Characterization of Bio-oils from Jatropha Residues and Mixtures of Model Compounds

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ABSTRACT

This study analyzed the composition of actual bio-oils produced by fast pyrolysis of jatropha and compared these with model bio-oils prepared based on typical biomass as reported in the literature. Bio-oils were found to consist primarily of organic acids, phenols, ketones, and alcohols, which were modeled using acetic acid, phenol, acetone, and ethanol, respectively. Properties of both the real and model bio-oils were subsequently characterized. While the phy sico-chemical characteristics of these bio-oils varied widely, long chain acids, such as oleic and palmitic acids, accounted for over 70%. Real bio-oils had higher energy content, density, viscosity, acidity, and flash and pour points than the model oils, because of the variety of large and heavy molecules present in the real bio-oils compared to the light compounds were used to represent the model oils.

Keywords: Biomass, Fast pyrolysis, Fuel property, Renewable energy

INTRODUCTION

Biomass offers an abundant and environmentally friendly source of clean energy that can help mitigate greenhouse gas emissions (Chen et al., 2014). For liquid fuel production, Biomass can be converted to liquid fuel in a number of ways (Bridgwater, 2012), with fast pyrolysis a promising one (Pattiya et al., 2007; Jaroenkhasemmeesuk; Tippayawong, 2015).

Fast pyrolysis is a thermal decomposition process occurring in a continuous flow system in the absence of oxygen (Laird et al., 2009). Bio-oil is the main product from fast pyrolysis. Direct applications of bio-oils are mainly limited by their high viscosity, high water and ash content, low heating value, instability, and high corrosiveness (Xui and Shahbaz, 2012). The unfavorable properties of bio-oils are caused by a complex mixture of water and various organic compounds, such as carboxylic acid, phenols, ketones, aldehydes, alcohols, and oxygenated oligomers that can react with themselves to form larger molecules. The properties