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Production of biocrude oil by waste biomass CatLiq process and characterization of oils

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The CatLiq process is a thermochemical conversion of wet biomass with process conditions at the critical point of water. This technology has similarities to other thermochemical conversion processes such as liquefaction, pyrolysis and gasification. But it cannot be classified exactly as one of these technologies. This process is a continuous process that takes place at supercritical point of water by using both heterogeneous and homogeneous catalysts. Seven different waste biomass samples, such as saw dust, black liquor, paper mill sludge, bark, cow manure, sewage and bio gasification sludge were subjected to CatLiq process. Biocrudes, gases and aqueous samples obtained from these processes were subjected to characterization tests. Biocrudes obtained from different waste biomass by CatLiq process were dark brown, free-flowing liquids and had distinctive odor. The densities of biocrude oils were ~1.10 g/m³, higher than the density of petroleum crude oils. Crude bio-oils was a complex mixture of several hundreds of organic compounds, mainly including acids, alcohols, aldehydes, esters, ketones, phenols, and lignin-derived oligomers. Some of these compounds are directly related to the undesirable properties of bio-oil. Raw bio-oils obtained from liquefaction of different kinds of waste biomass had very high water content, high viscosity and density and high oxygen content. The heating values of raw bio-oils were between 32.0-37.06 MJ/kg, lower than crude oil. Biocrude obtained from catalytic liquefaction of sewage sludge had highest heat of combustion (37.06 MJ/kg). It is obvious that waste biomass can be utilized to produce crude bio-oil and CatLiq process is a promising alternative technological pathway for the production of crude bio-oil. Crude bio-oils obtained from CatLiq process can be used as a combustion fuel in boiler/burner/furnace systems for heat generation, as a transportation fuel after upgrading, for the production of chemicals and resins (e.g., agri-chemicals, fertilizers, acids and emission control agents), also as a feedstock in making adhesives, e.g., asphalt bio-binders. Depending on feedstock, some crude bio-oils can be mixed with crude petroleum oil up to 3% and can be refined together using petroleum refinery systems. Altaca Energy has been running a pilot scale plant since 2011 on its premises in Turkey. Pre-commercial demonstration scale plant was constructed in Gönen, Balıkesir/Turkey and startup studies of this facility was planned to begin in the mid of 2015.

Biography

Parvana Aksoy is a Senior Researcher at the Energy Institute. She received her BS and MS from Department of Chemistry of Çukurova University/Turkey. She completed her PhD in the Department of Chemistry at Çukurova University in 2004. After receiving her PhD degree, she visited Penn State University where she conducted Post-doctoral research on the development of thermally stable jet fuels for 6 years. She did an extensive research on production of jet fuel from coal. She was also a Principal Investigator of industrial projects to make coal/petroleum based activated carbons and cokes. She also worked as a quality control manager at the private fuel testing laboratory AMSPEC LLC. She joined TUBITAK four years ago. She is still working at the Energy Institute as a Senior Researcher under the "Gasification and Combustion" group. Her research mainly based on production and upgrading of bio-oils, production of transportation fuels, gasification of coals and biomass.

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