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Industrial Air Pollution Reduction using the Urea Bed Neutralizer Method

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Abstract - *Pollutants in the air are a mixture of particles and gases that can reach harmful concentrations both outside and inside. Its effects can range from reduced disorder risks to rising temperatures. Pollutants such as soot, smoke, mould, pollen, methane, and carbon dioxide are just a few examples of everyday pollution. The majority of this air pollution is caused by the industrial use of fossil fuels such as coal, oil, natural gasoline, and gas. Pollutants from industries include carbon dioxide (CO2), nitrogen oxides, and sulphur oxides. These are extremely dangerous to all living beings and plants. As a result, the goal of this study is to increase the use of urea neutralizer bed in a more comprehensive solution. This method is both simple and cost-effective. The waste products could be used to make manure. The output of the neutralizer bed could be examined to determine the device's efficiency.*

Key Words **Pollutants, Urea neutralizer bed, manure.**

1. INTRODUCTION

Air pollution is a serious concern since it causes adverse effects on public health as well as on different sectors of the world economy. It is generally caused by the natural and anthropogenic sources. In which the anthropogenic sources contributes for the major air pollution. Particularly, the tremendous growth in the industrial activities in recent years exhausts more pollutants to the environment. Among the various industrial activities, Thermal power generation accounts for 80% of India's industrial emissions of particulate matter and sulphur and nitrous oxides, which often create toxic smog and cause lung diseases. Hence it is necessary for periodical monitoring and identification of advanced controlling techniques. The methods including: Flue Gas Desulfurization System, Spray Dryer Absorber (SDA), Circulating Dry Scrubber (CDS), Limestone-based Wet FGD, Low NOX burners, Selective Non Catalytic Reduction, Electrostatic Precipitator, Bag House Dust Collector, all of which have been evaluated and installed extensively to reduce SO_2, NO_X, PM and other emissions. Each control technology has its advantages and disadvantages. In this study an attempt was made to neutralize the pollutants generated by a thermal power plant located in Thoothukudi by catalytic reaction method using Urea catalyst bed neutralizer.

2. CAPACITY OF THE POWER PLANT

Thoothukudi Thermal Power Station consists of five units with a total installed capacity of 1,050 MW spread across 160 hectares (400 acres). The entire unit is powered by coal. The coal that is transported is fed into crushers, which reduce the coal particles to 10-20mm in diameter. Coal bunkers transport crushed coal to coal grinding mills with bowl rollers. The powdered coal is fed into the pulverizer and furnace via forced draught fans. For tangential firing, there are four mills surrounding the furnace, as well as oil injecting nozzles from oil storage.

3. PREPARATION

A neutralizer bed is a device used to reduce the toxicity of industrial emissions. A neutralizer bed creates an environment for a chemical reaction that converts toxic combustion byproducts to less toxic substances. The neutralizer bed was one of the most significant emission control inventions in the history of carbon and greenhouse gas emissions monitoring. The urea catalyst material was created by combining CO (NO3)2.6H2O and Mn(NO3)2.4H2O from their processor material.

A suitable amount of the processor material was accurately weighed and dissolved in a suitable amount of iso-propanol. The two solutions were combined, and the resulting solution was mixed with pretreated zeolite. The solution was vigorously stirred to ensure complete evaporation of the iso-propanol.

4. Experimental method

Figure-3 depicts the entire experimental procedure. The collected sample, which contained exhaust gas SO_X, NO_X, CO_2, CO, and HC, was first passed through the primary filter cloth and then through the urea neutralizer tank. The reaction time while passing through the urea bed was kept between 10 and 15 minutes. Finally, the gas was collected and tested for pollutant levels

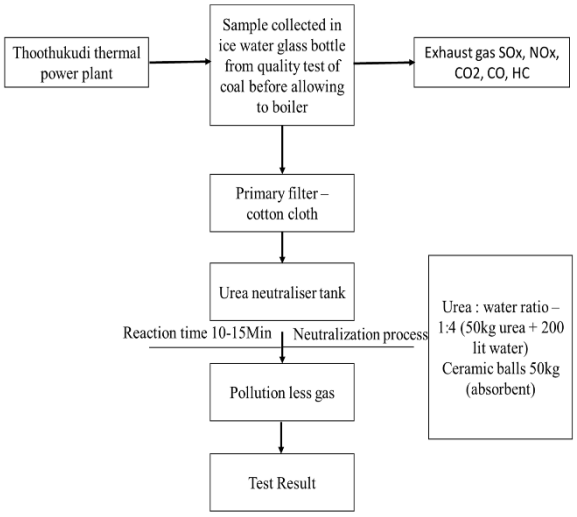

Figure-3: Flow chart of the Experimental process

We can reduce the activation energy of the HC, CO, and NO by using both a reducing and an oxidising catalytic converter, allowing them to react more quickly to form less noxious products. A catalyst is responsible for the reactions that occur in the neutralizer bed. The catalyst is said to be heterogeneous or contact catalyst if it exists in a separate phase from the reactants. Contact catalysts are substances that can adsorb molecules of gases or liquids onto their surfaces.

A two-way neutralizer bed has two simultaneous tasks:

1. Oxidation of carbon monoxide to carbon dioxide: $2CO + O_2 \rightarrow 2CO_2$
2. Oxidation of unburnt hydrocarbons (unburnt and partially-burnt fuel) to carbon dioxide and water: $C_xH_{2x+2} + [(3x+1)/2]\ O_2 \rightarrow xCO_2 + (x+1)\ H_2O$ (a combustion reaction)

A three-way neutralizer bed has three simultaneous tasks:

1. Reduction of nitrogen oxides to nitrogen and oxygen: $2NO_x \rightarrow xO_2 + N_2$
2. Oxidation of carbon monoxide to carbon dioxide: $2CO + O_2 \rightarrow 2CO_2$
3. Oxidation of un burnt hydrocarbons (HC) to carbon dioxide and water: $C_xH_{2x+2} + [(3x+1)/2]\ O_2 \rightarrow xCO_2 + (x+1)\ H_2O$

5. RESULTS & DISCUSSION

Data were collected by using five gas analyzers. With the help of five gas analyzer, the air pollutants (CO, CO2, HC, NOx and SOx) coming out from the vehicle exhaust will be measured.

Five gas analyzer: After the equipment is being setup, the five-gas analyzer is allowed to warm- up (radioactive bed). The purpose of the radioactive bed is to convert the molecules from the exhaust into particles.

Table-1: Amount of gases before using urea bed

Parameter	Regulation unit	Actual value
CO	3.5%	1.85
NOx	0.50g/km	0.36
HC	6000ppm	3725

Table-2: Amount of gases after using urea bed

Parameter	Regulation unit	Actual value
CO	3.5%	1.25
NOx	0.50g/km	0.14
HC	6000ppm	1015

6. CONCLUSION

Toxic emissions can be neutralised from industries by using these neutralization tanks. This experimental setup will be carried out using a urea solution tank. This method is both simple and cost effective. The waste products can be used as manure. The output of the neutralizer bed will be tested in order to determine the system's efficiency. This urea waste can also be used as agricultural manure.

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