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Separation of CO_2 from air through electrostatic precipitator

Jay Kesur[1], Divyesh Vadhwana[2], Gayatri Gadgul[3], Prof. Bhushan Save[4]

[1] Department Of Electrical Engineering, Viva Institute of Technology, Virar, Maharashtra (India)
Email: 17405069jay@viva-technology.org
[2] Department Of Electrical Engineering, Viva Institute of Technology, Virar, Maharashtra (India)
Email: 17401061diyeshl@viva-technology.org
[3] Department Of Electrical Engineering, Viva Institute of Technology, Virar, Maharashtra (India)
Email: 7041058gayatri@viva-technology.org
[4] Department Of Electrical Engineering, Viva Institute of Technology, Virar, Maharashtra (India)
Email: bhushansave@viva-technology.org

Abstract— *with the increase of carbon dioxide content in the atmosphere it has become must to find an alternative to reduce the carbon dioxide. Our project mainly focuses to separate carbon dioxide from oxygen molecules through electrostatic precipitator. The features of electrostatic precipitator include a basic filtration unit known as HEPA filter that is paper material to rectify hair, dust etc. A high voltage is served to electrodes that will collect carbon dioxide as positive charge attracts negative charge present on electrodes and helps to separate carbon dioxide from oxygen, also a treatment of UV rays of C category will help keep the oxygen molecules free from bacteria.*

Keywords— HEPA filter, Electrodes, High voltage supply, Electrostatic precipitator, UV- C.

I. INTRODUCTION

As per the data obtained, India is the fourth highest emitter of carbon dioxide in the world; it is expected emissions to grow by a solid 8.9 percent. Therefore, to rectify this problem, this project introduces some ways that helps to purify the air. Here the carbon dioxide has been separated from oxygen by using a process known as electro precipitator. There are many attempts made to purify air through electrostatic precipitator however with the additional purification steps this process is made more efficient like initial filtration system that almost rectifies amount of carbon and dust by 65% and remaining contents will be treated by high voltage on electrodes as well as removal of bacteria by UV rays. Therefore, by using this process we try to remove as much as carbon dioxide content in the atmosphere.

II. BLOCK DIAGRAM

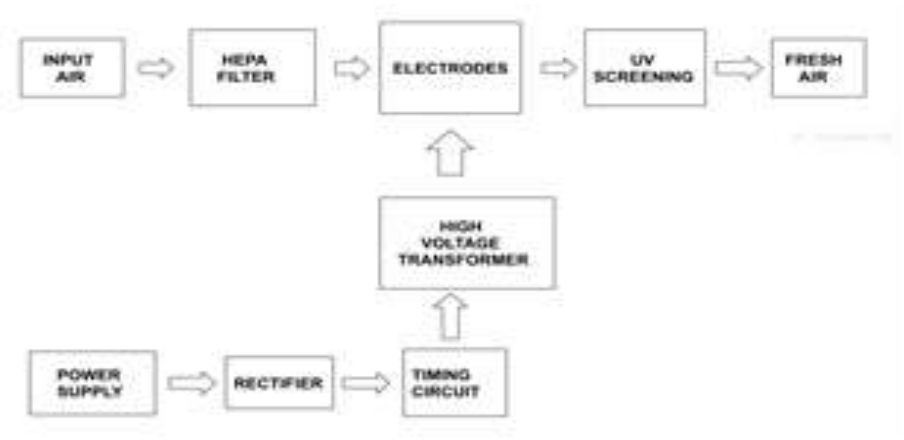

FIGURE 1: Block Diagram of carbon separation from air through electrostatic precipitator

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III. MATERIAL AND METHOD

3.1 SIGNIFICANCE OF CARBON COLLECTION VIA ESP

- Electrostatic precipitator, also called electrostatic air cleaner, a device that uses an electric charge to remove certain impurities—either solid particles or liquid droplets—from air or other gases in smokestacks and other flues.
- The precipitator functions by applying energy only to the particulate matter being collected, without significantly impeding the flow of gases. Originally designed for recovery of valuable industrial-process materials, electrostatic precipitators are used for air pollution control, particularly for removing particles from waste gases at industrial facilities and power-generating stations.
- Precipitators function by electrostatically charging particles in the gas stream. The charged particles are attracted to and deposited on plates or other collection devices. The treated air then passes out of the precipitator and through a stack to the atmosphere. When enough particles have accumulated on the collection devices, they are shaken off the collectors by mechanical rappers.
- The particulates, which can be either wet or dry, fall into a hopper at the bottom of the unit, and a conveyor system transports them away for disposal or recycling. Precipitators are often deploy with denitrification units that remove nitrogen oxides and scrubbers or other devices that remove sulfur dioxide.

IV. PRINCIPLE OF WORKING

Initially atmosphere air is an input consisting of oxygen molecules with carbon impurities. Now this impure air has to be processed through electro precipitator, which will separate the carbon from the air; however, the actual process involves major parts in it, which are:

1)HEPA FILTER- It is a type of filtration paper which is used to block unwanted hard materials such as hair, dust, paper or plastic particles etc.

2)Electrostatic precipitator- This is the heart of the separation unit, it consists of a chamber where electrodes are placed in such a way alternate to each other, so that whenever carbon molecules(being positively charge) passes through electrodes the positive electrode will give repulsion force however negative electrode will attract resulting in collecting carbon on the base of electrode negative charged plates, To successfully achieve this feat , components like rectifier, separation circuit, and a transformer is used to gain high voltage.

3) UV bulb- Now the air separated from carbon is passed through UV bulb chamber to make sure remaining bacteria present in air should be neglected and thus we could pass the purified form of air as an output which will be carbon-less

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V. CIRCUIT DIAGRAM

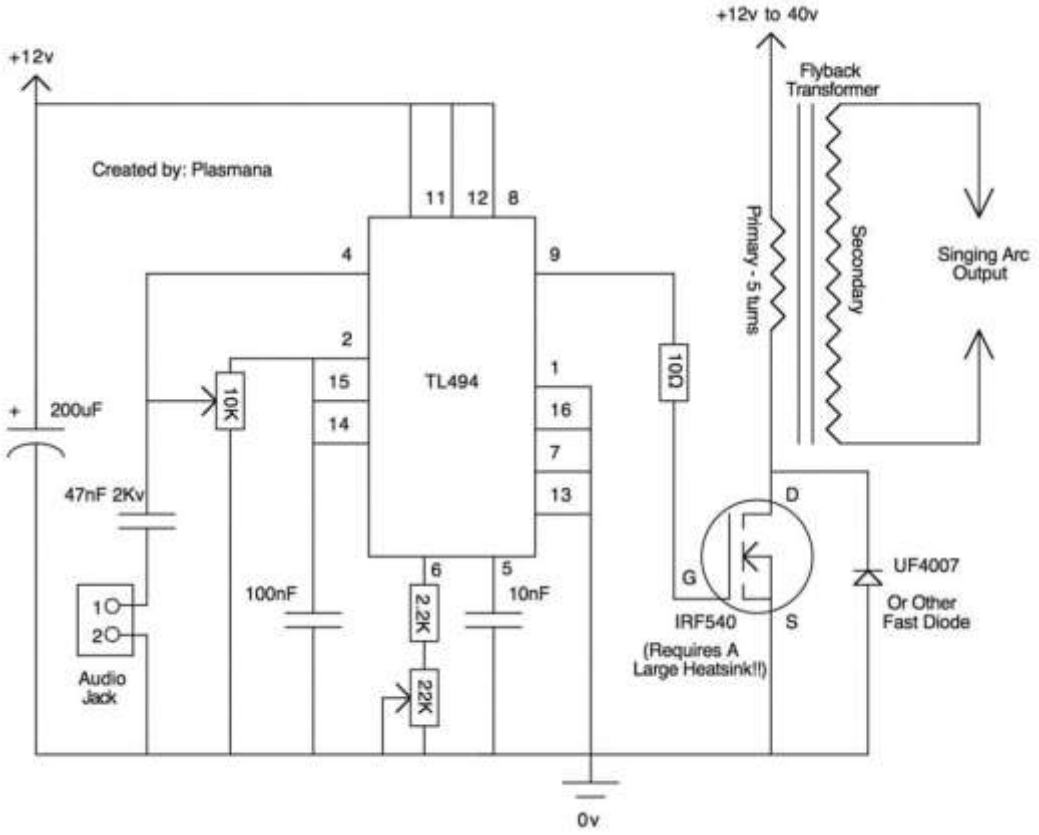

FIGURE 2: Separation of CO_2 from air through electrostatic precipitator

VI. LIST OF COMPONENTS

1 Fly back transformer
2 IC-TL494
3 Resistor
4 Capacitor
5 Diode
6 MOSFET
7 Electrostatic precipitator
8 UV chamber type C
9 Gas sensor
10 16-bit display

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VII. ADVANTAGES

1. The High Efficiency of Removal of Particles/Pollutants.
2. Collection of Dry as Well as Wet Pollutants.
3. Low Operating Costs

IX. ANALYSIS AND RESULT

After completing the project, the result is expect to be efficient for which some analysis is made that is in terms of technical, financial, management, work distribution.

Analysis where made based on the same expectations and hopefully they were fulfilled such as technical aspect was perfect as per the output was expected however the workload was distributed according to the skills of the persons involved. So after taking an account of all terms mentioned above analysis were same as expected and planned

X. DISADVANTAGES

1 High Capital Costs.
2 Requires Large Space.
3 Risk of accidents.

XI. CONCLUSION

The Air Purifier specially designed for old age homes, hospitals, offices etc. This can be used to remove dust, fungus and reducing harmful gases from the air. The technology used in Air Purifier has a bright future because it works on as and when required basis and thus saves energy.

XII. LITERATURE REVIEW

Electrostatic Separation of Carbon Dioxide by Ionization in Bifurcation Flow (2004) Takao Ito∗, Yoshio Otani and Norikazu Namiki Graduate School of Natural Science & Technology, Kanazawa University, 2-40-20 Kodatsuno, Kanazawa 920-8667, Japan.

Concentration of CO2 in the air is one of the major issue. Therefore, ionization separator was used to the separate carbon dioxide from inert gases. In this paper, it is found that carbon dioxide can be separated mostly in the form of anion although some fraction of carbon dioxide decomposes by the soft X-ray irradiation.

XIII. FUTURE SCOPE

To move from a simple dimensional analysis to a full development of the technology, a number of R&D issues will need to address. One is the modeling and understanding of the airflow in order to define the maximum level of CO2 that can be removed at any given site without untoward side effects. Preliminary studies suggest the feasibility of the approach in this regard. One needs to choose between various designs for contacting natural airflows. The situation is right now wide open and somewhat reminiscent of the early days in windmill design. Many vastly different designs competed with each other until finally a handful of particularly elegant and simple solutions took over. One needs to find a good sorbent. Currently the only sorbent that is environmentally acceptable and guaranteed to work is Ca (OH)2. Other possibilities will need to be explored. We are planning

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the analysis of several process implementations for the extraction of CO2 from air. A successful process design, combined with any of the methods proposed for carbon dioxide disposal would be a major step toward solving the greenhouse gas problem and toward establishing a net zero carbon economy that would not have to abandon the vast fossil energy resources that could fuel economic prosperity for generations.

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