Sustainable Extraction of Carbon Dioxide

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Abstract - *The issue of global warming is a significant one. Reduced CO2 levels in the atmosphere is one method of preventing climate change. CO2 capture and storage technology can help with this. Because of the technology's relative novelty, lack of experience, and considerable risk of adoption in practise, many people are sceptical of CCS projects. As a result, a targeted plan to promote CO2 capture and storage technologies is required.*

Key Words: *CO2 Capture and Storage Technology (CCS) Project, Global Warming*

1.INTRODUCTION

Extreme storms, wildfires, and flooding are becoming more common as global carbon emissions continue to rise at an accelerating rate. In the 1950s, CO2 extraction from ambient air as a pretreatment for cryogenic air separation became commercially viable. Such reports, according to the most recent climate research, will not be sufficient to keep temperature rises below 1.5-2°C. As a practical carbon-reduction approach, direct air capture (DAC) is gaining traction. Chemical reactions are used in DAC, which is a technical strategy for extracting carbon dioxide from the environment. These compounds react selectively when air passes over them, trapping CO2. CO2 absorption into alkali metal hydroxides and carbonates, particularly lithium sodium and potassium, has been studied and used for a range of purposes since the early twentieth century. In modern CO2 extraction technologies, strong bases such as NaOH, KOH, and LiOH are utilised to absorb CO2 directly from the air. KOH is the safest way to remove CO2 because NaOH is extremely hazardous to people and LiOH is a vital component in the creation of anaesthesia.

2 LITERATURE SURVEY

This chapter gives a quick review of the experimental work done to assess density, viscosity, VLE, and kinetics in hydroxide and carbonate systems. Several scholars have been studying CO2 absorption into hydroxides and carbonates since the early twentieth century. The majority, but not all, available literature data sources for experimental measurements are included in this chapter, as well as certain models to forecast the experimental data.

2.1 PROBLEM STATEMENT

The United Nations Framework Convention on Climate Change (UNFCCC) was established on March 21, 1994, as a result of continued human-caused greenhouse gas emissions. The goal of reducing greenhouse gas emissions and raising temperature reflects the decrease in CO2 levels in the atmosphere. The necessity to reduce CO2 emissions by deploying DAC and utilising renewable energy sources. Carbon capture can take many forms, including technological and chemical methods that can aid in reducing carbon levels in the atmosphere. Climate change, extremestorms, wildfires, and glacier melting are all issues that must be addressed in a long-term perspective. As a result, CO2 must be managedand lowered by the use of technology.

2.1 PROPOSED METHOD

We can reduce CO2 levels in the environment by using the direct air capture approach. Because the chemicals utilised in this are neither dangerous nor damaging to nature or humans. The quality and temperature of the air in the atmosphere are also improved by this technique. As a biproduct, this technology generates additional carbon dioxide, which can be employed in other regions or initiatives. Due to the technology's relative novelty, a lack of knowledge, and a significant risk of deployment, many people have a negative attitude regarding DAC projects.

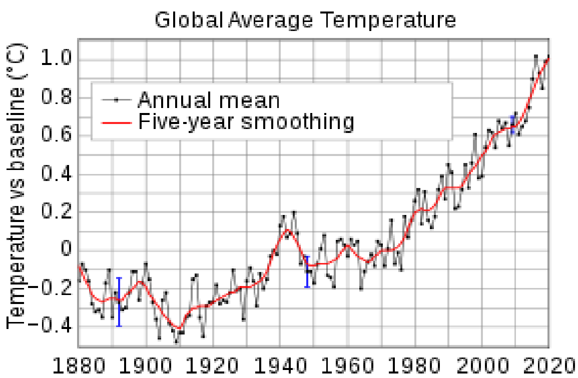

Chart -1: Global average temperature

3. METHODOLOGY

To overcome the rise in global warming, the most important chemical is carbon dioxide. This carbon dioxideis responsible for greenhouse effect and poor air quality in atmosphere. By reducing co2 or by capturing co2 we can control air pollution. We are going to build a system that will directly absorb the Co2 from air with the help of hydroxide and carbonate systems. The captured CO2 is stored in a solid and thermodynamically stable form i.e. CaCO3 and will be captured in a closed system.

4. WORKING PRINCIPLE

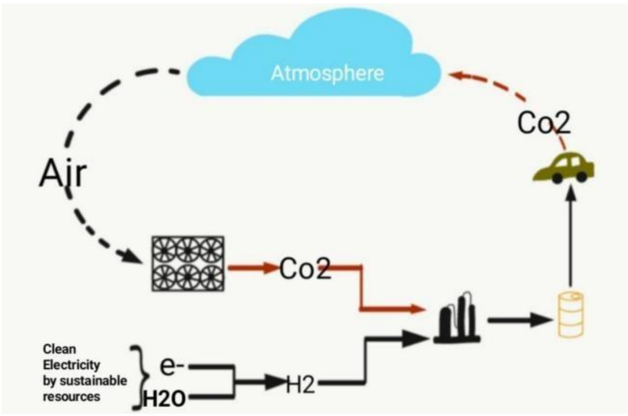

Fig -1: DCA Cycle

Data bank for density and viscosity of hydroxides and carbonates is found in the literature. Differentiation between temperatures and concentrations do not allow using data from literature alone. Literature review played an important role in shaping experimental and modeling work carried out in this work. CO2 absorption into hydroxides and carbonates of alkali metals, especially lithium,sodium and potassium,has been studied and used for several applications since the 20th century. Electrolyte parameters obtained from equilibrium modeling were used to calculate activitycoefficients for CO2 and OH-.

The technologies for CO2 capture directly from ambient air involve chemical absorption by strong bases like NaOH, KOH and Na2CO3. Alkali scrubbing of CO2 at atmospheric pressure is studied in semi-batch well stirred reactor. It was found that operation at pH value higher than 5.5 may lead to loss of caustic solution. The Shell, under-development, precipitating carbonate process (Moene et al., 2013) employs the carbonate to bicarbonate reaction for the absorption of CO2. The method is touted as a viable alternative to current carbon capture technology.

In reaction 1, water is freed and consumed, ensuring that the entire process is balanced. Each box illustrates a chemical reaction with an enthalpy of kilojoules per mole of carbon at STP, as well as the reaction number for future reference.

5. MATERIAL SELECTION

Key feature for the selection of KOH and stainless steel 316 for our proposed work: -

1) KOH: -
   a) Highly soluble in water.
   b) Only reactive with CO2.
   c) Better thermal stability.
   d) Economical chemical.
   e) Less harmful for human race.
2) Stainless steel 316: -
   a) Reactance of KOH is excellent.
   b) Corrosion resistance.
   c) Good mechanical properties
   d) High temperature resistance.

6. DESIGN / MODEL

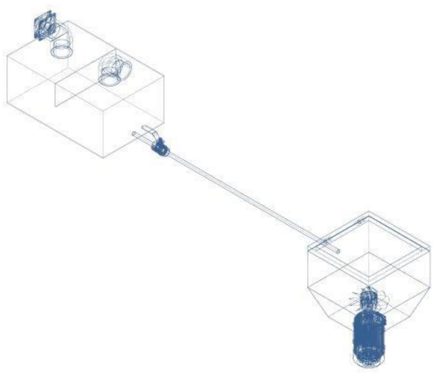

Fig -2: Wire frame Diagram of DAC

Fig -3: Front View of DAC

Fig -4: Top View of DAC

7. CONCLUSIONS

Carbon Engineering intends to build large-scale direct air capture facilities, and this prototype was designed to be the smallest representative unit of the air contactor in our full- scale design. Our unique and cost-effective contactor shape has been proven by the successful operation of this OC prototype with over 1000 hours of CO2 capture.

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