

PILOT SCALE PRODUCTION AND COMBUSTION OF LIQUID FUELS FROM REFUSE DERIVED FUEL (RDF) - PART II

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ABSTRACT

EnerTech is developing a process for producing pumpable slurry fuels, comparable to Coal-Water-Fuels (CWF), from solid Refuse Derived Fuels (RDF). Previous reports (Klosky, April 1995 and Klosky, October 1995) have described the characteristics of the enhanced carbonized RDF slurry fuels. This paper summarizes those fuel characteristics and reports on the latest combustion tests performed with the final product fuel.

The objective of this research was to determine the boiler and emission performance from the carbonized RDF slurry fuel using statistical screening experiments. Eight combustion tests were performed with a pilot scale pulverized coal/oil boiler simulator, with CO, SO₂, and NO_x emissions determined on-line. The combustion tests produced simultaneous CO and NO_x emissions well below and SO₂ emissions comparable to the promulgated New Source Performance Standards (NSPS). This research will form the basis for later combustion experiments to be performed with the carbonized RDF slurry fuel, in which dioxin/furan and trace metal emissions will be determined.

INTRODUCTION

In 1993, the U.S. generated approximately 207 million tons of Municipal Solid Waste (MSW), with 62% landfilled, 22% recycled, and 16% processed through Municipal Waste Combustion (MWC) (EPA 1994). In order to divert a larger portion of this generated MSW from landfills, MWC will have to play a growing role in MSW disposal. However, recently promulgated NSPS (EPA, October 1995) will add an additional financial burden, through mandated emission reductions and air pollution control technologies, to an already financially troubled MWC industry.

In the past, RDF, a solid fuel produced from MSW, has been fired in coal boilers as an alternative means of MWC. While lower sulfur dioxide (SO₂) emissions provided the impetus, firing RDF in coal

boilers suffered from several disadvantages including increased solids handling, increased excess air requirements, increased air emissions, increased slag formation in the boiler, and higher fly ash resistivity.

Bituminous and higher rank coals can generally be slurried to pumpable fuels of satisfactory solids loading, and hence heating value. These slurry fuels, sometimes termed Coal-Water-Mixtures (CWM) or CWF, have been and still are commercially fired in pulverized coal (pc-) and oil boilers. However, low rank solid fuels, like RDF, do not slurry as well. Supported by the Department of Energy (DOE), Environmental Protection Agency (EPA), and National Science Foundation (NSF), EnerTech has developed a process called SlurryCarb™, which greatly improves the solids loading, heating value, chlorine content, and uniformity of RDF slurry fuels. The enhanced RDF slurry fuels can be effectively fired in pc- or oil boilers without the previously cited disadvantages.

With EnerTech's SlurryCarb™ process, a pumpable slurry of RDF is continuously pressurized with a pump between approximately 1200 and 2500 psi. The feed RDF slurry is pressurized above the saturated steam curve, in order to maintain a liquid state when the slurry is heated above its normal boiling point. From the pump, the pressurized slurry is heated by indirect heat exchange to approximately 480 to 660°F, with its pressure and temperature maintained for less than 30 minutes.

At this temperature and pressure, oxygen functional groups in structures of the RDF are split off as carbon dioxide gas. This removed carbon dioxide gas comprises a significant weight percentage of the feed RDF, but only a minimal percentage of the heating value. While the mass of total solids are reduced approximately 20-70%, the carbonized product still contains approximately 95-98% of the energy content of the feed RDF. The carbonized RDF particles are dramatically reduced in size and can be concentrated to a solids loading, and hence heating value,