RESEARCH ABSTRACT

ENVIRONMENT

Title: Thermochemical Conversion Process to Produce Oil from Swine Manure – **NPB #06-102**

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Scientific Abstract

Thermochemical conversion (TCC) is a chemical reforming process of organic polymers in a heated enclosure, usually in an anoxic or very low oxygen environment. The products are liquid oil, char, and gases, depending on operating conditions. Unlike pyrolysis, which requires dried feedstock, the TCC process in this study treats the manure slurry directly. The major end product in this process is liquid oil. TCC technology has been studied using feedstock such as coal and wood sludge since the oil crises in the 1970's, but the technology was not sustained due to the low fossil oil prices and high cost of the feedstock. The TCC process, has been applied to the processing of livestock manure − a costless feedstock, not only for renewable energy production but also for waste reduction and treatment.

In our first stage research, a batch TCC reactor was developed and a systematic investigation on process parameters, including operating temperature, type and initial pressure of process gases, retention time, total solids content and feedstock pH levels, was conducted. The process was evaluated in terms of oil production efficiency and waste reduction efficiency, and the oil product was analyzed for its benzene solubility, elemental composition, and heating values. The key factors of the TCC process were found to be the operating temperature, the retention time, and the addition of a process gas. Processed with carbon monoxide between 15-30 minutes at temperatures of 295°C to 305°C an average of 62% wt of the volatile solids (or 54% wt of the total solids) was converted to oil product, COD was reduced by 60 to 70%. At optimum operating parameters, 80% wt of volatile solids (or 70% wt of total solids) were converted to oil, of which 80% had a heating value between 32,000 and 36,700 kJ/kg.

Biomass conversion studies in the early 1970's showed that conversion of wood sludge into renewable energy was technically sound, but not economical (Jones and Radding, 1980), primarily due to the low price of fossil oil and high cost of feedstock (wood sludge). Economic evaluations by the University's licensee for commercialization of the technology suggest that the TCC technology may be economically feasible once the design and operations are perfected for production scale applications.