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# Experimental Investigation on Self Neutralization Efficiency of Chimney

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**Abstract:**
The Contribution of Carbon-di-oxide in polluting the atmosphere is increasing day by day. Among all, thermal power plant is one of the major source for emission of carbon-di-oxide through Chimneys. This carbon-di-oxide, along with all other gases, reduces earth's reflection of light from the surface, thus increasing the warming effects of the sun. The warming effect is responsible for rising sea levels and reducing stable weather pattern results in various natural disaster. In order to reduce this problems and make a pollution free environment an experimental study has been undertaken to check the airborne gas absorption capacity of chimney using Basalt as the base material for construction which naturally has a property of carbon sequestration i.e., it absorbs and stores the carbon dioxide which in turn converts the absorbed carbon dioxide into a carbonate mineral. In order to evaluate the airborne absorption capacity of basalt, chimney prototypes are constructed. For this, the comparative study is done between conventional chimney prototype and Basalt chimney prototype. The emission rate of airborne gas from the chimneys has been measured using CO2 measuring device which gives the emission rate in ppm.

**Keywords:** Basalt, CO2 reduction, chimney, global warming.

## I. INTRODUCTION

Recently the innovation in construction has stepped into a new trend of Eco friendly construction. Various researches have been undertaken to extend the efficiency and benefits of Eco-friendly buildings. The need for this new innovation is mainly because of increased warming of earth's atmosphere. We know that the global warming is a outcome of increased rate of greenhouse gas emissions. The emission of GHG is rapidly increasing in the current scenario which is to be reduced immediately. One of the greenhouse gases which causes more effect is carbon dioxide. There are various sources for carbon dioxide emission but the source which leads to major emissions are Thermal power plants. Electricity production is a function of Thermal power plant which is achieved from the coal firing. Among all sources of electricity production, the high rate of electricity is produced from coal fired thermal power plant.

## II. BACKGROUND STUDY

Carbon dioxide emission from the coal fired Thermal power plants has been becoming a major source for global warming and polluting the environment. In the year 1990-2004, the carbon dioxide emission rates upto 30% among all other Greenhouse gases. Recently, the demand for electricity is goes on increasing all over the country due to development and increased population. To overcome this demand, the coal fired thermal power plants is a major depended source .Thermal power plant accounts for 66% of generation and rest from other sources. In India, coal is the primary fuel which accounts for 50-55% of power generation. This percentage of coal will only get larger in an upcoming years. In 2010-2011, 111 plants with the capacity of 121 GW consumed 503 million tons of coal and generated an estimated quantity of 665 million tons of CO2 .These emissions resulted in an estimated 80,000 to 1, 15,000 pre matured deaths and 20 million Asthma causes from exposure to pollution.

## III. PROPOSED SOLUTION

The attempts to reduce the CO2 is getting increased day-by-day. One of the method in reducing carbon dioxide from electricity sector using smart electric grid applications Increased Efficiency of Power Plants and Fuel Switching, use of Renewable Energy and Nuclear energy to produce electricity and in addition several other laws were made by Air quality control board to restrict the emission rate. But there is no appreciable reduction in the carbon The Environmental Engineer mainly concern about the CO2 reduction. They attempts to alter the fuel as a Biomass co- firing .When the CO2 is reduced at the place of generation, then high rate of emission can be reduced. In a coal fired thermal power plant, the source of CO2 generation is found to be emitted into the atmosphere via chimneys. Thus in the chimneys reduction of CO2 can be achieved by altering the construction technique or construction materials. One of the alternative material to reduce the CO2 emission is found to be an Igneous rock Basalt.

**Figure. 1. Base Material Basalt**

**a). BASALT CHIMNEY**

Basalt is an igneous rock formed from the rapid cooling of molten lava which is found largely in Deccan Plateau. The basalt has various construction properties which makes it suitable for construction. The chemical composition of basalt has been analyzed with chemical analysis method which shows that the material Basalt naturally has a property of trapping CO2 within itself. The calcium released from the **b**asalt combines with the CO2 to for carbonate mineral. Normally the chimneys are made of RC, steel, stone masonry and Brick masonry which is called as a conventional chimney. Thus in the path of altering the base material as basalt, it can be used as a replacement for fine aggregate, coarse aggregate in RC chimneys or in the form of stone in the stone masonry chimneys. It can either be used in a fiber form in concrete. In this project the model of chimney is constructed with the material basalt in the form of stone block. The density and mass of the basalt is very high hence the use of basalt in the stone block will be very efficient in absorbing the CO2 for a long period. Size of the model is evaluated by constraining the actual section of chimney from thermal power plant. The prototype is constructed with fire place for the coal firing and elevated into the chimney for atmospheric emission.

**Figure.2. . Basalt Chimney Model**

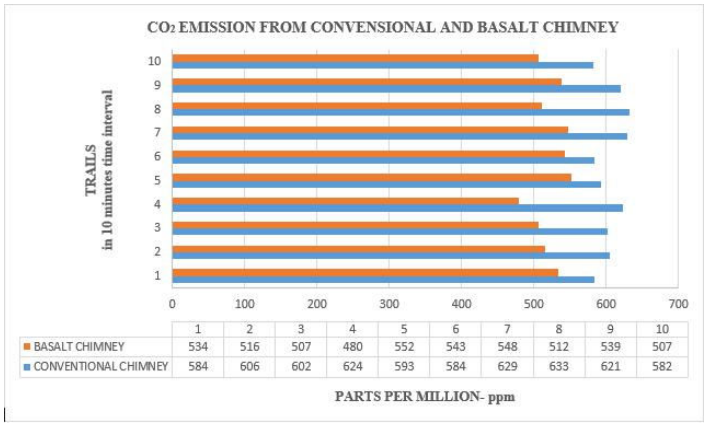
## IV. EXPERIMENTAL INVESTIGATION

The real time model of chimney is constructed with basalt block. Here the conventional chimney model of same dimension is also constructed with brick masonry. This is because to make comparison related to the emission rate. The same quantity of coal is burnt in the both the chimney for investigation. The coal of same size with the same quantity is weighed and burnt in both the chimneys. The carbon dioxide emission from both the chimneys is measured with the CO2 Sensor. The sensor has been for many purposes namely stowaway detection, to check the indoor air quality, cryogenesis and ventilation management etc. The sensor detects the rate of emission of carbon dioxide among the released gases of burning coal. The reading with the sensor is taken at a certain time interval which depends on the burning stages of coal. The emission rate had been found from the Beginning of burning to the completely burnt stage of coal. This reading should be taken periodically and the sum of the results gives the total emission of carbon dioxide for the quantity of coal burnt in both the chimney models. The comparison analysis has been done to find the absorption capacity of basalt chimney.

**Figure.3.. Real Time Prototypes**

## V. RESULT AND DISCUSSION

The result has been taken by comparing the analysis results of $CO_2$ in chimneys. The different trails had been carried out throughout the burning of coals at different time intervals and occurred a different result from the sensor from both the chimneys. The rate of carbon dioxide emission is depends up on the fuel used and heating operation .The sensor reading is depends on the temperature and pressure according to the ideal gas law. Gas released from the burning of coal with same quantity in both the chimneys has a different rate of CO2 emissions. The readings has been drawn in the graph to find the absorption capacity of basalt. From the comparison analysis it is clear that the emission rate of CO2 in basalt chimney is less when compared to the conventional chimney.




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| BASALT CHIMNEY | 534 | 516 | 507 | 480 | 552 | 543 | 548 | 512 | 539 | 507 |
| CONVENTIONAL CHIMNEY | 584 | 606 | 602 | 624 | 593 | 584 | 629 | 633 | 621 | 582 |

**Figure.4. Comparison Chart**

## VI. CONCLUSION

In the aim of reducing carbon dioxide emission and make a pollution free environment various researches has been carried out. In this project the objective of reducing carbon dioxide with the basalt has been achieved and the absorption rate of basalt is analyzed by comparing with conventional chimney. In power plant the emission of CO2 can be reduced very efficiently which is also a life time benefits when compared to the other attempts. As the basalt is natural resource which is available in a large quantity all over the world, it is economical. The chimney constructed with basalt has all the property as available in chimneys along with addition property of carbon sequestration which results in pollution free environment.

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