PERFORMANCE ANALYSIS OF ELECTROSTATIC PRECIPITATORS(ESP) IN THERMAL POWER PLANTS

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Abstract -Electrostatic precipitators are used in thermal power plants. Generally Indian coal is not of a superior grade i.e. having low calorific value and high ash content. In India, max thermal power plants are used for controlling fly ash from ESP. in the present thesis various attempts have been made to analyze the cause of problems in terms of chemical constituents of ash, resistivity, conductivity etc. a special emphasis was given to corelate the different forms of Sulphur and mercury emissions on ESP performance. Also, we will discuss some methods which are being applied in thermal power plants to improve the collection efficiency of ESPs

1. INTRODUCTION

The world thermal power plants, in addition emitting greenhouse gases, are a major source of local pollution and health damages. This is especially true of coal fired plants, which generate 41% of the world's electricity. The regulation of power plant emission raises several policy questions.

The first is which pollutants should be targeted and how stringently they should be regulated. In the US, regulation has focused on Sulphur dioxide (SO2) to control fine particles and on nitrogen oxides (NOx) to control fine particles and reduce ground level ozone.

Burning coal to produce electricity releases PM, SO2, NOx and Hg. If the emission trends of thermal power plants remain unchanged, projections estimate that these pollutants will cause an estimated 1.3 million deaths in India per year by 2050 (Health Effects Institute, 2018).

To address the issue, the central government set emissions standards in 2015 for all four pollutants (Ministry of Environment Forest and Climate Change, 2015). The permitted emissions levels varied with the age of the generation unit: older units were allowed higher emissions than more modern ones.

Compliance requires a retrofitting or upgrading of pollution-control equipment.

1.1 Aims and Objectives

In overall, we will discuss some methods to **improve the collection efficiencies of ESPs.**

2. DESIGN PARAMETERS

Resistivity

Resistivity, a characteristic of particles in an electrical field, is a measure of a particles resistance to transferring charge. Electric resistance may be a operate of a particle's chemical composition as flue gas operational conditions like temperature and wetness. Particles will have high, moderate or low electric resistance

ESPs work best beneath traditional electric resistance conditions. Particles with traditional electric resistance don't speedily lose their charge on arrival at the gathering conductor. These particles slowly leak their charge to grounded plates and are preserved on the gathering plates by building block adhesive and cohesive forces. This permits a particulate layer to be designed up and so dislodged from the plates by rapping. Inside the vary of traditional mud electric resistance (between 107 and a pair of x 1010 ohm-cm), ash is collected additional simply than mud having either low or high electric resistance.

High electric resistance will typically be reduced by doing the following:

- Adjusting the temperature
- Increasing wetness content
- Adding learning agents to the gas stream
- Increasing the gathering expanse.

For most dusts, electric resistance can decrease because the flue gas temperature will increase,.

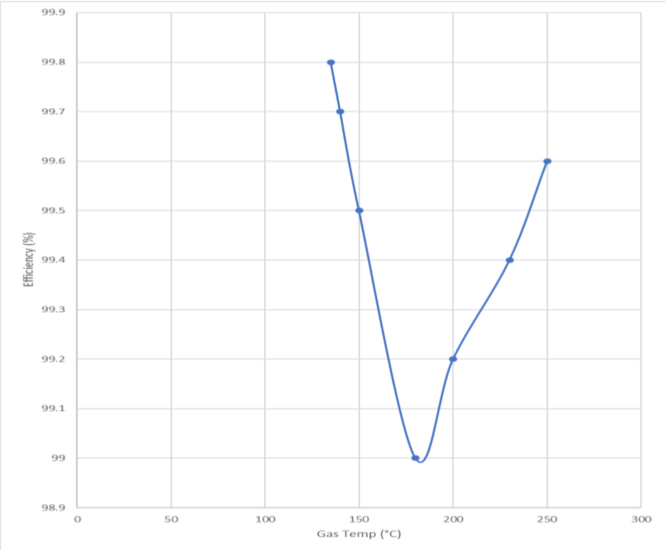
The moisture content of the flue gas stream also affects particle resistivity. Increasing the moisture content of the gas streams by spraying water or injecting steam into duct work preceding the ESP lowers the resistivity. As the percentage of moisture increases from 1% to 20%, the resistivity of the dust decreases.

PARTICLE DIAMETER, APPLIED VOLTAGE and INLET VELOCITY

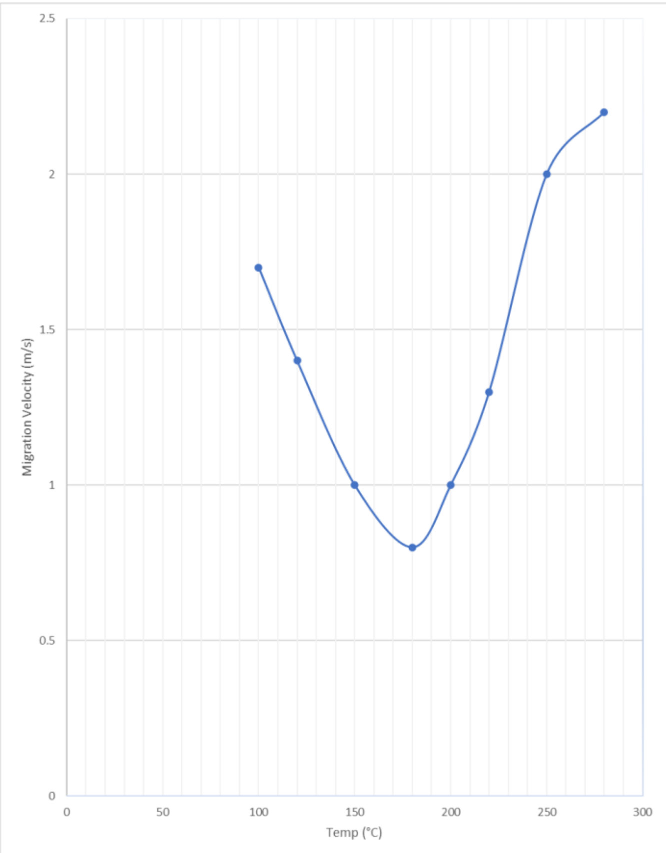
The influence of basic operating parameters including particle diameter, air velocity and electric potential on efficiency of ESPs was studied. The results showed that with increasing the particle diameter and applied voltage, the precipitator efficiency increases, and increase of inlet velocity reduces the efficiency of ESPs.

3. EXPERIMENT RESULTS

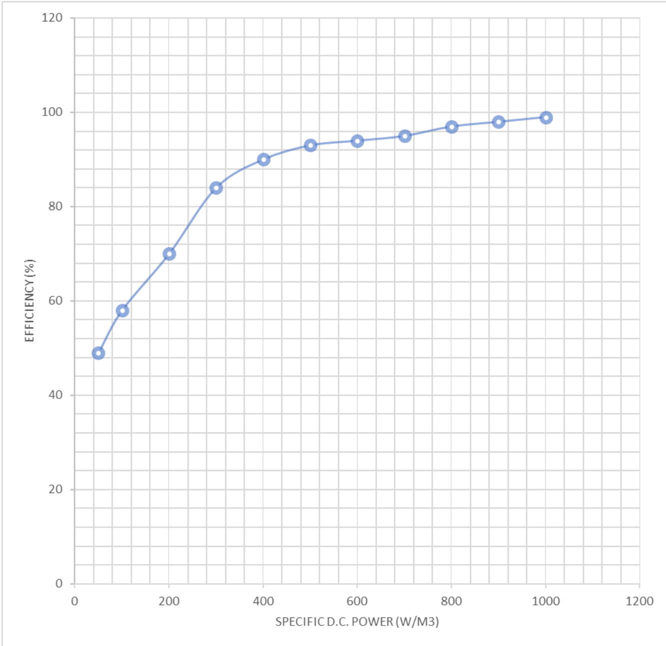
3.1 Effect of gas temperature on ESP efficiency:



3.2 Effect of temperature on migration velocity



3.3 Specific power absorption on ESP efficiency:



CONCLUSIONS

The overall collection efficiencies for particulate have been improved on adopting following steps:

1. Plugging of leakage in the boiler/ESP System up to the stack. This will minimize infiltration as well as make ID Fans operation suitable to create adequate suction in the furnace.
2. Operating the boiler at stable load with minimum fluctuation.
3. Increasing current level of collecting electrodes of ESPs with lower current in initial fields and higher current in final fields.
4. Increasing the height from 7.5 to 8.5 m, which increased the collection area by about 13 percent and reduce the emissions by about 22 percent.
5. Sodium Conditioning of flue before feeding to boiler. While there is limited reduction in emission level due to water fogging, quite appreciable reduction in observed in emission levels due to intermitted charging of the fields in ESP.
6. At around temperature near 130 degree C and 250 degree C, ESP works in best efficiency.

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