

FY07-LXI (61)-154

“Development of Biomimetic Membranes for Near-Zero PC Power Plant Emissions”

Submitted by: Carbozyme Inc.

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PARTICIPANTS

<u>Sponsor</u>	<u>Cost Share</u>
U.S. DOE	\$4,799,475
Carbozyme	\$ 130,049 (\$28,449 in-kind)
Siemens	\$ 41,679 (\$30,218 in-kind)
Novozymes	\$ 256,983 (\$74,926 in-kind)
Visage Energy	\$ 94,442 (\$44,642 in-kind)
SRI	\$ 44,063 (\$12,197 in-kind)
KES	\$ 16,400
Cogentrix Energy	\$ 72,000 (in-kind)
Otter Tail Energy	\$ 30,000
Great River Energy	\$ 30,000
MDU	\$ 30,000
OLI Systems	\$ 24,150
NDIC	\$ 260,000
Total Cost	\$5,832,241

Project Schedule – 3 years
Contract Date – 8/6/07
Start Date – 7/1/07
Completion Date – 12/31/09

Project Deliverables:
Status Reports:
10/1/07 (✓); 4/1/08 (✓);
10/1/08 (✓); 4/1/09 (✓);
Final Report: 1/31/10 ()

OBJECTIVE / STATEMENT OF WORK:

Evaluate and demonstrate the ability of a contained liquid membrane permeator to capture CO₂ from flue gas produced during the combustion of lignite.

STATUS

March 28 – September 30, 2007. A multi-step process was taken to identify the specific flue gas compositions. Lignite coals from three North Dakota mines were included in the flue gas analysis. A polishing scrubber would be needed and designed to reduce the SO_x to manageable levels for the liquid membrane permeator. Enzyme development tests are being designed. Discussions have commenced with prospective membrane manufacturers. Permeator scale-up design was started relative to heat transfer. A kick-off meeting with DOE was conducted in June.

October 1, 2008 – March 31, 2008. A report giving flue gas compositions for various coals and power plants was completed. EERC completed the design and ordering, and started the installation and construction of the pre-treatment scrubber. Enzyme immobilization onto a polypropylene surface was achieved. Novozymes produced a candidate enzyme for the HFCLM and has sufficient quantity with which to begin permeator testing. A relationship was established with preferred membrane/module supplier. A 3-tubesheet test module for the permeator was completed and tested. All legal agreements with subcontractors were executed.

April 1, 2008 – September 30, 2008. EERC began fabricating and installing the pre-treatment scrubber. Enzyme providers have been identified and have submitted samples for testing. Researchers achieved a substantial increase in the duration and percent of immobilized enzyme activity that could be retained on a membrane surface. Successfully constructed and tested a 0.5 square meter 6-tubesheet permeator.

October 1, 2008 – March 31, 2009. EERC completed fabrication, installation and testing of the pretreatment scrubber. New sources for thermophilic enzymes were developed. An approach was developed for immobilizing thermophilic carbonic anhydrase onto an activated polymer membrane *in situ* and *ex situ*. An agreement was signed with Celegard/Membrana to be the membrane manufacturer. Testing continued to design membranes.