Poster E17

Upgrading of Bio-Oil by Supercritical Fluid Extraction: Simulation and Economic Evaluation

Camila PEREIRA
Federal University of Rio Grande do Norte, Natal, PORTUGAL

✉camilagpereira@yahoo.com.br

New energy sources have been investigated in order to attend environmental requirements and the necessities of the world. Bio-oil is a liquid produced by the biomass pyrolysis, used as fuel for boiler, diesel engines, gas turbine, furnaces and other engines. Even with several advantages of bio-oil compared to the conventional fuels, such as higher energy density, lower cost for storage and transportation in comparison with biomass, it is necessary an additional treatment to be effectively used as transport fuel. The reason for that is the high content of water and the presence of different oxygenated compounds in its composition (organic acids, ketons, aldehydes, aromatics, etc.), making it one complex mixture. Several technologies have been developed to improve the quality of bio-oil, such as hydrodeoxygenation, catalytic cracking, conventional and molecular distillation, others. Supercritical fluid technology has shown an attractive alternative to upgrading the bio-oil by different ways: esterification and pyrolysis in supercritical alcohols, hydrodeoxygenation of phenols in supercritical hexane, and by fractionating using supercritical extraction. The high selectivity and the easy removal of solvent from the final extract are the most important advantages of the supercritical fluids. In this work, the supercritical extraction using carbon dioxide applied to the treatment of bio-oil from biomass pyrolysis was evaluated. Simulations were done at 318 - 338 K of temperature and 20-30 MPa of pressure. The composition of bio-oil was represented by three sets of components, containing oxygenated compounds such as guaiacol, furfural, acetylacetone, acetol, acetic acid, 2-hydroxyacetaldehyde and propanoic acid. Supercritical fluid extraction was compared with conventional process (multistep separation process). The results showed the quality of bio-oil improves with the use of the SFE technology, being the best results observed at 30 MPa and 338 K.

Comparing with other conventional treatments, SFE has shown to be economically feasible for obtaining a bio-oil with competitive price.