FY07-LXI (61)-155

"Activated Carbon Production from North Dakota Lignite – Phase IIA"

Submitted by: EERC
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PARTICIPANTS

Sponsor	Cost Share
U.S. DOE	$277,821
BNI Coal	$290,348
NDIC	$290,348
Total Cost	$858,517

Project Schedule – 9 Months
Contract Date – 6/19/07
Start Date – 7/1/07
Completion Date – 3/31/08

Project Deliverables
Status Reports:
9/30/07 (✓); 12/31/07 (✓)
Draft Final Report: 4/30/08 (✓)
Final Report: 5/31/08 (✓)

OBJECTIVE / STATEMENT OF WORK:

The project is designed to: 1) establish the technical feasibility of manufacturing high-quality mercury sorbents from North Dakota lignite using a pilot multiple-hearth furnace for producing activated carbons (ACs); and, 2) examine the effectiveness of pretreatment of the produced ACs to generate the enhanced carbons for mercury control in a variety of coal-derived flue gas environments.

STATUS

July 1 – September 30, 2007. Activities during the quarter focused on Task I. Particles of lignite in three sizes were exposed to rapid heating at three temperatures to compare decrepitation and particle size. Ten tests were performed and results documented.

October 1 – December 31, 2007. Activities during the quarter focused on Task III – Carbon Resource Assessment. A review of the industry and regulatory environment was initiated. Estimates of the AC demand along with the AC supply were reviewed. Commercial bookings for mercury control equipment were reviewed and a competitive analysis was initiated.

Final Report. The project team produced activated carbon in a pilot-scale multiple-hearth furnace and processed the activated carbon for enhanced mercury control, tested several enhanced carbons against benchmark activated carbons, and performed a carbon resource assessment. The pilot-scale rotary kiln activated carbon production process, achieved in Phase I of the project, was successfully upgraded to a 5-hearth multihearth furnace (MHF) system producing high surface-area activated carbon at a rate of 25 lb/h. The carbons were prepared, ground, and subsets enhanced with various proprietary formulas for comparison to other enhanced carbons used for mercury control. The carbon resource assessment process was conducted through Internet searches, printed literature review, and industry interviews, including industry overview, market assessment, supply and demand, regulation, legislation, competitive analysis, and market barriers and opportunities.

The 5-hearth MHF system streamlined the process from a two-stage semibatch production mode producing 3 lb of activated carbon in 2 hours to a continuous system producing high surface-area activated carbon, with iodine numbers over 600 mg I_2/g, at a rate of 25 lb/h. The enhanced activated carbons produced from North Dakota lignite were superior to commercial DARCO® Hg-LH for mercury removal (85% vs. 68%) and improved mercury control by seven times over native capture in a pilot-scale application firing Powder River Basin subbituminous coal at a sorbent injection rate of 5 lb/Macf. The sorbents produced in the MHF attained 85% mercury removal, whereas native capture by the system was only 12%. Less than half of the amount of enhanced North Dakota carbon (1.6 lb/Macf) was needed to achieve 60% more mercury removal over native capture vs. DARCO Hg-LH (4.1 lb/Macf). In addition, the activated carbon produced from North Dakota lignite improved ash performance in an ash-foaming test while attaining better mercury removal than DARCO Hg-LH. The carbon resource assessment indicated a strong emerging market for mercury control. The opportunities for the activated carbon market are based on the emerging markets for sorbent for mercury control, federal regulations, and regulations in progressive states. New coal-fired power plants are specifying activated carbon injection for mercury control, and many existing plants in regulated states have determined that they will use activated carbon injection. Barriers to the market include mercury capture while producing an ash by-product that meets the needs of the reuse market, time constraints for new market entrants trying to respond to the demand, and other competing technologies**.** Those who are able to overcome the barriers will find significant opportunity.

The activated carbon produced from North Dakota Center lignite represents a viable and competitive product in the market with low-price leadership being a major competitive strategy. A significant demand for activated carbon is anticipated, particularly enhanced activated carbon. The market environment is most promising for suppliers who are ready for market, and a significant opportunity exists for ash-friendly sorbents. Overall, there is an opportunity for activated carbon as a sorbent for mercury control for coal-fired utilities.