



RESEARCH PAPER PRESENTED IN ENGINEERING COLLEGE AS A PART OF NATIONAL CONFERENCE ON THE ROLL OF EDUCATION IN SUSTAINABLE DEVELOPMENT IN INDIA.

*RECLAIMING UNBURNT COAL FROM FLY ASH AND BOTTOM ASH IN COAL
BASED THERMAL POWER PLANT. – A REVIEW PAPER.*

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ABSTRACT

This topic is about an analysis of unburnt carbon may present in a fly ash and/or bottom ash. Here, work has done on the ash by tribo charging method and froth flotation process which are mentioned in this paper. The loss of coal particles are in powder form or in pallets at bottom of the boiler. In flyash, coal particles may present in the form of powder. So, It is a try that whether it is achievable or not.

KEY WORDS: unburnt coal particles, energy efficiency, tribo charging, power- plant.

[1] INTRODUCTION

As we know that the coal based Thermal power plants are mostly used for power generation in India. The coal based thermal power plants are working on the Rankin cycle. According to the Rankin cycle, it is consisting main four different components which are boiler or evaporator, steam turbine, condenser and pump. The schematic diagram of basic steam power plant is shown in Fig (1) and T-S diagram of Rankin cycle is shown in Fig (2)^[1].

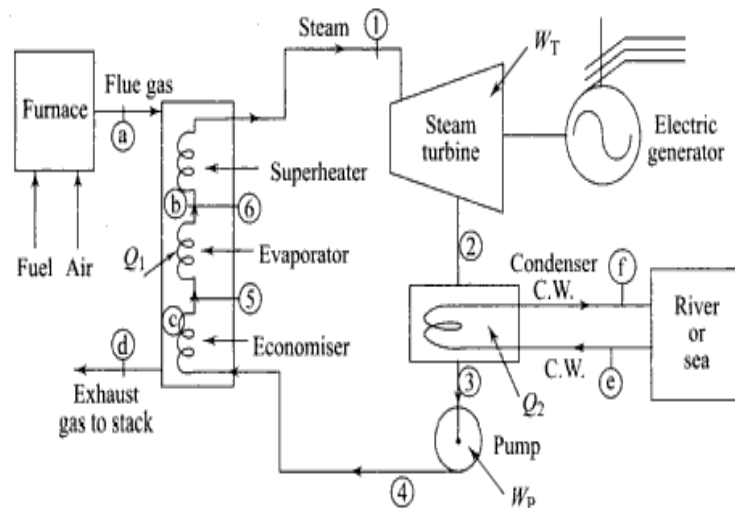


Fig. (1) basic steam power plant^[1].

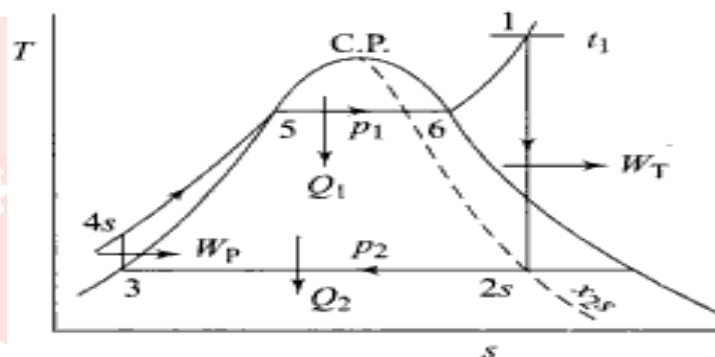


Fig. (2) T-S diagram of Rankin cycle^[1].

Most of thermal power plants use AFBC (Atmospheric Fluidised Bed Combustion) Boiler. The boiler boils the water by burning of coal and converts the liquid water into the superheated steam. This superheated steam supplied to the steam turbine for mechanical work. And by using generator we can convert mechanical work into the electricity. The cycle will be continuing by following condenser and pump.

[2] IDENTIFICATION OF PROBLEM

In many thermal power plants there are losses of coal particles occur during combustion process. These coal particles are known as unburnt coal. The majority of unburnt coal remains in the bottom ash. Carbon loss is one of the considerable elements.

Normally an unburnt coal in bottom ash, in pulverized fuel firing are higher sized particle and of higher specific gravity having the unburnt macerals like fusinite embedded in mineral matter and the low melting constituents encapsulating the reactive macerals. The normal types of unburnt are inlet macerals, cenospheres and carbonaceous clay [2].

Unburnt carbon may be recovered via physical method such as tribo-charging method or by chemical means like acid digestion.

[3] UNBURNT COAL RECOVERS BY TRIBO-CHARGING PROCESS.

Tribo charging or electrostatic separation based on static electricity phenomenon. This states that it is an imbalance of electric charges within or on the surface of a material [3].

Tribo-charging (electrostatic separation) involves charging of particles by contact or friction with other particles or with a third material, usually the walls of a container or pipe, followed by transport or free fall through an electric field that deflects the particles according to the magnitude and sign of their charge. When two dissimilar particles are in contact or rub against each other, there is a transfer of electrons from the surface of one particle to the other until the energy of electrons in each material at the interface is equalized.

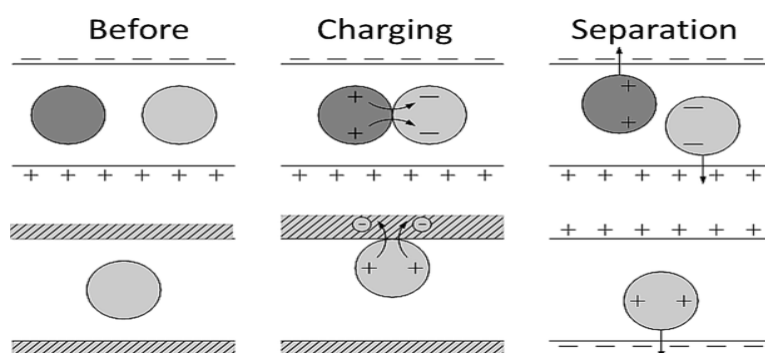


Fig. (3) Basic process of particle charging or rubbing [4].

The basic process of charging/rubbing of particles is shown in above Fig. (3)^[4]. A collected mixture of fly ash and bottom ash or simply bottom ash or fly ash can be enter from inlet of the apparatus of tribo-charging.

Before the vibration process, the heating process will be done for removing moisture content from the mixture or individual ash. The temperature required is in range of 96⁰C to 100⁰C ^[5]. After heating process, the mixture of ash or individual ash will come inside the vibrator. And after vibration feed the charged particles of ash will be gathered in charge collector. The charge collector will supply these particles between two high voltage plates. The voltage supply in a range of 10 V to 20V^[5].

Unburnt coal particles will have a positive charge on it. And other particles will have a negative charge on it. Positively charged coal particles will be attracted by the negatively charged plate. And other particles will be attracted by a positively charged plate. By happening of this, the particles will be gathered in particle collector.

The collected coal particles and their charge on it will examine by the Electrometer. Gathered unburnt coal particles can be used as refuel in the boiler by directly feed to the boiler. The procedure of tribo charging and its arrangement is shown in Fig.(4)^[6].

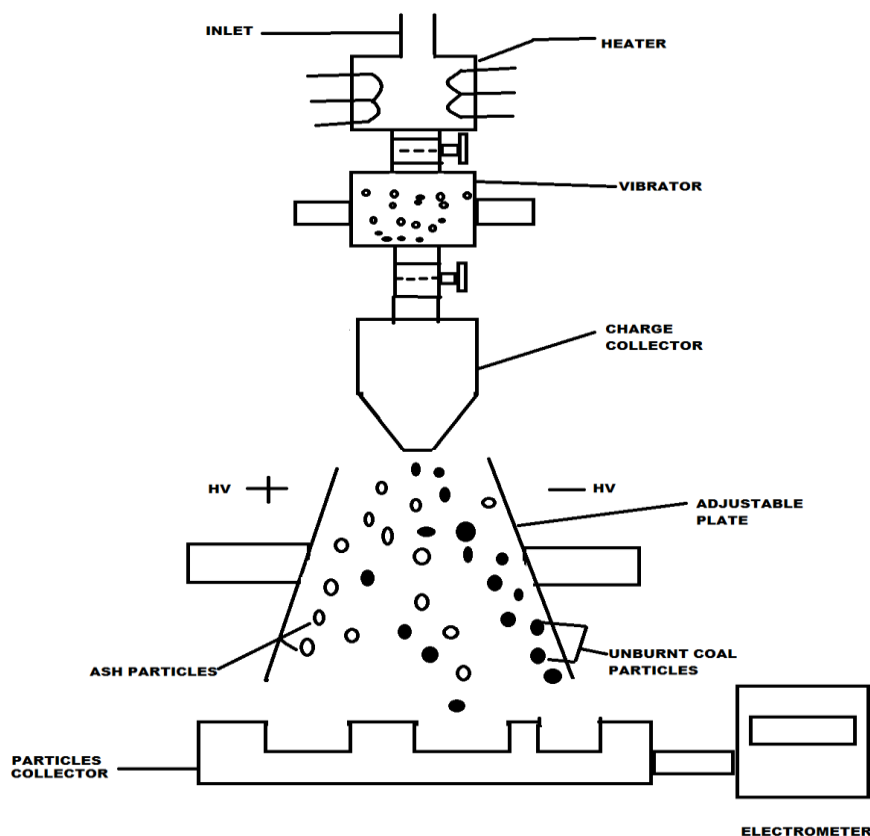


Fig.(4) process of tribo charging and arrangement^[6].

[4] UNBURNT COAL RECOVERS BY FROTH FLOTATION.

According to Indian coals, it contains high percentage of ash, as much as 40% and above, the power plants produce about 150Mtons of fly ash per annum^[7]. The carbon amount in fly ash needs to be reduced, the disposal of fly ash containing appreciable amount of unburnt carbon is posing serious problems causing environmental damages^[7].

Froth flotation is a process for selectively hydrophobic materials from hydrophilic. In froth flotation, fatty acids and oils were used as flotation reagents it can be used for separating coal particles from ash forming minerals^[8]. The mixture of reagents and fly ash act as a slurry, which is supplied to the chamber. Then after air supplying and churning process have done. During this process the hydrophobic particles being gathered on the surface of rotating slurry.

The remaining particles contain slurry will follow the path which called tail path. The collected coal particles in form of froth (foam). Then removing the moisture contain from it. And by this coal particles will be gathering and resupplying to the boiler furnaces. The diagrams of froth flotation process have shown as Fig.(5(a))^[9] & Fig.(5(b))^[9].

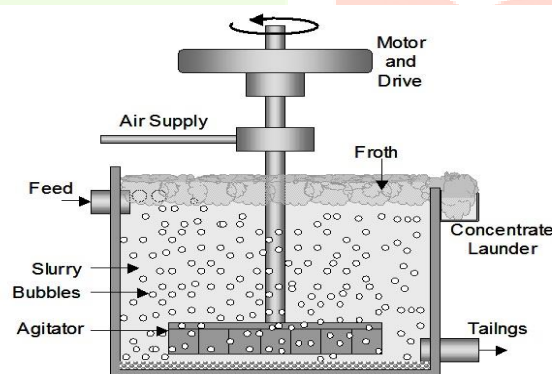


Fig. (5(a)) Diagram of Froth flotation process^[9].

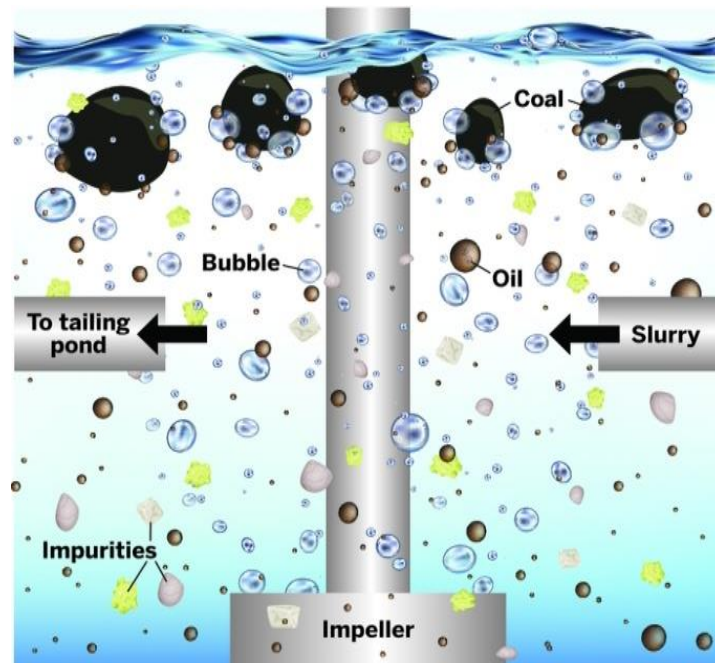


Fig.(5(b)) Coal particles floating on the surface^[9].

[5] CONCLUSION.

- According to both methods unburnt coal particles can be achieved. Froth flotation process is highly effective and efficient. But tribo charging process is convenient for industry due to less equipment cost compared to froth flotation process.
- Coal particle size should be in a range of 3mm to 6mm. If the sizes of coal particles are quite big, then it has higher chances to escape the combustion region because of mass, and a velocity of feeding coal particles. And it can be detected by one of these processes.

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