



High Pressure Homogenization (HPH) Method for Enhanced Stability of Bio-Oil

The Technology

The complex chemical composition of bio-oil tends to change during storage, transport and use. It is both a physical and chemical transition that can result in the breakdown and separation of bio-oil components. Traditionally, bio-oil storage problems have been controlled by creating mixtures with commercial surfactants (agents that reduce the tension of the liquid) and diesel fuel as emulsifiers. In this approach, the bio-oil is mixed with the surfactant and diesel fuel in a very low concentration (less than 10%). While this method improves the stability of the oil, it does nothing to improve the original properties of the bio-oil itself. Additionally, this method is expensive, costing approximately \$0.052/L to \$0.089/L at a 10% to 30% surfactant concentration, respectively.

Researchers at the University of Tennessee have developed a high pressure homogenization (HPH) process to enhance the stability of bio-oils produced for use in fuel applications. This method has been shown to significantly reduce the viscosity, solid content and mass average molecular weight of the bio-oil while not affecting the heating value, water content, density, pH or ash content. Further, the HPH treatment remarkably improves the bio-oil stability -- the increase in viscosity of oil homogenized at 100MPa was only 13.9% after storage at 40°C for 60 days, whereas the untreated oil viscosity increased 56% under the same conditions. The total operational cost for HPH processing has been estimated to be \$0.0102/L (based on increased power requirements). Therefore, HPH offers a lower cost alternative to traditional storage enhancement methods that not only increases the stability, but also improves the physiochemical properties of the bio-oil.

Benefits

- New lower cost method for enhancing bio-oil stability
- Produces improved physiochemical properties of treated bio-oil
- Reduces chemical additive requirements

The Inventor

Dr. X. Phillip Xe is an Assistant Professor in Biosystems Engineering and Soil Science at the University of Tennessee. Dr. Ye's group specializes in value-added bioprocess engineering and specifically works in the areas on converting biomass into industrial feedstock and products, applied and fundamental research to characterize and evaluate biological materials using advanced instrumentation (NMR/MRI, FTIR/FTNIR), modeling of transport phenomena in food and bioprocess engineering.

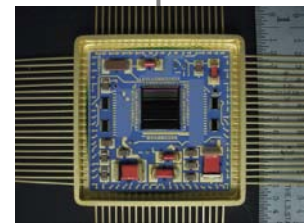
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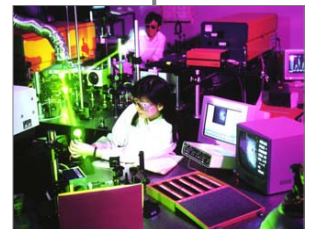
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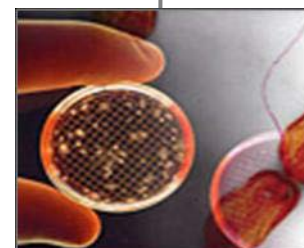
ENGINEERING



MATERIALS



MEDICINE





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Related Publications

He, R., X. P. Ye, F. Harte, B. English. 2009. Effects of High-Pressure Homogenization on Physicochemical Properties and Storage Stability of Switchgrass Bio-Oil. Fuel Processing Technology, Vol. 90, pg. 415-421.

Patents

EFFECTS OF HIGH-PRESSURE HOMOGENIZATION ON PHYSIOCHEMICAL PROPERTIES AND STORAGE STABILITY OF BIO-OIL. US Provisional application, Filed 6/28/08.

Contact

The University of Tennessee Research Foundation (UTRF) is a non-profit corporation responsible for commercializing University of Tennessee technologies and for supporting University research. UTRF is seeking parties interested in learning more about this technology and in exploring possible research and/or commercialization arrangements.

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