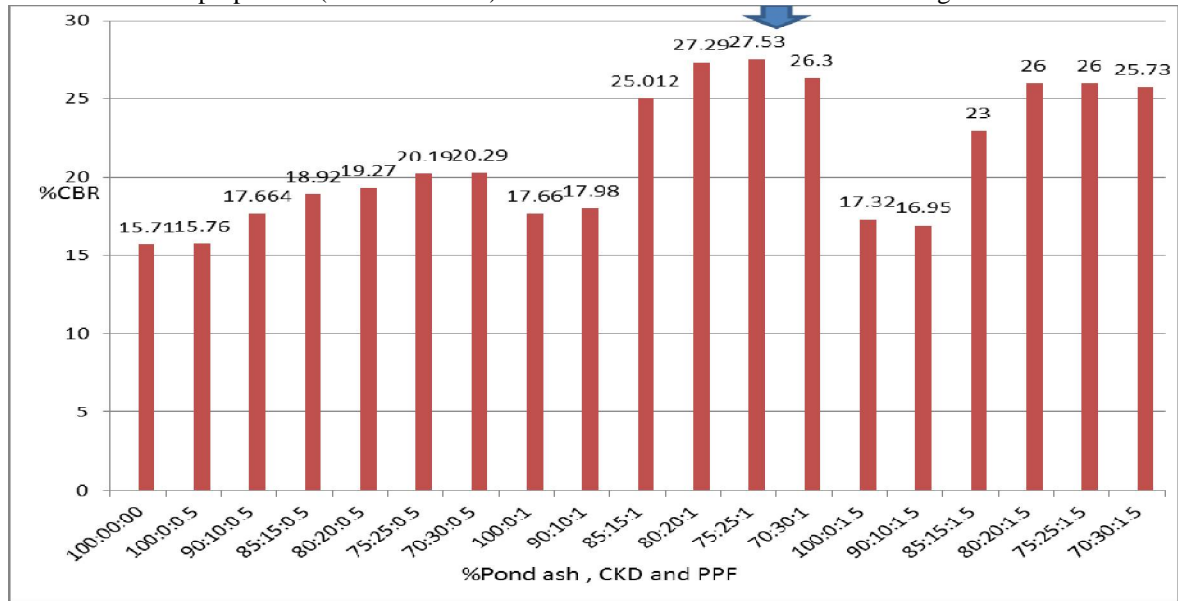
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### 3.3. California Bearing Ratio (IS: 2720, Part-16)

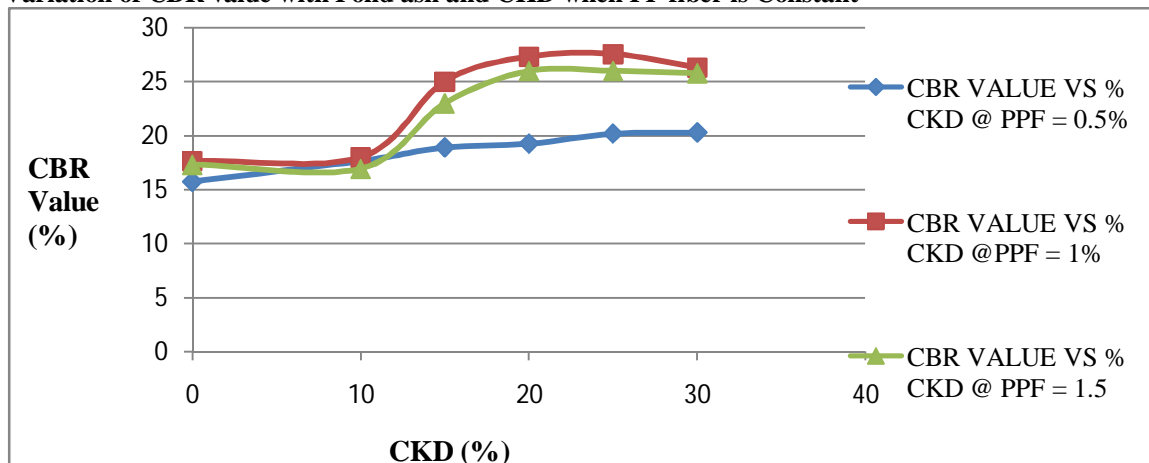
CBR value for various proportion (PA: CKD: PPF) at unsoaked condition are discussed in fig.3.



**Fig.3 CBR value for various percentages of pond ash, CKD and PP fibers**

Graph shows that CBR value for pure pond ash is 15.71% with addition of CKD and Polypropylene Fiber, CBR value increases upto 27.53%. This is because CKD has pozzolanic properties which impart strength to the mixture and PP fiber reinforced the mixture which helps to increase CBR value. Graph shows that the maximum CBR value attains for mix i.e. 75% of pond ash and 25% of CKD with 1% of PP fiber.

#### 3.3.1 Variation of CBR value with Pond ash and CKD when PP fiber is Constant



**Fig.4 Variation of CBR value with Pond ash and CKD @ PP fiber is 0.5%, 1% and 1.5%**

From Fig.4 , it is observed that addition of CKD and fiber in pond ash increases CBR value to certain limit and further addition it start decreases. The maximum CBR values attain for mix 75% of pond ash and 25% of CKD with 1% of PP fiber. Therefore, Optimum mix percentage is (PA: CKD: PPF =75:25:1).

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## IV. CONCLUSIONS

- Maximum dry density of pure pond ash is 14.55kN/m<sup>3</sup>, with addition of cement kiln dust up to 30 % with increment dry density increases up to 15.88kN/m<sup>3</sup>. Therefore, this shows that cement kiln dust has pozzolanic properties which increased the density of composition.
- The optimum mix is found to be 75:25 (% of pond ash: CKD) on the basis of Compaction test. The optimum mix is the proportion at which the composition gives satisfactory results.
- CBR value is maximum in all i.e. 27.53% for optimum mix (75:25:1), whereas CBR value of pure pond ash is 15.71%. Which shows that 75% of increment.
- The permeability of pure pond ash is  $8.66 \times 10^{-3}$  cm/s, with addition of cement kiln dust up to 20% with increment of 5% permeability of pond ash slightly decreases to  $5.48 \times 10^{-3}$  cm/s.

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