

Carbon Dioxide Sequestration

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Extended Abstract

The prospect of global warming is a matter of genuine public concern. The concentration of carbon dioxide in the atmosphere has been increasing since industrialization in the 19th century and consensus is forming that mankind is having a visible impact on the world's climate. It is generally acknowledged that the most important environmental impact of fossil fuel burning is an increased global warming from the buildup of greenhouse gases in the atmosphere. This warming occurs when added greenhouse gases trap more of the earth's outgoing heat radiations.

There is a wide consensus from extensive research in the last three decades that rapid climate change is already happening, that global average temperatures are increasing at unprecedented rates. In parallel, CO₂ emissions from anthropogenic sources have also been increasing in the same time frame and these are known to produce greenhouse effect.

The greatest contributor to global warming over the past century has been carbon dioxide. Of all the greenhouse gases present in the atmosphere CO₂ holds 82%. It is the major greenhouse gas vented to the atmosphere due to human activities. CO₂ is produced mostly from deforestation, emission from subsurface reservoirs and fossil fuel burning in automobiles, industries etc.

To mitigate climatic changes it is necessary that carbon dioxide should be removed from the atmosphere. One of the methods for the removal of carbon dioxide from atmosphere is carbon dioxide sequestration also known as carbon capture and storage. In CO₂ sequestration the carbon dioxide produced is captured and then stored in the geologic traps of oil and gas present in the subsurface for geologic period of time.

CO₂ sequestration consists of following steps:

- Capturing of carbon dioxide at its source or from the atmosphere where its concentration is high.
- Transporting the captured CO₂ to the depleted oil or gas well.
- Pumping of CO₂ in the reservoir where it is stored for millions of years.

As carbon dioxide moves away from the source its concentration in the atmosphere decreases due to which the capturing of CO₂ from the atmosphere becomes very difficult. The most convenient method is to capture CO₂ at its source of formation like industrial burners etc. Following are the three methods for the capturing and separation of CO₂ from other gases:

- Post-combustion (flue gas separation)
- Pre-combustion

- Oxy-fuel separation

After injection of CO₂ in the reservoir, it is trapped in the reservoir and the trapping of CO₂ can be due to:

- Hydrodynamic trapping
- Solubility
- Mineralization
- Phase trapping

During the trapping process the permeability of the reservoir is affected. Due to changes in the permeability the Injectivity of CO₂ is affected. Injectivity 'I' is defined as the ratio of well's volumetric flow rate 'q' to a characteristic pressure drop or flow potential 'ΔP' given by the following equation:

$$I = \frac{q}{\Delta P}$$

In this paper the effect of carbon dioxide injection on the permeability of different reservoirs is discussed.

Permeability is a very important parameter during CO₂ sequestration. Permeability will be responsible for the amount of CO₂ that can be stored and the time which will be taken to pump it. Pressure drop in the reservoir during injection is affected by the permeability of the reservoir.