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Study the Behaviour of Fly Ash Mixed with Polymer

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Abstract: ***Commercial leftover like fly-ash which is creating environmental problems, is mainly used as a building material due to its low cost and easy availability. But the main disadvantage of these bricks is its low strength. So, a lot of research is going on to increase the strength of these bricks. The present research work is carried out to develop a new systematic procedure to produce fly ash composite bricks which will have higher compressive strength. Here the fly-ash is mixed with Cold setting resin at different proportions and water treated at different temperatures to find out a solution to the brick industry. The compressive strength, Hardness, water absorption, Density and thermal conductivity of the fly ash-resin powder bricks obtained under optimum test conditions are 12 MPa, 47.37HV, 19.09% 1.68 g/cm3, and 0.055 W/mK respectively. The sliding wear behaviour is also investigated. The structure-property correlation of these composites are studied using X-ray diffraction, FTIR analysis and scanning electron microscopy.***

Keywords**:** ***Fly ash, Physical Properties of Flyash, Resign, FTIR analysis, XRD analysis***

I. INTRODUCTION

The entire development of a country depends on the production value of power and consequently its consumption as energy. Our country, India needs huge power resources to meet the expectation of its occupant as well as its aim to be a developed nation by 2020. Fossil fuel plays an important part in meeting the demand for power generation .Coal is considered to be one of the world's richest and widely distributed fossil fuel. Around the world, India dominates the third position in the largest production of coal and has the fourth largest coal reserves approx. (197 Billion Tons). It has been estimated that 75% of India's total installed power is thermal of which the share of coal is about 90%. Nearly about 600 Million tons of coal is produced worldwide every year, with Fly ash generation is about 500 MT at (60-78 %) of whole ash produced [1, 2].In India, the current generation of FA is nearly about 180 MT/year and is probable to increase about 320 MT/year by 2017 and 1000MT/year by 2032 [3] .No doubt Indian coal has high ash content and low heat value. In order to meet the increasing challenging demands, many coal based thermal power plants have been constructed. As a result of which huge amount of combusted residue in the form of Fly ash (80 %), and Bottom ash (20%) has been produced. The finely dispersed particle from the burnt coal is discharged out through the flue gases which are detached mechanically through electrostatic precipitators and separators which are then collected together in the field of hoppers. The rate of production of FA is high and it goes on increasing year after year. The annual production of FA in China, India and US is approximated about 275 million metric tons. But less than half of this is consumed in various areas. The greatest challenge before the processing and manufacturing industries is the disposal of the residual waste products. The harmful impact on the surroundings suggests the necessity for appropriate dumping of fly ash and justifies full utilization of FA when feasible. Waste products that are generally toxic, ignitable, corrosive or reactive have detrimental environment consequences. This major issue requires an effective, economic and eco- friendly method to tackle with the disposal of the residual industrial waste products. The problem with safe disposal of ash without affecting the environment, disturbing ecological balance and the large storage area required are major issues and challenges for safe and sustainable development of the country. Hence needful efforts are being made continuously by making stringent regulations by the government to fully utilize the ash. Currently only 50% of the fly ash is being profitably utilized in India [4]. The most common and feasible ways to utilize these industrial wastes products is to go for construction of roads, highways and embankments. The Problem with environmental 3 | P a g e pollution can be greatly reduced if these wastes products be effectively utilized in construction of roads, highways and embankments. But sufficient amount of soil of desired quality is not available easily. So these industrial wastes not only used as an alternate for natural soils in the construction rather it also solve the problems of disposal and environment pollution.

This will provide a number of significant benefits to the constructing industry as well as to the country as a whole by conservation of natural resources, by reduction of volume of waste to landfills, by lowering the cost of construction materials, and by lowering waste disposal costs. With the help of some suitable stabilizer like lime, thermosetting resins or cement, the properties of fly ash can be increased and it can be further used as a construction material. FA shows self -hardening behaviour that is why it is used in construction broadly.

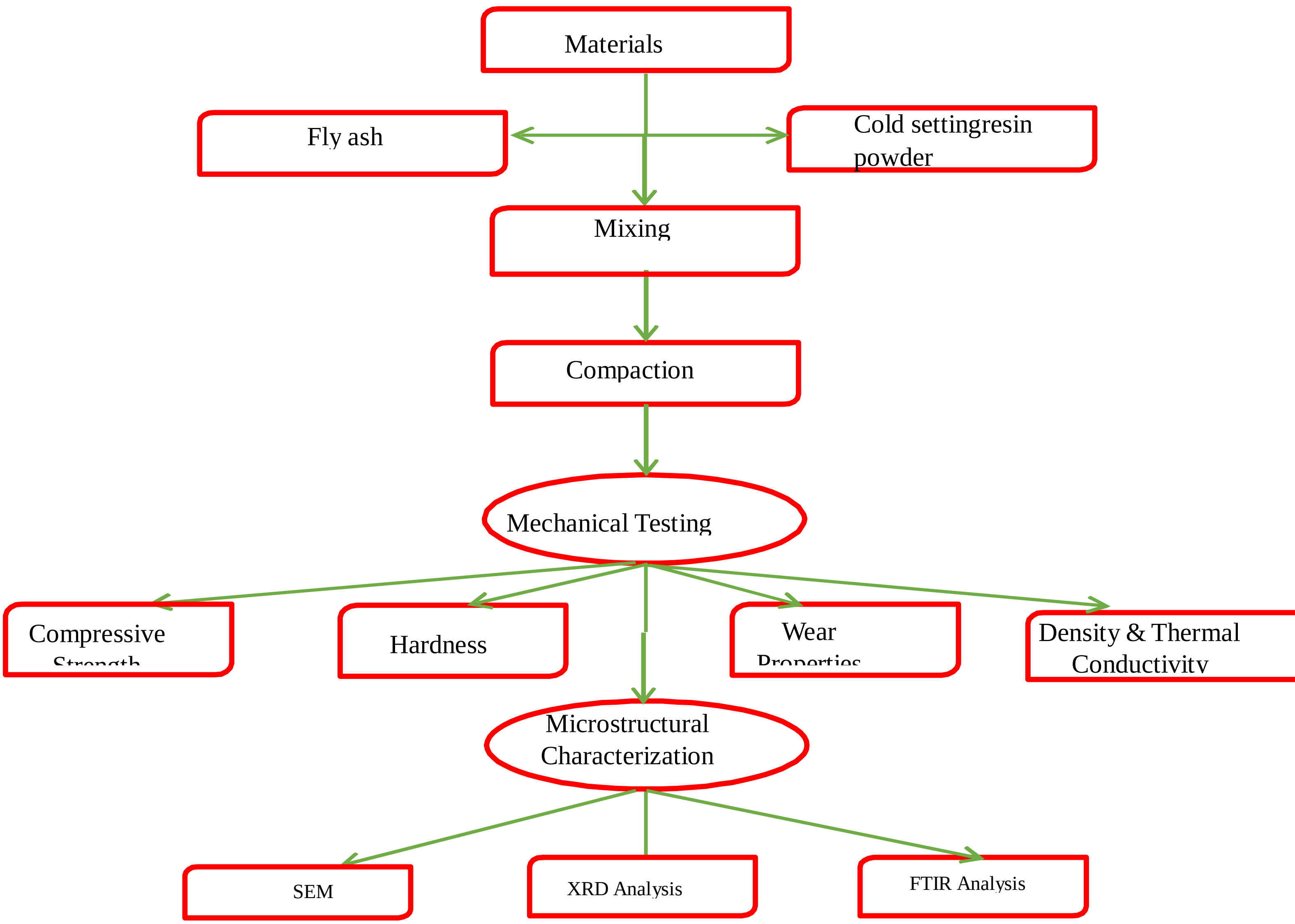
II. PROBLEM STATEMENT

1) Commercial leftover like fly-ash which is creating environmental problems, is mainly used as a building material due to its low cost and easy availability.
2) But the main disadvantage of these bricks is its low strength. So, a lot of research is going on to increase the strength of these bricks.
3) The present research work is carried out to develop a new systematic procedure to produce fly ash composite bricks which will have higher compressive strength.
4) Here the fly-ash is mixed with Cold setting resin at different proportions and water treated at different temperatures to find out a solution to the brick industry.

III. OBJECTIVE OF THE PRESENT WORK

The aim of the present work is to fabricate Fly ash polymer composite at different proportions of polymer and to study physico mechanical, thermal conductivity and wear behavior. In present project an attempt was made to increase the density and hardness of the water cured cylindrical samples. SEM, XRD and FTIR analysis were also done to investigate the microstructural changes,

IV. ARCHITECTURE OF WORK



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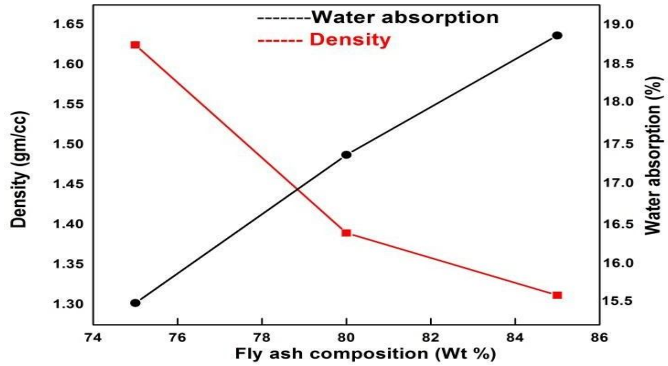
V. RESULT AND DISCUSSION

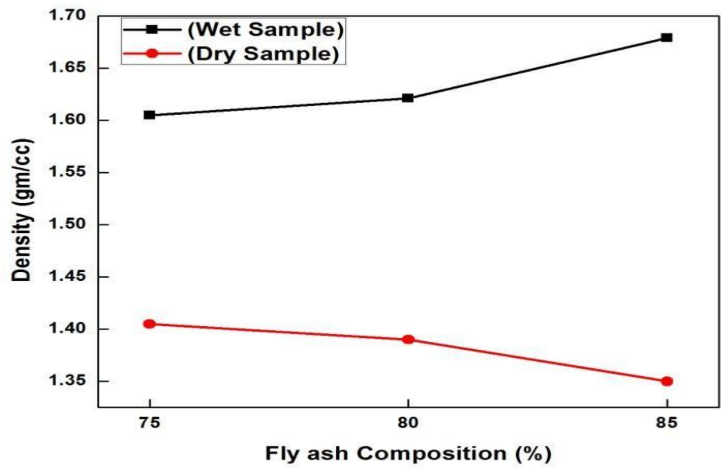
A. Water Absorption Test

It is evident from the graph that the water absorption increases with increase in FA content. 85wt. % FA absorbs water to a maximum of 19.09%. This indicates that that most of the openings of the compacts are open to outside.



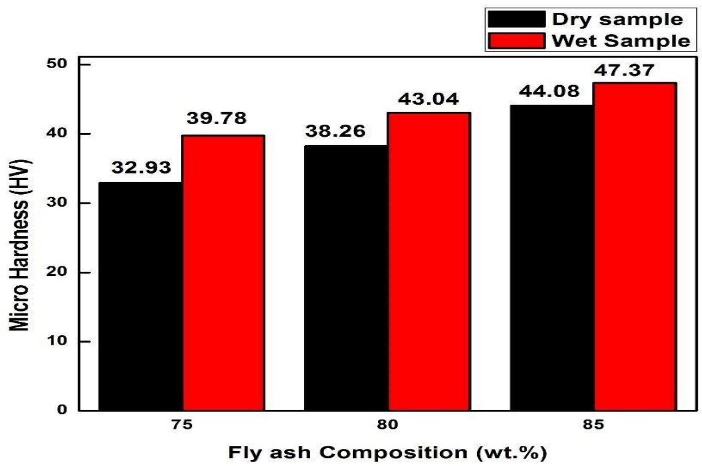
B. Density Measurement

Density of the samples was calculated before and after treatment. From Fig. 4.2 we can say that density of dry compacts decreases with increase in weight percentage of FA. As the dry compacts are immersed in water at 110^{0}C -180^{0}C, then through capillary action voids are filled and it becomes hard and the porosity is eliminated. As a result of which the compacts become dense and finally the density increases with increase in FA content.



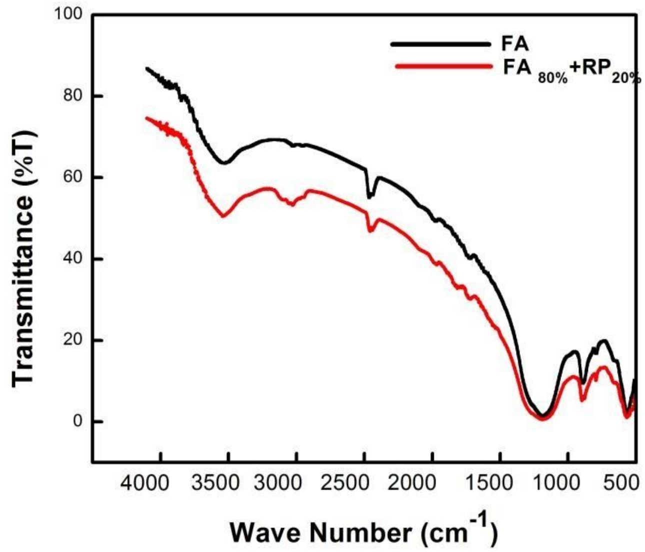
C. Hardness Measurement

The values of hardness are in the range of 32.93 HV – 44.08 HV for dry composites and 39.78 HV – 47.37 HV for wet FA composites respectively.



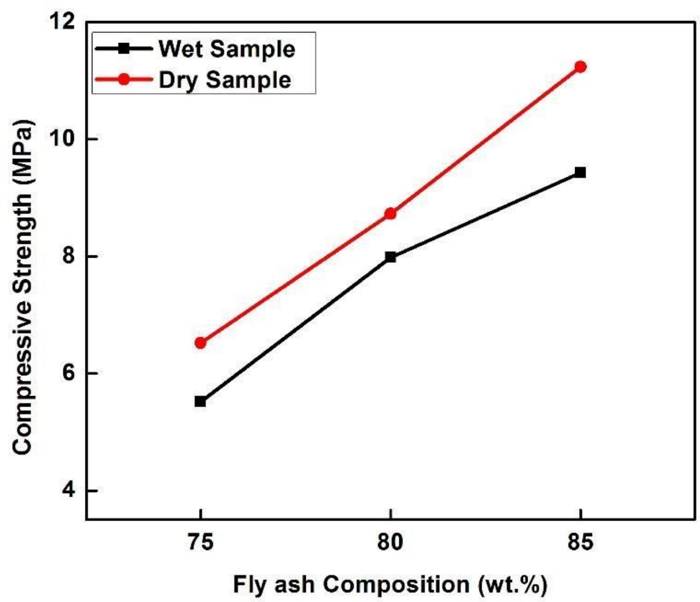
D. FTIR Analysis

Fourier transforms infrared radiation (FTIR) spectrometer plot of 100 % FA along with 80% FA + 20 % RP mix . It can be seen that for 80 % FA mix the (%) transmittance is getting decreased with respect to 100% FA .With comparison of FTIR spectrum phase transformation of FA and FA mix can be recognized.



E. Determination Of Compressive Strength

The Compressive strength value lies in the range of 6.5 to 11.28 MPa. 85 wt. % FA compositions have got the highest strength value while the lowest strength value of 6.5 MPa was gained by 75 wt. % FA composition.



VI. CONCLUSION

1) Water tested compacts shows positive effects on the hardness values. Out of all dry compacts, FA with 85 wt. % possesses a higher hardness value of 44.08 HV. Much improvement in the hardness value is achieved when the composites are treated in water at 110^0- 180^0C and this value rose to 47.37 HV. This increment in hardness value is due to the presence of CSH and CASH in the presence of moisture as obtained from XRD analysis.
2) With an increase in polymer addition (resin powder), the compressive strength of dry compacts decreases to a lower value of 6.5 MPa. Composition of 75 wt. % FA shows lower value. No significant reduction in Compressive strength is achieved in the case of wet compact.

3) Water absorption increases with increase in FA content. Maximum of 19% water is absorbed in case of 85 wt. % FA.
4) Density of dry compacts decreases with increase in FA content. While in case of wet compacts, it increases with increase in FA content.

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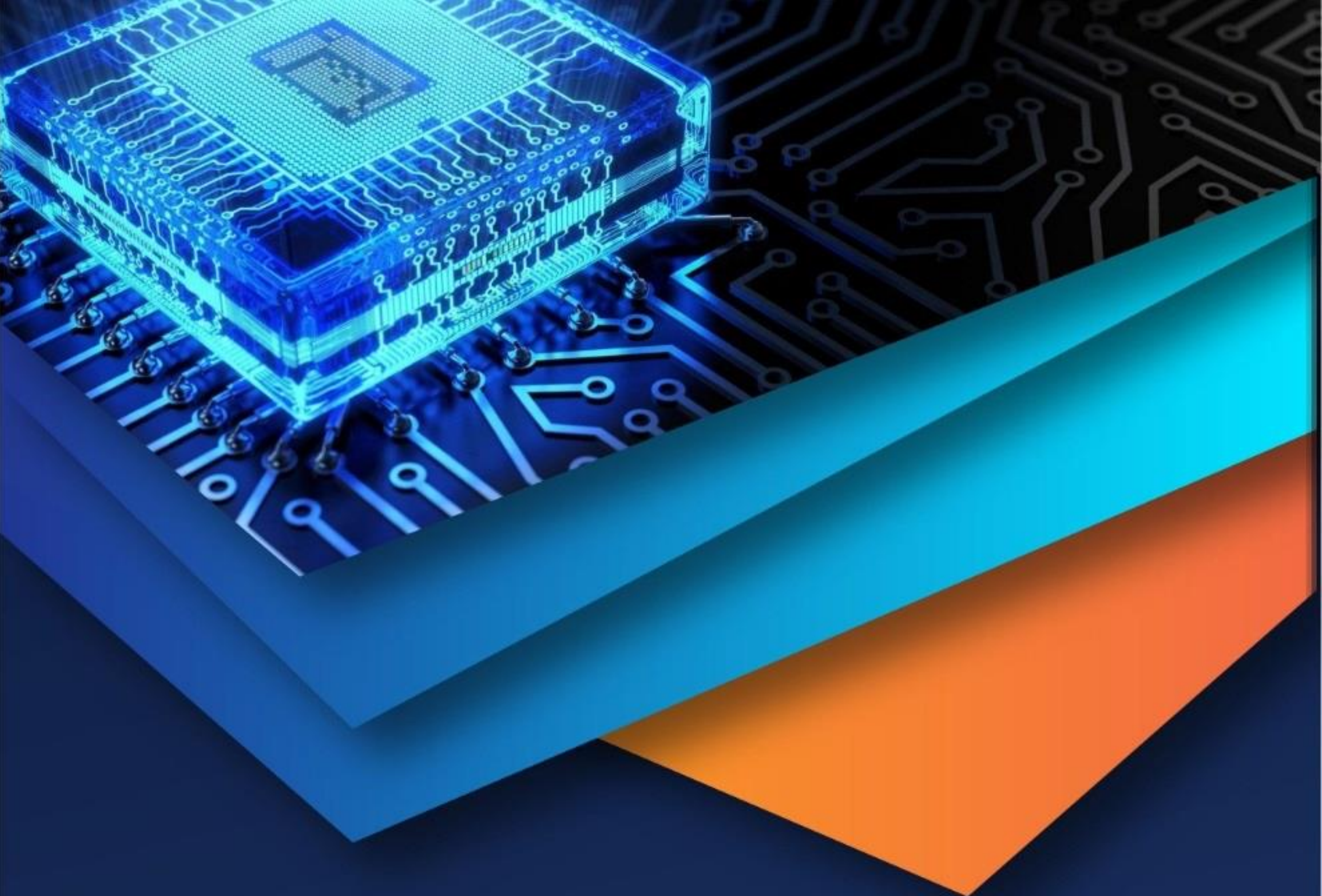

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