Title: An Integrated Sequential Production of Bio-Ethanol, Biodiesel and Briquette from Spent Coffee Ground

Muluken Eshetu Tefera, MSc, Jimma University, Ethiopia

Abstract

In this study, biodiesel, bioethanol and briquette samples were sequentially produced from spent coffee ground. The oil extracted from spent coffee ground with solvent extraction route at hexane to spent coffee ground ratio of 22.5g/g with an extraction time of 30.4min resulting in 11.892% of oil yield. This was comparable with literature values and subsequently used for biodiesel production experiments using a 1% by wt of NaOH at reaction temperatures and residence times ranging from 50 to 65 °C and 20 to 60min, respectively. The optimization carried out using central composite design methodology gave 81.507% of methyl-ester yield at a reaction temperature of 57.133 °C and reaction time (residence time) of 45.117 min with model determination coefficient (R^2) of 0.9465 while the optimum reducing sugar yield for dilute acid hydrolysis experiments for ranges of operating parameters of temperature (70-100 °C) and (1-3M)of H_2SO_4 concentrations was found to be 39.161% at a temperature of 98.313°C and H_2SO_4 acid concentration of 2.962M. Experiments were conducted at the predicted optimum conditions and resulted 79.65% of biodiesel yield (out of 11.892g of oil) and reducing sugars yield of 37.28 %(out of the hydrolysate). The bio ethanol produced by simple distillation having alcohol by volume yield of 55% can be considered as a good result and it can be easily concentrated to a fuel grade ethanol by using fractionating column. Moreover, the characteristics of the biodiesel produced were in good agreement with ASTM and EN standards. The end product of the process; briquette has been produced from 75% wt of dilute acid hydrolysis residue and 25% wt of glycerol, resulted a calorific value of 13.35MJ/kg, with its easy mold -ability. This study signifies the value addition that can be affected from spent coffee ground and results obtained in this regard are discussed.

Image

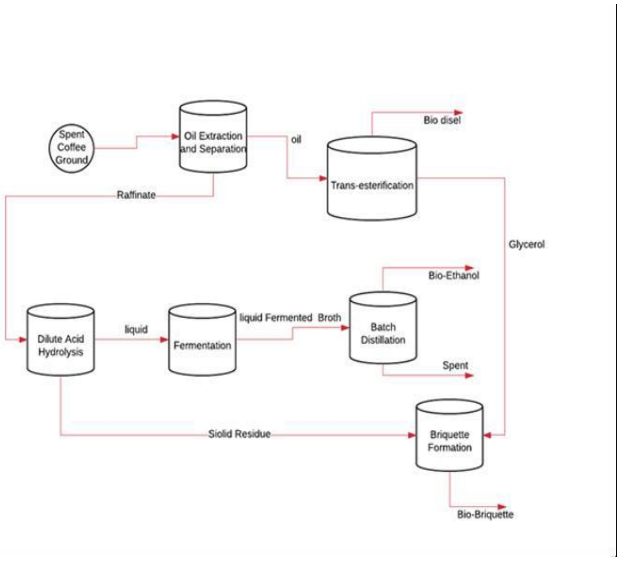


Figure: Process flow sheet for biodiesel, bioethanol and briquette production process

Recent Publications (minimum 5)

1. Nı´dia S. Caetano (December 2013) Spent coffee grounds for biodiesel production and other applications
2. Mebrahtu Haile (2013).et al., International journal of renewable energy research Volume.3.issue.2
3. Krit Somnuk,*, Optimization of coffee oil extraction from spent coffee grounds using four solvents and prototype-scale extraction using circulation process Prince of Songkla University, Hat Yai, Songkhla, 90112, Thailand (2013)
4. Molla Asmare (2014).Synthesis and Characterization of Biodiesel from Castor Bean as Alternative Fuel for Diesel Engine. American Journal of Energy Engineering. Vol. 2, No. 1
5. Muche A, Sahu O. (2014) Biofuels from Biomass in Rural Area, J. Biotechnol. Bioinformatics.



Biography

Muluken Eshetu Tefera has been working as a lecturer at Jimma University,Jimma Institute of Technology under the school of Chemical Engineering since Aug 2014. He has been working on giving lectures on Fluid Mechanics for Chemical Engineers, Mass Transfer Unit Operation and Entrepreneurship for Engineers courses, assisting undergraduate students in Thermal and Mass Transfer Unit Operations Laboratory, Advising graduating students, mentoring industrial intern students and many more activities.

Email:mulushakached@gmail.com

- Full Name: Muluken Eshetu Tefera
- Personal Email: mulushakached@gmail.com
- Mobile Number:+251912802857
- Linked In:Muluken Eshetu

- Facebook: https://www.facebook.com/muluken.eshetu.94
- Session Name/ number:
- Category: Oral presentation
- Date of Birth:Jan/08/1990
- Postal Address: Jimma University P.O.BOX 378