Carbon Sequestration

Using Teledyne ISCO Syringe Pumps

TELEDYNE ISCO
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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. CO_2 can be stored in such places as depleted oil reservoirs, coal seams, deep saline reservoirs, and shale formations.

Enhanced Oil Recovery (EOR)

CO_2 sequestration can be accomplished as an enhanced oil recovery technique, where CO_2 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 CO_2 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 CO_2 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 CO_2. In addition, large saline reservoirs are easily accessible by most major producers of CO_2 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 CO_2 movement in the geologic formation into which it is injected, and how CO_2 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.

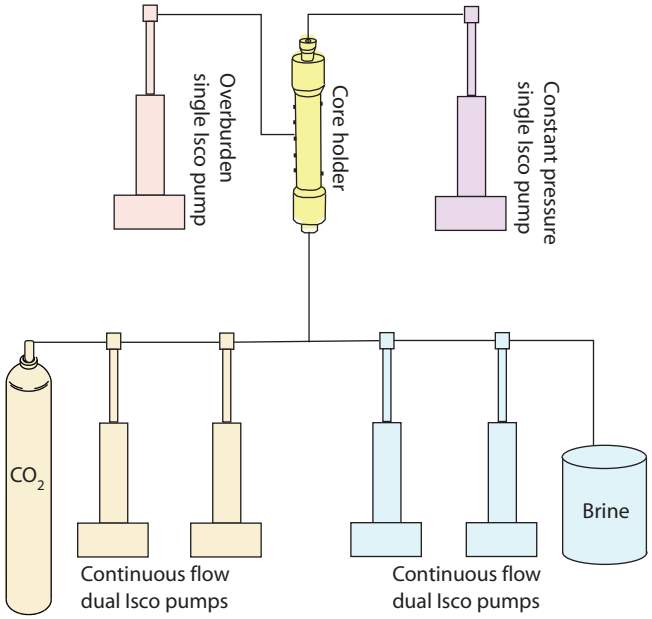

Figure 1: Modeling CO_2 distribution and transport

In a saline reservoir formation

Teledyne ISCO Pumps

Teledyne ISCO Syringe Pumps are excellent CO_2 pumps, and can be used in CO_2 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	260x	500x
Flow Range (mL/min)	0.001 - 107	0.001 - 204
Pressure Range (psi)	0 - 9,500	0 - 5,000

REFERENCES

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

4) Jia, Annie. "Researchers examine carbon capture and storage to combat global warming." Stanford News Service 13 June 2007. Stanford University. 29 Feb. 2008 <http://news-service.stanford.edu/news/2007/june13/carbon-061307.html>.

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Product model names have been updated in this document to reflect current pump offerings.

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