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ACTIVATION OF FLY ASH USING STRONG ALKALI

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ABSTRACT: Majority of thermal plants in our country are coal based. 55% of the power generated in India is from coal-based thermal power plants and in these plants, bituminous coal is burnt and the coal ash percentage of which is in almost 40%. The operating conditions and type of coal they burn governs quantity and quality of fly ash generated. Fly ash production in India was more than 226.13 million tons for the year 2019-20, as per report and the land occupied by ash ponds is near to 65000 acres. Fly ash particles are light weight and has a tendency to get suspended in the air. They can enter respiratory system and has a potential to damage life. They can mix with water and make the water toxic as they contain toxic elements and compounds. Hence a tactful disposal strategy is the required.

Keywords: Activation, Fly ash, Alkali, Coal, UCS, Permeability

I. INTRODUCTION

55% of power generated in India is generated from coal-based thermal plants. These plants use bituminous coal for generation of heat and they produce fly ash as residue. This fly ash is light weight and gets suspended in air very easily. The disposal of fly ash is very difficult. Utilization is one way of disposal. In 2004-05, 42 million tons of fly ash was utilized out of total 112 million tons produced. In the year 2019-20, the utilization of fly ash was only 187.81 million tons out of the total production of 226.13 million tons. Stabilization of soil by using fly ash is being explored extensively and is showing positive results. Effect of different concentration of alkalis with different curing period, used to activate fly ash has shown to increase MDD and decrease OMC. The strength parameters of alkali activated fly ash are being explored too.

II. METHODOLOGY

Fly ash for the study was taken from Birsinghpur Thermal Plant. Specific gravity as determined by 2720: Part 3 was found to be 1.74. NaOH was purchased from local market and was of reasonable purity. Fly ash was sieved through 1 mm sieve. The fly ash was then oven dried at the temperature of 105-110 °C and then sieved through 425 µm sieve. Fly ash was activated by adding 0%, 2%, 4% and 6% of alkali by weight to the fly ash. MDD and OMC was determined. After that UCS was carried out at varying concentration and varying curing period. Permeability and pH were determined.

III. RESULTS AND DISCUSSION

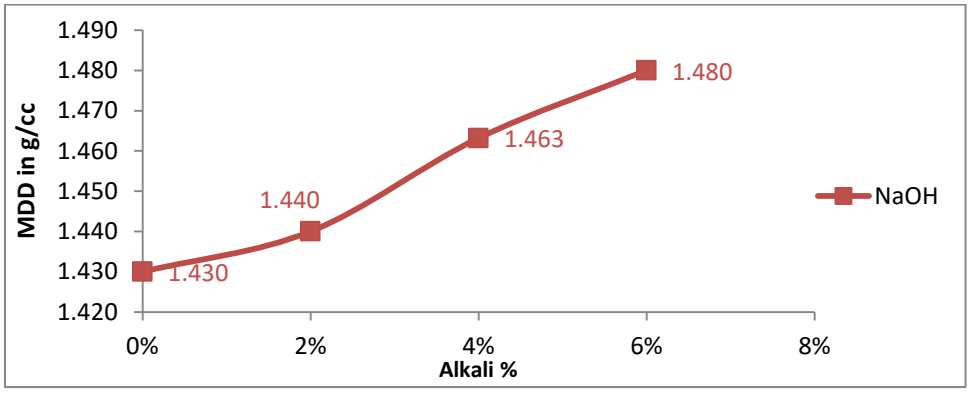

Figure 1: Variation of MDD (g/cc) with alkali content for two types of alkalis.

From Figure 1 we get that the MDD values increases for alkali activated fly ash as we increase the concentration of alkali.

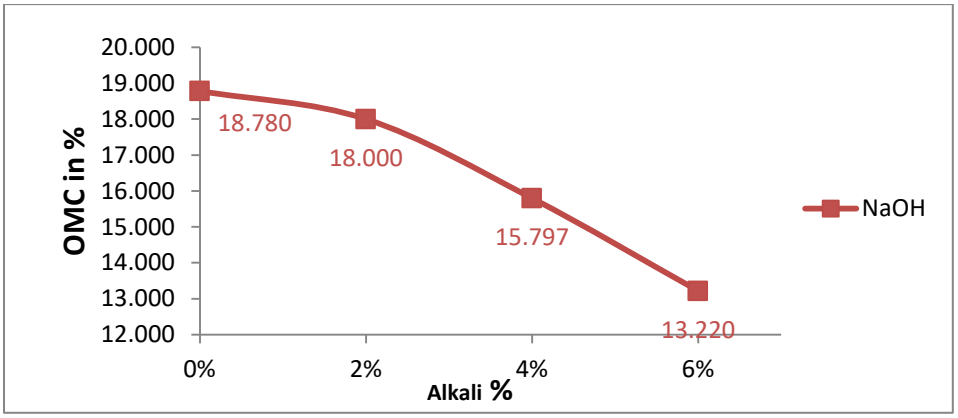

Figure 2: Variation of OMC (in %) with alkali content for two types of alkalis.

From Figure 2 it is clear that the OMC content decreases as we increase concentration of alkali.

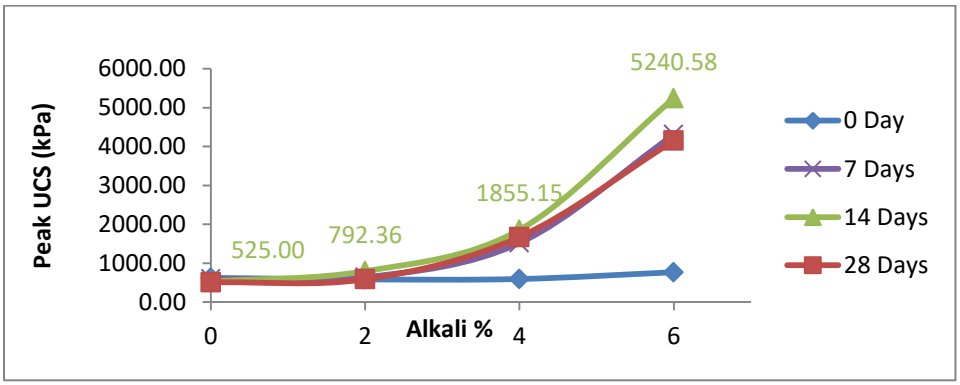

Figure 3: Variation of Peak UCS values with different NaOH content.

Figure 3 shows the trend for strength of NaOH activated fly ash. The graph suggests that the maximum strength for activated fly ash was achieved at 14 Days of curing. Maximum value is 5240.58 kPa, achieved after 14 days curing and at 6% alkali concentration.

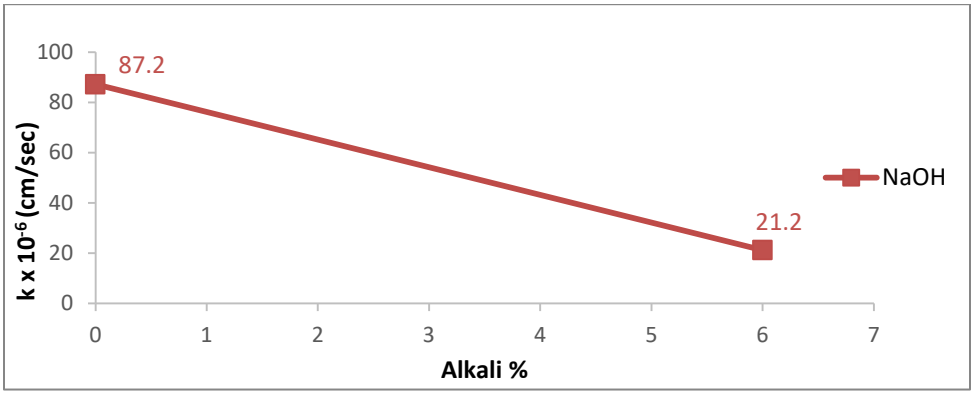

Figure 4: Co-efficient of permeability variation.

Figure 4 shows the change in permeability values for pure fly ash and alkali activated fly ash. The results shows that the k value for pure fly ash is 87.2 x 10^{-6} cm/sec. The value of coefficient of permeability for alkali activated with 6% NaOH is 21.2 x 10^{-6} cm/sec. The k value decreases and becomes almost ¼ of the value of pure fly ash.

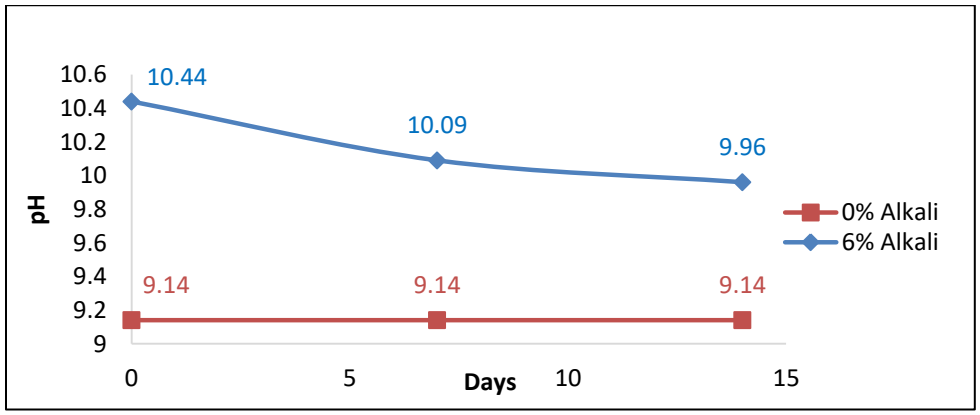

Figure 5: Variation of pH values with different NaOH content at different curing period.

Figure 5 shows pH value of activated alkali at 0% and 6% concentration, cured at 0, 7 and 14 days. The pH values decreases as curing days increases.

IV. CONCLUSION

From the study we can infer that maximum dry density increases and optimum moisture content decreases for alkali activated fly ash. Furthermore, it can be seen that the alkali activated fly ash shows greater strength than that of pure fly ash and the peak strength is achieved after 14 days curing and 6% alkali concentration. The permeability of alkali activated fly ash is around ¼ of permeability value for pure fly ash. The alkalinity decreases with passage of time. In a nutshell it can be said that alkali transforms fly ash into a material which can have geotechnical use and consequently it will increase the utilization of fly ash.

V. REFERENCES

1. U. S. Energy Information Administration, India's Central Electricity Authority.

2. Dhadse et al. (2008) "Fly ash characterization and Government initiatives in India-A review" Journal of Scientific & Industrial Research, Vol 67, January 2008, pp. 11-18.

3. Report on Fly ash generation at coal / lignite based thermal power stations and its utilization in the country for the year 2019-20 by Ministry of Power.

4. Ahmad et al. (2015) "Stabilization of Low Shear Strength Soil by using Fly Ash" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 12, Issue 4 Ver. VI (Jul. - Aug. 2015), pp. 33-36.

5. Chowdhury et al. (2015) "An Experimental Investigation on Strength Characteristics of Alkali Activated Fly Ash". Procedia Earth and Planetary Science 11 (2015) pp. 402 – 409.

6. Chowdhury et al. (2015) "Alkali Activated Fly Ash: A New Generation Geo-material" 5th Young Indian Geotechnical Engineer Conference Mar 14-15, 2015, India.
7. F. Santos, L. Li, Y. Li and F. Amini (2011) "Geotechnical properties of Fly Ash and Soil mixtures for use in Highway Embankment".
8. S.P. Singh and A. Pani (2014) "Evaluation of Lime Stabilized Fly Ash as A Highway Material". International Journal of Environmental Research and Development. ISSN 2249-3131 Volume 4, Number 4 (2014), pp. 281-286.
9. A. Dixit and R.K. Srivastava (2015) "An Estimate of Contaminated Land Area due to Industrial Hazardous Waste Generation in India" International Journal of Advanced Research in Education & Technology 2016, vol.2 issue 3, pp. 117-125.
10. S.P. Singh, S. Chowdhury and P.N. Mishra (2015) "An Experimental Investigation on Strength Characteristics of Alkali Activated Fly Ash". Procedia Earth and Planetary Science 11 (2015) pp. 402 – 409.