CLEAN PRODUCTION OF COKE FROM WASTE CARBONACEOUS FINES

Quarterly Report for the Period July - September 1999

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Milestones

Task 1. Feedstock acquisition and analysis

During the previous reporting period, adequate supplies of coke breeze, petroleum coke fines, and coal fines to perform the required testing were identified and acquired. Coke breeze was obtained from the coking operations at Geneva Steel in Provo, Utah. Petroleum coke was acquired from the Chevron USA refinery in North Salt Lake City, Utah. Coal fines were received from Covol Technologies, Inc. of Lehi, Utah. Each of these feedstock materials was analyzed for proximate and ultimate analyses (see Table 1).

Table 1. Proximate and ultimate analysis of feedstocks (as received basis).

Parameter	Coke Breeze	Petroleum Coke	Coal Fines
Ash	12.7	0.31	7.01
Moisture	0.4	7.6	12.9
Fixed Carbon	84.34	82.9	46.19
Volatiles	2.56	9.19	33.90
Carbon	84.85	87.04	65.96
Hydrogen	0.3	4.2	6.0
Nitrogen	1.4	1.1	1.6
Oxygen	<0.1	5.6	18.7
Sulfur	0.75	1.75	0.73
Heating value (Btu/lb)	12,231	14,705	11,581

Facilities for performing pyrolysis testing and tar processing were assembled. A vertical tube furnace had been modified and fitted with an Inconel vessel to be used in the briquette calcining operations.

During the current reporting period coal pyrolysis tests were completed using the above mentioned furnace system. Important to these tests was the collection and analysis of tars and pyrolysis gases obtained from heating the coal under inert conditions. The alternative coking process under investigation utilizes the collected tars as a binder and the fuel-rich gases as process fuel.

During these tests it was discovered that the shell and tube condenser was not very effective at condensing tars which exited the Inconel vessel as a fume. As a result, a spray-type condenser was fabricated and installed which proved to have superior performance and was used for the remainder of the testing.

The collected tars were analyzed for quinoline insoluble (QI) content, elemental composition, and proximate analysis. Non-condensable gases were collected and analyzed using gas chromatography. Test results for the tar and gas are shown in Tables 2 and 3 respectively.

Table 2. Analysis of tars collected from pyrolysis tests.

Parameter	Result (wt %)
Carbon	84.4
Hydrogen	7.1
Nitrogen	1.5
Oxygen	3.8
Sulfur	0.59
Fixed Carbon	18.6
Volatiles	80.8
Ash	0.6
QI	3.5

The test results indicate that the collected tar is excellent for chemical feedstock or fuel. However, tar higher in fixed carbon or QI content is desired for use as a binder for this process. This is because, during the calcination process, the tar volatiles escape, leaving a fixed carbon matrix behind to encapsulate the coke and coal fines. Therefore, some processing of this particular tar would be undertaken prior to use as a binder. Proprietary process development is currently underway to cross-link the tar structure resulting in higher fixed carbon values.

Table 3. Analysis of gases collected from pyrolysis tests.

Compound	Result (Vol %)
Hydrogen	49.0
Oxygen	0.266
Nitrogen	3.0
Methane	21.9
Carbon Monoxide	11.59
Carbon Dioxide	4.70
Ethylene	2.86
Ethane	1.66
Acetylene	0.028
Hydrogen Sulfide	0.151
Carbonyl Sulfide	<0.005
Propane	1.52
n-Butane	1.150
iso-Butane	0.413
Hydrogen Cyanide	0.621
n-Pentane	0.022
iso-Pentane	<0.005
Carbon Disulfide	<0.005
Benzene	0.197
Heating Value	604 BTU/cu.ft.

This completes all proposed activities outlined in the proposal under Task 1.

Task 2. Experimental test apparatus set-up

As described in the previous Quarterly Technical Progress Report, Task 2 was completed during the previous reporting period. No activities remain as part of the Task.

Task 3. Briquette/block manufacture and testing

Coke briquette manufacture and testing are currently underway. Parametric variation in coke particle size, coke type, and binder quality and amount are being investigated. Resulting coke product is being tested for crush strength, proximate composition, specific gravity, coke reactivity, and strength after reaction. This testing will continue through the up coming reporting period.

Task 4. Establish criteria for process facility

Work on this task is scheduled to begin during the ninth month of the award period.

Task 5. Perform preliminary economic analysis

Some economic information regarding available market types, market sizes, and requirements is currently being obtained which will be used in the preliminary economic analysis. Completion of this task is scheduled for the final quarter of the project.

Task 6. Reporting

This report summarizes the current progress of the project. Additional reports will be prepared as they are required.

Schedule and Budget

The project is considered to be on schedule and within budget. Tasks 1 and 2 have now been completed. Work on Task 3 is well underway and is scheduled to be completed by the end of the third quarter of the project.

Personnel

No key personnel changes have been made or are anticipated.

Month

Month