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Abstract

This research focuses on advancing the knowledge of a catalytic gasification process as a potential in-situ resource utilization and waste management alternative. This research has significance in a variety of engineering applications, but it is of particular relevance towards reducing landfill waste or as an in-situ resource generation system for space exploration beyond Low Earth Orbit (LEO).

This process evolves through a reaction mechanism consisting on two liquid-phase oxidation reactions of long-chain polymers, complemented by two gas-phase reactions. This project focusses on one of the gas phase reactions: one of the main fuel producing reactions, the Sabatier (also referred to as "methanation") reaction. The primary focus of this project is to analyze experimental data collected for this reaction, and to determine the kinetic parameters of the Sabatier reaction.

The research is an outgrowth to previous kinetic determinations available for the reaction. Indeed, the data used to perform the kinetic analysis was originally collected by Lunde and Kester in the 1970s (*Ind. Eng. Chem., Process Des. Dev., Vol. 13, No. 1, pp. 27-32, 1974*). The kinetic analysis presented here is based on fundamental reactor design equations and was accomplished using numerical techniques not readily available at the time of Lunde and Kester's analysis. The experimental data was split into two sets of data: one set used for parameter estimation, and second set to be used for validation purposes. Comparison with the original approach followed by Lunde and Kester is also provided.