DESIGN AND FABRICATION OF ELECTRO STATIC PRECIPITATON IN AUTOMOBILE

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ABSTRACT:

An ESP uses a high voltage electrostatic field to separate dust, fume or mist from a gas stream.The precipitator consists of vertical parallel plates (collecting plates/electodes) forming gas passages 12 to 16 in.(30.5 to 40.5cm) apart. Discharge electrodes are electrically isolated from the plates and suspended in rows between the gas passages.

Every particle either has or can be given a charge positive or negative.A high voltage system provides power to the discharge electrode to generate an electrical field. The particulate is then attracted to the grounded collector plate,and forms a dust layer on the plate

KEYWORDS: Electrostatic Precipitation, Process Optimisation, Particle Size Distribution, Software

INTRODUCTION:

Many industrial, power generation and chemical processes produce unwanted fine particulate material as a consequence of their operation. Electrostatic precipitation (ESP) is a highly efficient method of removing entrained particulate contaminants from exhaust gases and is extensively used in these industries to limit particulate emissions. In view of this, information on construction, working, design, erection, commissioning, operation and maintenance of electrostatic precipitators; and emission standards is given in this booklet.

Project and operation parameters have a big influence on the performance of a precipitator. Although a great deal of research has been done on the influence of these parameters, contradictory are often reported. The shape of the precipitator has

Considerable influence on its performance. Many researchers (e.g. Leonard et al., 1980; Petersen, 1981; Riehle and Löffler, 1992a) discuss this influence, but the conclusions are contradictory. Chang and Bai (2000)

Used a mathematical model to show that the wider precipitators do not function as well. Navarrete et al. (1997), however, verified that precipitators with wider ducts were more efficient in the removal of high resistivity materials. The performance of electrostatic precipitators is, in general, evaluated under different electric operational conditions, which is perhaps what leads to the different conclusions observed in the literature. The complexity of the phenomenon is poorly addressed in the models available for predicting collection efficiency, particularlyin the submicronparticle sizerange. The objective of this work was to study the performance of the electrostatic precipitator in the removal of a particulate with a wide range of sizes, under different operational conditions and to compare the results for collection efficiency with predictions by available theoretical models.

They have been successfully used for removal of fine dusts from all kinds of waste gases with very high efficiency. The principle on which this equipment operates when a gas containing aerosols is passed between two electrodes that are electrically potential, aerosol particles precipitate on low potential electrode[1]. An ESP is designed for a particular industrial application. Building an ESP is a costly endeavor, so a great deal of time and effort is expended during the design stage. Manufacturers use various methods to design ESPs.

They also consider a variety of operating parameters that affect collection efficiency including resistivity, electrical sectionalization, specific collection area, aspect ratio, gas flow distribution, and corona power.

PRINCIPLE :

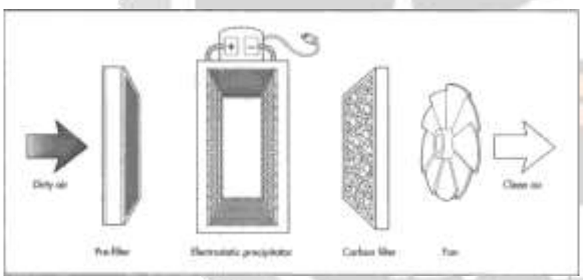
An ESP setup contains sharp discharge elec- trodes and smooth collecting electrodes. When HVDC is applied to the discharge electrode, a corona discharge takes place. Ions and electrons are produced at the corona point, and ionic current flows through the space. The ion polarity is either positive or negative. These ions attach to suspended solid particles. These charged particles are moved to- wards the collecting electrode by a Coulomb force, and are collected on that electrode. When the thickness of the layer of the collected solid par- ticles reaches a predetermined level, the collecting electrode is rapped mechanically using a hammer, and the layer falls down into a hopper located below.

MATERIALS AND METHODS

Experimental setup

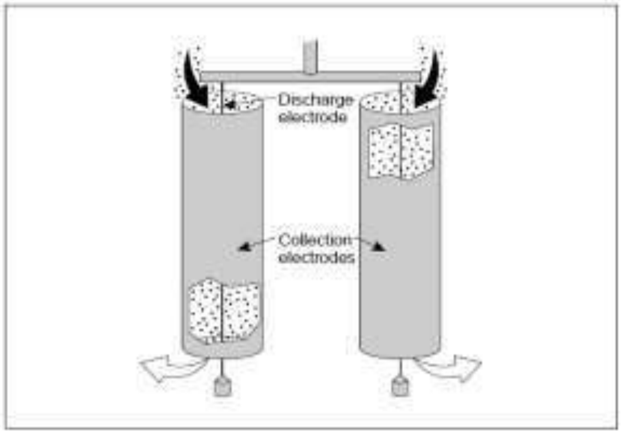
The experimental system used in this study consisted of three electrostatic precipitators of the wire-plate type, whose main dimensions are given in A schematic view of one of the three modules

Each precipitator consisted of a rectangular box built of acrylic and PVC, with the lateral walls covered by grounded copper plates. These plates constituted the collection electrodes. The discharge electrodes were stainless steel wires, stretched half way and orthogonal between the collecting plates. The distance between the electrodes (2c) could be varied for each precipitator, according to the values presented.



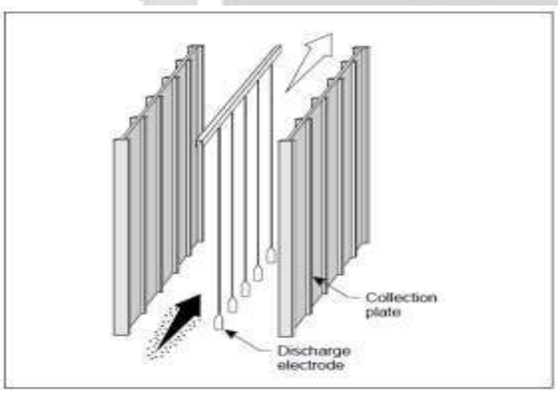
TUBULER

Tubular precipitators consist of cylindrical collection electrodes (tubes) with discharge electrodes (wires) located in the center of the cylinder. Dirty gas flows into the tubes, where the particles are charged. The charged particles are then collected on the inside walls of the tubes. Collected dust and/or liquid is removed by washing the tubes with water sprays located directly above the tubes. The tubes may be formed as a circular, square, or hexagonal honeycomb with gas flowing upward or downward. A tubular ESP is tightly sealed to minimize leaks of collected material Tube diameters typically vary from 0.15 to 0.31 m (0.5 to 1 ft), with lengths usually varying from 1.85 to 4.0m (6 to 15 ft). Tubular precipitators are generally used for collecting mists or fogs, and are most commonly used when collecting particles that are wet or sticky [2]. Tubular ESPs have been used to control particulate emissions from sulfuric acid plants, coke oven byproduct gas cleaning (tar removal), and iron and steel sinter plants



PLATES

Plate electrostatic precipitators primarily collect dry particles and are used more often than tubular precipitators. Plate ESPs can have wire, rigid-frame, or occasionally, plate discharge electrodes. Figure 1-11 shows a plate ESP with wire discharge electrodes. Dirty gas flows into a chamber consisting of a series of discharge electrodes that are equally spaced along the center line between adjacent collection plates. Charged particles are collected on the plates as dust, which is periodically removed by rapping or water sprays. Discharge wire electrodes are approximately 0.13 to 0.38 cm (0.05 to 0.15 in.) in diameter. Collection plates are usually between 6 and 12 m (20 and 40 ft) high. For ESPs with wire discharge electrodes, the plates are usually spaced from 15 to 30 cm (6 to 12 in.) apart. For ESPs with rigid-frame or plate discharge electrodes, plates are typically spaced 30 to 38 cm(12 to 15 in.) apart and 8 to 12 m (30 to 40 ft) in height. Plate ESPs are typically used for collecting fly ash from industrial and utility boilers as well as in many other industries including cement kilns, glass plants and pulp and paper mills.



LITERATURE SURVEY:

1. S.H. Kim, K.W. Lee, Kwangju Journal of Electrostatics 48 (1999) Journal of 5 Experimental study of electrostatic precipitator performance and comparison with existing theoretical prediction models

Electrostatic precipitators (ESPs) are one of the most commonly employed particulate control devices for collecting ash emissions from boilers, incinerators and from many other industrial processes

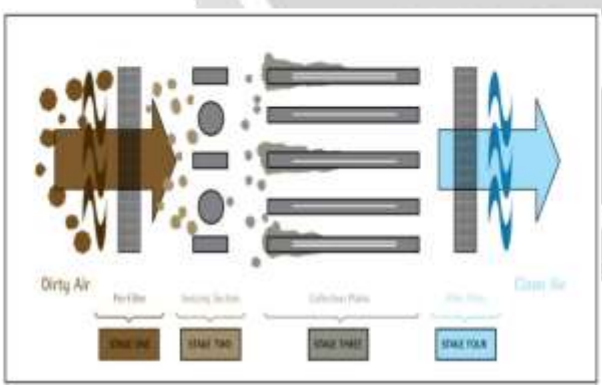
2. Shailendra Kumar Bohidar, Kheer Sagar Naik, Prakash Kumar Sen3IJARSE, Vol. No.4, Special Issue (01), April 2015 ROLE OF ELECTROSTATIC PRECIPITATOR IN INDUSTRY The principle on which this equipment operates when a gas containing aerosols is passed between two electrodes that are electrically potential, aerosol particles precipitate on low potential electrode[1]

3. Harry J. White & William H. Cole
   Journal of the Air Pollution Control Association
   ISSN: 0002-2470 Design And Performance Characteristics of High- Velocity, High-Efficiency Air Cleaning Precipitators The specific design and performance requirements included the removal of sub-micron air-borne dis- persoids at efficiencies up to 99.8% in a precipitator of compact size and low ozone generation.

4. A Mizuno IEEE Transactions on Dielectrics and Electrical Insulation Vol. 7 No. 5, October 2000 Electrostatic Precipitation ESP setup contains sharp discharge elec- trodes and smooth collecting electrodes. When HVDC is applied to the discharge electrode, a corona discharge takes place

WORKING METHODOLOGY

An ESP uses a high voltage electrostatic field to separate dust, fume or mist from a gas stream. The precipitator consists of vertical paralle l plates (collecting plates/electrodes) forming gas passages 12 to 16 in. (30.5 to 40.6 cm) apart. Discharge electrodes are electrically isolated from the plates and suspended in rows between the gas passages. Every particle either has or can be given a charge - positive or negative. A high voltage system provides power to the discharge electrode to generate an electrical field. The particulate, entrained in the gas, is charged while passing through the electrical field. The particulate is then attracted to the grounded collector plate, and forms a dust layer on the plate.



The methodology used in the tests consisted in initially setting up the experimental system with the levels of the variables to be tested: the blower was started and the air flow rate adjusted so that the gas velocity inside the precipitator reached the required value. The test was then started with the feeding of the particulate matter. After reaching the steady state (approximately five minutes), the powder concentration was measured at the entrance of the system by isokinetic sampling. Soon after, a new sampling was taken as the matter left the precipitator to obtain the concentration of particles at the exit of the system. The grade efficiency of collection for each test was obtained from the size analysis of the particulate matter retained in the filters used in the samplings. The particulate matter sampled from the precipitator was re-dispersed in a solution (deionized water plus dispersant agent) utilizing an ultrasonic bath. The suspension was then put in a Malvern Mastersizer, where size was analyzed.

CONCLUSION:

Electrostatic precipitators use electrostatic attraction to control particulate matter and can handle large volume of gases at low pressure drops. In an ESP, pollutant particles are electrically charged and then collected on collection electrodes. When the discharge and collection electrodes are rapped, the collected particles fall into a hopper and are removed. In this paper we introduce the two types of electrostatic precipitator, but all types of electrostatic precipitator are their own importance in their places. In modern world the pollution is a great problem which affect every body indirectly. To reduce the pollution by dust particles, the ESP is very effective dust collection device

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