

Carbon Sequestration

Using Teledyne Isco Syringe Pumps

Syringe Pump Application Note AN13

Overview

Reducing greenhouse gases such as carbon dioxide to combat global climate change has become an increasing concern. Possible ways to reduce these gases include:

- Improving process efficiencies
- Using low carbon fuels
- Carbon sequestration

Carbon Sequestration Strategies

Carbon sequestration can involve either of the following concepts:

- Direct—Removal of greenhouse gases from the generating source (i.e., automobiles, power plants, and industrial processes)
- Indirect—Removal of greenhouse gases from the air for storage in reservoirs, oceans, or terrestrial ecosystems

Ongoing research includes both direct separation, capture, and storage, and indirect terrestrial or ocean storage. CO₂ can be stored in such places as depleted oil reservoirs, coal seams, deep saline reservoirs, and shale formations.

Enhanced Oil Recovery (EOR)

CO₂ sequestration can be accomplished as an enhanced oil recovery technique, where CO₂ is pumped into oil reservoirs to maintain production levels of crude oil. This is very cost effective, given the benefit of increased oil production.

Enhanced Coal-Bed Methane (ECBM) Recovery

Methane recovery through CO₂ injection into coal beds is another promising method of sequestration. As with EOR, the value-added benefit of energy revenue offsets the costs of sequestration.

Saline Reservoir Injection

The injection of CO₂ into deep saline aquifers has many advantages. The storage capacity of these geologic formations is very large; aquifers in the United States alone have been estimated at up to 500 billion tons of CO₂. In addition, large saline reservoirs are easily accessible by most major producers of CO₂ in the U.S.

Elsewhere in the world, companies participating in greenhouse gas emission reduction or emissions trading may stand to earn emission reduction points and/or tax savings, offsetting the costs of employing green technologies.

Research

Studies are underway in the areas of direct and indirect sequestration, and of long-term storage and value-added energy recovery methods.

Experimental Procedures

Current research concerns the amount of CO₂ movement in the geologic formation into which it is injected, and how CO₂ injection and storage impact the integrity of the formation.

The diagram in Figure 1 depicts a test setup replicating conditions found in a deep saline aquifer to determine its potential for long-term carbon storage.

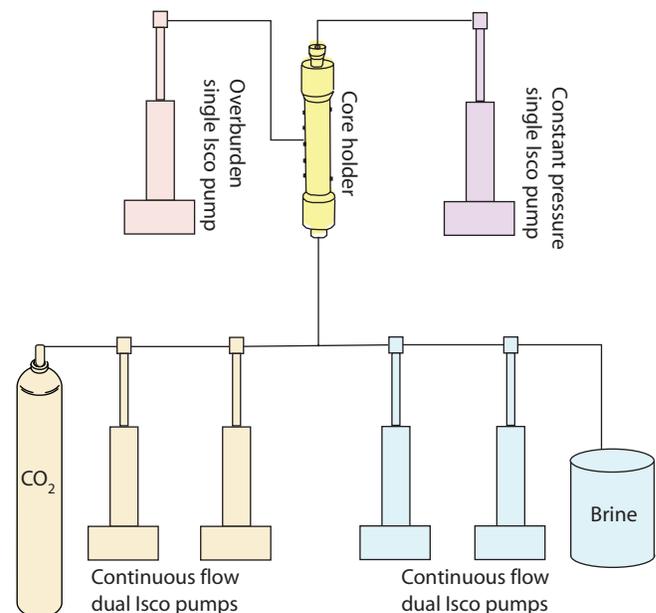


Figure 1: Modeling CO₂ distribution and transport
In a saline reservoir formation

Teledyne Isco Pumps

Teledyne Isco Syringe Pumps are excellent CO₂ pumps, and can be used in CO₂ sequestration experiments to duplicate the fluid and pressure conditions present in geologic formations. These high precision

pumps are very effective with low and high flow rates. They deliver precise pulse-less flow, and can operate in either constant flow or constant pressure mode.

Table 1: Recommended Isco Pumps

Model	260D	500D	500HP
Flow Range (ml/min)	0.001 - 107	0.001 - 204	0.001 - 204
Pressure Range (psi)	0 - 7,500	0 - 3,750	0 - 5,000

REFERENCES

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- 3) Stanford University. 2007-2008. Global Climate & Energy Project. 1 May 2008 <<http://gcep.stanford.edu/>>.
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Last modified September 30, 2008

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