DE-FG22-94PC94211

Co-firing High Sulfur Coal With Refuse Derived Fuels

Technical Progress Report #11

Wei-Ping Pan, John T. Riley, and William G. Lloyd
Materials Characterization Center
and
Department of Chemistry
Western Kentucky University
Bowling Green, KY 42101

May 31, 1997

This report was prepared with the support of the U.S. Department of Energy, Grant No. DE-FG22-94PC94211. However, any opinions, findings, conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the view of the DOE. US/DOE patent clearance is not required prior to the publication of this document.

DISCLAIMER

The objective of this quarter of study was to prepare fuel pellets containing PVC, newspaper and plastics to be co-fired with coal in the AFBC combustor. The Western Kentucky University atmospheric fluidized bed combustion system requires the fuel to fall from a bunker into a lock-hopper, and from there into a mixing box where the fuel is auger-fed under pressure into the bottom of the fluidized bed. The fuel must flow freely out of the bunker and through the lock-hopper for proper feeding into the combustor. In order for the fuel to continuously fall through these units and into the mixing box during combustion, the density of the fuel and the size of the particiles must meet certain requirements. The particles must be no larger than 3/8 inches in diameter and must have a density approaching that of coal. Loose materials such as sawdust, shredded paper products and most shredded plastics do not feed properly in the WKU AFBC system. Bridging and blockage of feed chutes result, even with constant vibration of parts of the feed mechanism. It is not possible to run the AFBC system powered solely by these loose materials.

Attempts have been made at Western Kentucky University to prepare pelletized refuse derived fuels suitable for use in the laboratory AFBC system. This study has been ongoing for several months and has been centered around the use of a model 2298YA California Pellet Mill. The study has included the following evaluations:

- evaluation of particle sizes of paper, plastic and other waste materials suitable for pelletizing;
- evaluation of the use of binders;
- evaluation of the use of combinations of materials.

Initial pelletizing studies were done with materials with particle sizes approximately 1-½ inches in diamater. The waste materials were prepared by grinding in a chipper mill obtained from a local hardware store. These particle sizes were too large and would bind in the dies of the pelletizing mill. Wetting the refuse did not reduce the binding. Adding a pellet binder (starch) also produced unsatisfactory results.

Studies using ground waste materials (approximately 1-1/2 inch particle size) with sawdust (1/4 inch particle size) were not successful. It was assumed the harder sawdust particles would help feed the larger waste produced through the auger into and out of the die or the pelletizing mill. This did not work and materials would bind in the dies. Both 1/4 inch and 3/8 inch dies were used in the experiments.

A series of experiements were then conducted in which the waste material was ground to about 1/16 inch particle size using a Brinkman model cutting mill. This size particle would feed through the pelletizing mill, but it took more than an hour to grind about 200 grams of material. To grind enough material to this size for use as a fuel in the AFBC system would be impractical because of the weeks of grinding required.

A series of experiments were then conducted in which the waste material was ground to about ½ inch particle size using the Brinkman cutting mill with a screen we made in the College shop. This provided what we believe is the optimum particle size for use of waste materials as

fuel. However, experiments to prepare firm pellets of the material failed. Use of a wet slurry of material, a slurry and binder, a slurry with sawdust, a slurry with starch binder and sawdust a slurry with a binder and -8 mesh coal (which is about 1/8 inch top size) were all unsuccessful. Attempts to prepare pellets with both the 1/4 inch and 3/8 inch dies were unsuccessful. Most of the materials would bind between the auger feed and the race pressing the materials through the dies.

The results of the pelletizing experiments lead us to conclude we can not make 1/4 inch or 3/8 inch pellets from the waste paper prpducts and plastic materials with our California pellet mill. Therefore, we have designed a series of experiments in which the waste materials will be ground to about 3/8 inch size with the Brinkman cutting mill. The materials will then be thoroughly mixed (by hand) with the -4 mesh coal we have prepared for the combustion runs. The materials will be weighed, combined, and thoroughly mixed before firing in the AFBC system. The AFBC test runs have been scheduled for June 30 and July 3.

Report Number (14) DOE/PC/94211--T12

Publ. Date (11) 19970531

Sponsor Code (18) DOE/FE, XF

JC Category (19) UC-101, DOE/ER

DOE