

Public Abstract

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Department:Chemical Engineering

Degree:PhD

Title:Investigation of Supercritical Fluids for Use in Biomass Processing & Carbon Recycling

An apparatus was built in the Carbon Recycling Center to explore the continuous thermochemical conversion of biomass and model compounds in supercritical water. The apparatus was used to investigate gasification of biomass and other organics in supercritical water to produce fuel gases. It proved to be superior to other designs in conversion of low value feed to higher value fuel gases. The apparatus was capable of achieving both high gasification efficiencies and high gasification rates, a unique characteristic of supercritical water gasification units described in the literature.

As well as excellent conversion, innovations in both separations and feeding mechanisms are presented. Separations relevant to a biorefinery are explored with the motivation to increase purity and energy density of gasification products. Results indicate density driven separations between fuel gases and carbon dioxide at sufficiently high pressures and low temperatures, giving opportunity for carbon capture. In addition to separations, solid feeding is an important issue during biorefinery operation. A novel feeder was developed to continuously feed a variety of biomass and waste feeds into the high pressure reaction environment.