REFUSE CONVERSION TO METHANE (RefCOM):  
A Proof-of-Concept Anaerobic Digestion Facility

DONALD K. WALTER and CHARLOTTE RINES
U.S. Department of Energy
Washington, D.C.

Discussion by

Donald L. Klass
Institute of Gas Technology
Chicago, Illinois

Gasification of urban refuse offers several advantages over disposal alone. Disposal combined with recovery of recyclable commodities such as metals and glass and energy recovery in the form of methane, the main fuel component of natural gas, should permit operation at lower overall costs and possibly even at a modest profit [1]. Further, urban refuse gasification generates the fuel in areas where it is most needed. When biological gasification is used, as with RefCOM, the residual digested solids can provide by-products for fertilizer and possibly animal feed applications. Also, since sewage sludge can supply the necessary additional nutrients to give a balanced refuse-sewage sludge feed blend capable of maintaining the anaerobic digestion process without the external addition of costly chemical nutrients, partial credit can be taken for sludge disposal too.

This paper presents a good summary of the background of the RefCOM project and provides some insight of the start-up and operating problems of the plant. This is the first demonstration-scale plant of its type in recent times. The operating data and gas production results will be quite useful for future development of anaerobic digestion processes for municipal solid waste-sewage sludge blends. Perhaps the authors now have the baseline data at mesophilic temperatures from the 1979 runs compiled and can present a summary of the results in the discussion volume.

The laboratory work of Dr. J. Pfeffer is cited as the basis of projected methane yields in the plant; 3,000 ft$^3$ (85 m$^3$) of methane/input ton of raw refuse is used for these projections. Although this yield figure appears to be low, based on other reports and the average energy content of refuse, it is important to emphasize that a portion of the product gas is used for digester heating which will reduce the amount of methane available for sale. This is especially important if digestion at higher thermophilic temperatures (55-60 C) is used; 57 C is reported to be the expected optimum temperature for RefCOM [2]. The in-plant fuel requirements and methane yields will determine whether a commercial plant can operate at a net energy gain.

REFERENCES


The paper describes the experimental, design, and operational considerations which have led to the construction of the 50-100 tons per day proof-of-concept anaerobic digestion facility now converting MSW to methane in Pompano Beach, Florida. At the time the paper was prepared, significant mechanical problems had precluded the gathering of representative data with respect to the bioconversion system. Nevertheless, initial results are encouraging and with the mechanical problems now behind them, it can be expected that the authors will soon be able to provide more insight into the overall feasibility of the process. In the meantime, the paper serves a very important function in identifying for the design profession the many practical problems — and solutions — which still face the resource recovery industry.

Two aspects of the paper warrant clarification. MSW is obviously a highly heterogeneous mixture of organic and inorganic materials, and no single series of chemical reactions can describe the anaerobic breakdown process, as the authors point out. Many workers in the field have found it useful, however, to focus on the breakdown of cellulose as a model. Cellulose is hydrolyzed in the presence of cellulase enzymes to glucose. In the second stage of the process, acid forming bacteria produce a mixture of organic acids, particularly acetic acid. Amino acids, cited in the paper, would not generally be produced in significant quantity. The third stage of the process results in the production of ammonia.

In reviewing the comparative advantages of mesophilic and thermophilic conditions, minor clarification is desirable. Because of the higher metabolic rate of the thermophilic microorganisms, the higher temperature reactors are generally considered to be less stable and more difficult to control. Thus, although regeneration of population is more rapid after a partial souring, souring can take place much more rapidly. Mesophilic digesters in general are easier to start up and operate. The potential higher rates under thermophilic conditions, nevertheless, warrants the extensive comparative studies which the authors describe.

RefCOM offers significant potential to produce a premium fuel from MSW. We are pleased to see that the start-up problems associated with the proof-of-concept experimental facility are largely behind us now. We look forward to reviewing future presentations as the experimental program proceeds.