

The effect of torrefaction reaction temperature on the *Elaeis Guineensis* Empty Fruit Bunch (EFB) pellet durability and calorific value

Abstract

Empty Fruit Bunch (EFB) are not being fully utilized for energy production due to its high moisture content, low density, having bulky characteristics and low calorific value. In order to improve characteristic of *Elaeis Guineensis* empty fruit bunch as fuel, pre-treatment process is necessary to overcome these shortcomings. Therefore, the aim of this research is to examine the effect of torrefaction reaction temperature on the *Elaeis Guineensis* pellet energy characteristics. The observed pellet qualities include the pellet durability and calorific value of the pellet. The torrefaction of empty fruit bunch was conducted in a fixed-bed reactor at 200 C, 220 C, 240 C and 260 C. The torrefied sample was pelletized, analysed and tested to examine the characteristics of empty fruit bunch biomass as fuel. The pelletization process was carried out by using the cold single press pelletizer and using cassava starch as binder. At higher torrefaction temperature, the decomposition of cellulose and lignin become more prominent. At the torrefaction temperature 260 C, the gross calorific value is the highest due to the removal of moisture, release of volatile matter and the decomposition of biomass components such as hemicellulose, cellulose and lignin which resulted in energy densification. By comparing the torrefied empty fruit bunch at 260 C with the untorrefied empty fruit bunch, it was found that the torrefaction increased the energy densification and pellet qualities of empty fruit bunch that can be utilized as biomass energy sources in renewable energy.