ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 8| Issue: 7| July 2022|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2022: 8.205 || ISI Value: 1.188

CAPTURING OF CARBON DI OXIDE AND PREVENTION OF CORROSION IN BIOMASS PRODUCTION

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Article DOI: https://doi.org/10.36713/epra10773
DOI No: 10.36713/epra10773

ABSTRACT

The generation of heat, electricity is being produced through biomass burning process, but it is seen that it has many challenges. The capture and storage of CO2emissions produced from the combustion of biomass and many other industrialization processes is a great deal to the world. Carbon di oxide emission percentage is continuously increasing in the atmosphere, thus this leads to the climate change in the form of global warming. This study analyses the viable and potent method of capturing carbon di oxide, transporting it in an affordable way and finally then safe storage of itself and increase the temperature as well as corrosive resistivity.

KEYWORDS: - ***Pre combustion capture, post combustion capture, biogas, biogas digester,ccs***

1. INTRODUCTION

Biomass is organic material like manure, sugar cane, dead plants, human waste etc. It is considered as a best renewable energy source. Biomass burning is the process in which agricultural waste, food waste, animal waste is burnt to produce electricity. When it is burnt then many products and by products have been released. Biomass burning releases most pollutant gases carbon di oxide (CO_2), sulphur di oxide (SO_2) and some amount of hydrogen sulphide (H_2S).

Importance in Present Scenario

We all know that India is a developing country still it emits 7% CO_2 of the global emissions in the world. According to IEA India has become the fourth CO_2 emitter in the world. It is massive quantity which is being produced by India. So it is a concerned topic in front of researchers.

According to international energy agency, 100 billion metric tons of carbon is being produced by the burning of biomass per year.

Since burning of biomass produce CO_2, a greenhouse gas, is to be reduced in upcoming years otherwise global warming will be increased. CCS is a technology in which carbon di oxide captured and stored from the burning of biomass, burning of fossil fuels, coals and from many industrialization processes like manufacturing of cement, steel etc. It is a low carbon technology.

The main purpose of this paper is to capture, transport and storage of carbon di oxide emissions. And the second objective of this paper is to prevent corrosion as well as increase the temperature in the digester.

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Table 1. Percentage Global Emissions in Various Countries

SN no.	Country name	Percentage of global emissions of CO_2
1.	china	27%
2.	US	15%
3.	European union	10%
4.	India	7%
5.	Iran	
6.	Russia	
7.	Saudi Arabia	
8.	Japan	
9.	South Korea	
10	Germany	15%
11.	Rest of the world	26%

Table 2. The Current Global CO_2 Emissions Levels and Concentration are as follows:

Year	Carbon Di Oxide Emissions in Gigabytes
2010	33.1
2011	34.4
2012	35.0
2013	35.3
2014	35.6
2015	35.5
2016	35.7
2017	36.2
2018	37.1

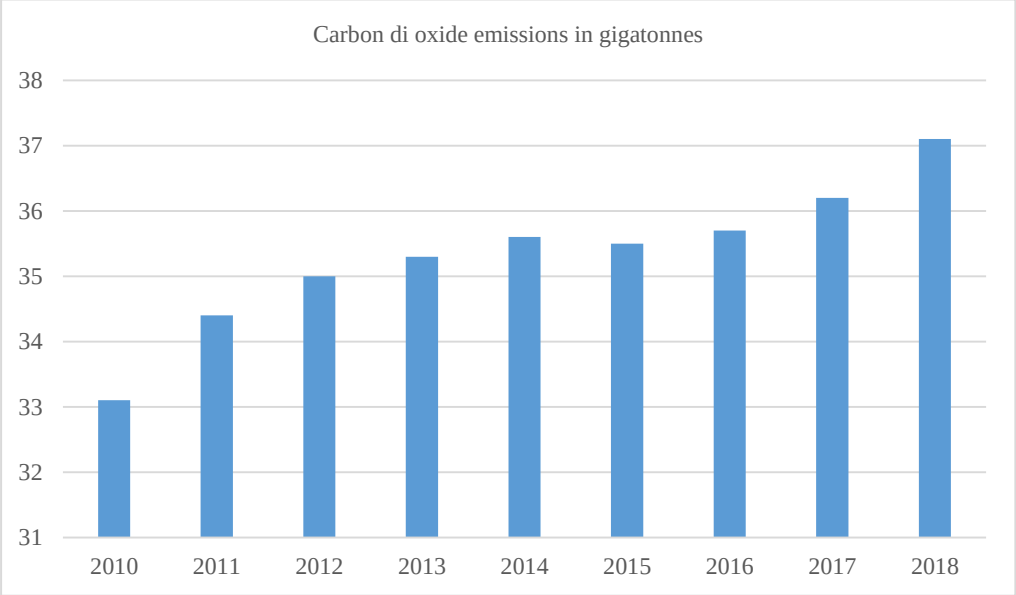

Fig. 1. Variation of Carbon Di Oxide Emissions in India Per Year (in gigatonnes)

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Figure 1 shows that, the percentage of carbon di oxide emission is continuously increasing as the year increased. The percentage ofcarbon di oxide emission was 33.1 giga tonnes in 2010, it has been reached 37.1 giga tonnes in last year. Although there is a little bit variation between the year 2014-2016, yet we can say that it is increasing because the emission of carbon di oxide is in giga tonne.

Carbon Capture and Storage Technology (CCS):

It is a technology which deals with the climate change in an inexpensive way, providing growth of economy. It combats against climate change including carbon di oxide capture from the air, transporting and storage, providing renewable resources, preventing pollution etc. it is crucial for us because, without it 70% more cost would be of fighting climate change. According to international energy agency, if we use this technology then reduction of carbon di oxide emissions from the atmosphere 19% more as well as cost would be 70% less by 2050.

2. METHODOLOGY

2.1Capturing the CO_2:-

First stage is of capturing the CO_2 emissions produced during the burning of biomass and fossil fuels. Separation of CO_2 from another gases has mainly two methods:-

I. PreCombustion Capture:-

Pre combustion capture process captures CO_2 using gasification process. In this process firstly solid biomass (solid fuel) is converted into syngas under high temperature and pressure in the presence of oxygen. Syngas is basically mixture of carbon mono oxide (CO), carbon di oxide (CO_2) and hydrogen (H_2) with small amount of impurities.

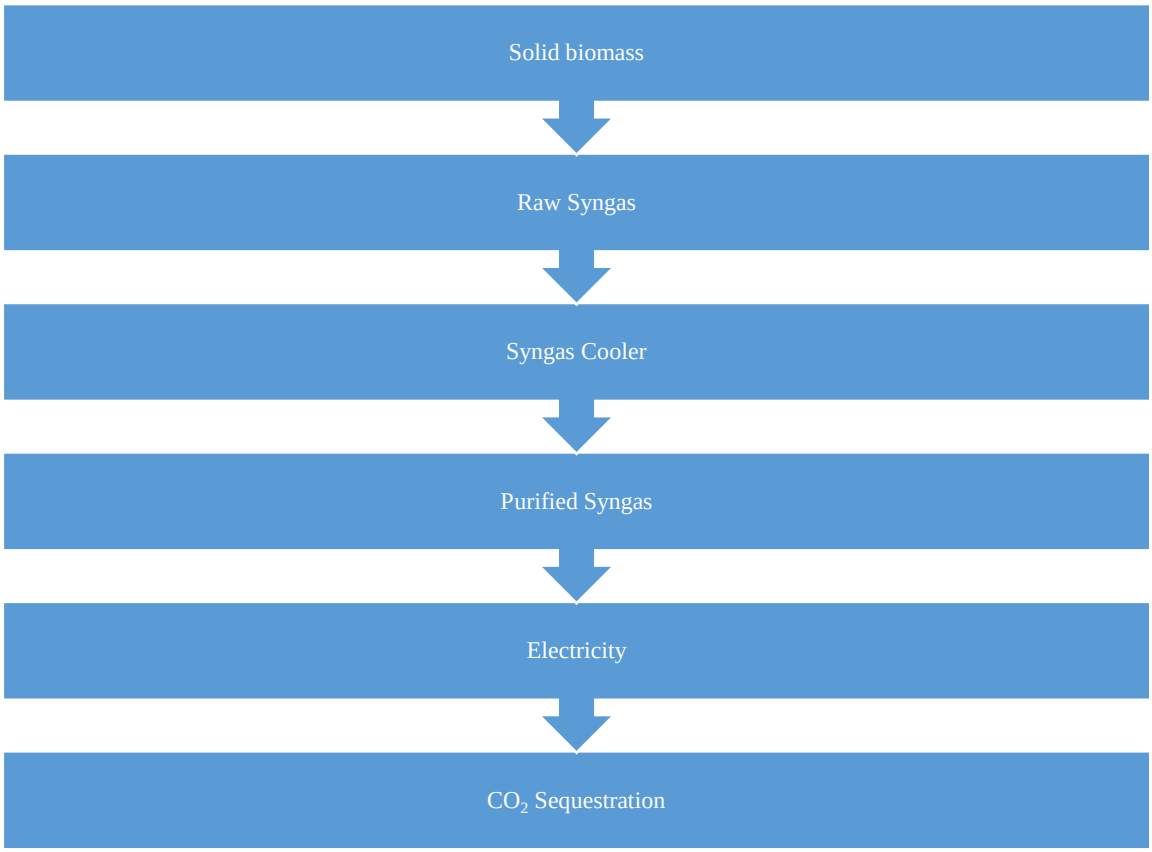
To complete the first step of capturing the CO_2, syngas is transferred in the Water Gas Shift where carbon mono oxide reacts with water and gives more carbon di oxide and hydrogen. The reaction as follows:

In this process 90% carbon di oxide is captured through water shifting process. After capturing the carbon di oxide residue hydrogen is used for electricity generation.

We can understand this process by flowchart as follows:-

$$CO + H_2O \rightarrow CO_2 + H_2$$

Flow chart of Pre Combustion Capture



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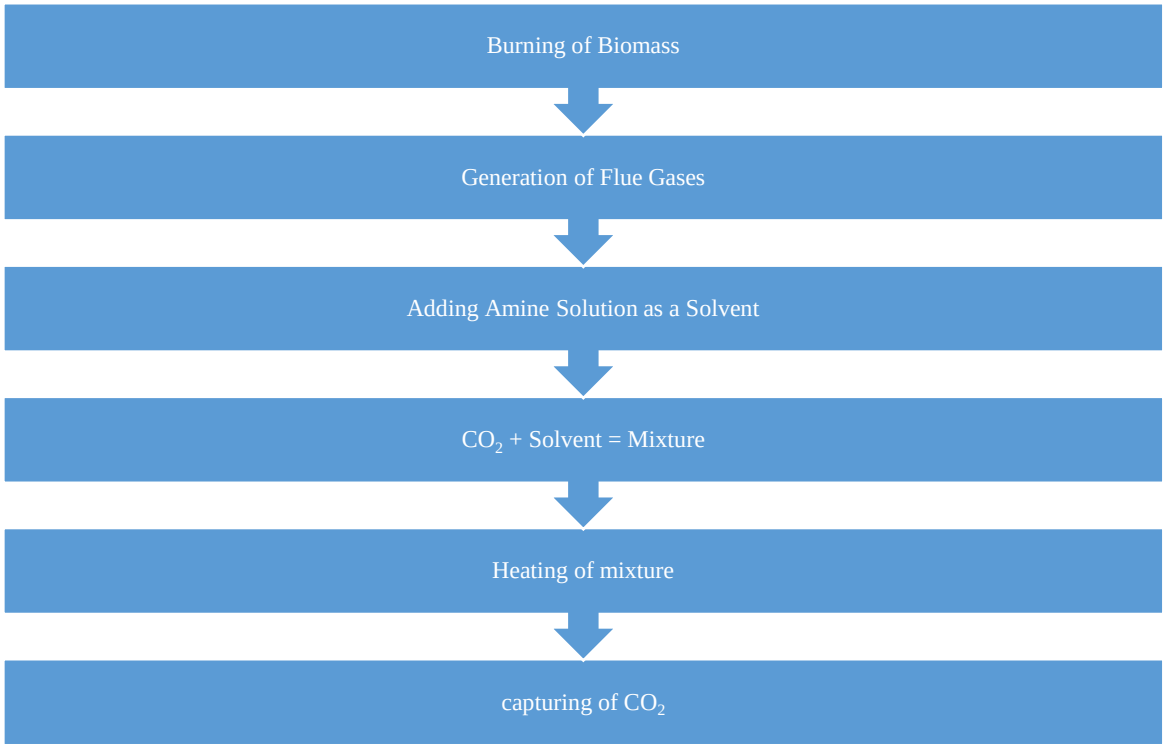
II. Post Combustion Capture:-

This process captures carbon di oxide from the flue gases after the burning of fossil fuel or biomass. In this process, a solvent is used. As a solvent amine solution is used. When it binds with carbon di oxide then it forms a CO_2 and ammine mixture solution. After that this mixture is carried in another tank and continuously heated. Finally carbon di oxide is captured but only this process captures 15-18% CO_2 which is lesser than the percentage of pre combustion capture.



Flow chart of Post Combustion Capture

2.2Transporting the CO_2

CO_2 must be transported after captured through road tanker, pipelines or ships. CO_2 is transported in the same way as other fluids, natural gas and oils are being transported.

2.3Storage of CO_2

After the capturing and transporting of carbon di oxide we have to store itself. The captured and transported carbon di oxide is stored several kilometers below the earth surface.

Existing system of biogas digester

Biogas digester is usually made up of concrete. When biomass is burnt then acidic solution is formed in the digester. When acidic solution comes into contact with concrete, it corrodes the digester parts. Thus this leads to increase the maintenance cost as well as the reduction of economic growth.

Concrete + acidic solution → corroding of digester parts

Proposed system of biogas digester:-In this system we can use stainless steel instead of concrete. When stainless steel comes into contact with then it corrode but less over concrete.

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Table 3. Characteristics of various materials:

SN no.	Material	Thermal conductivity	Corrosive resistance	Tensile strength
1.	Concrete	0.4-0.7	Average	2.2-4.2 MPa
2.	Aluminium	205-210	low	40-70 MPa
3.	Stainless steel	40-46	high	505-510 MPa

We are using stainless steel because its thermal conductivity is higher than concrete and tensile strength is also high. Thermal conductivity of concrete and stainless steel is 0.4-0.7 W/mK& 40-46 W/mK.Although aluminium has high thermal conductivity yet it is not used because it is lower corrosive resistance than stainless steel. Thus we can prevent corrosion in biogas digester using change the material.

3. RESULT

1. The study on the carbon capture as well as storage is concluded. As per studies, CCS could reduce CO_2 emissions which would also help to reduce the cost due to climate change that would otherwise be about 70% more without CCS.
2. The projects of CCS in power sector would cost about ₹ 4600 – 7000 per tonne of carbon dioxide, and this cost is expected to abate ₹ 2700 – 3900 per tonne of carbon di oxide by 2030.
3. This Process leads to the reductions of cost for capturing, storing and transporting of CO_2.
4. By using proper material in biogas digester we can prevent corrosion of it.

4. CONCLUSION

We all know that CO_2 emissions are continuously increasing in the atmosphere, so this is a major problem to the worldwide. We can't whole capture carbon di oxide that is emitted by the burning of fossil fuels but we can capture some amount of carbon di oxide. We have a technique which is called CCS, to capture, transport and storage of carbon di oxidein safe place. This technology is economically better and affordable too. We used another technology in this paper to prevent corrosion in biogas digester by changing of material of the digester. We can use stainless steel instead of concrete in biogas digester from which corrosion can be prevented in some scale.

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