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# EVALUATION OF UBI GAJAH FOR BIOETHANOL VIA HYDROLYSIS AND FERMENTATION

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## ABSTRACT

This research was carried out to evaluate utilisation of Ubi Gajah (*Manihot esculenta*), a non-edible cassava species, as a feedstock for bioethanol production by acid hydrolysis. The Ubi Gajah peels and pulp substrates were hydrolysed for a max. of 48 hrs with $H_2SO_4$ acid concentration ranges 5% v/v to 15% v/v at high temperature and pressure before fermentation process. While the yield was noted at 24 hr of 15% v/v acid hydrolysis. From the experimental results yield of bioethanol for Ubi Gajah Peel and Pulp 156.65 g/L and 220.89 g/L were noted respectively when both the substrates were hydrolysed with 15% v/v of $H_2SO_4$. The FTIR Spectra of the bioethanol, confirms –OH, C-O and C=C groups by absorption bands at 3251.98 $cm^{-1}$ to 3315.63 $cm^{-1}$; 1045.42 $cm^{-1}$ and 1085.92 $cm^{-1}$; and 1633.71 $cm^{-1}$ and 1645.28 $cm^{-1}$ respectively. The biofuel properties were tested according to ASTM standards and found to be complacent. The Bioethanol - diesel blends (BDB) of 5% to 20% v/v were prepared and fuel performance test was conducted on a diesel engine. The performance and emission results confirm suitability of the bioethanol as an alternative fuel.

**Key words:** Bioethanol, Ubi Gajah, acid hydrolysis

## INTRODUCTION

Energy is one of the most fundamental essential needs of the life (Shafiee & Topal, 2009). It is reported that fossil fuel reserves continue to diminish while the global energy demand and consumption is growing, which is leading unto the global warming (Suranovic, 2013). Consequently, many efforts have been done to introduce alternatives of energy sources such as liquid biofuels which captured the attention of researchers, policymakers as well as the consumers (Orian-Research, 2018). The liquid biofuels such as bioethanol and biodiesel are derived from organic substances, which offers a better alternative to reduce the consumption of Petro fuels and environmental pollution. Since the level of oxygen in biofuels ranges from 10% to 45%, the fuel combustion becomes more efficient yet lower the hydrocarbons in exhaust emission (Demirbas, 2009). Table 1 shows some of the common feedstocks for bioethanol production (OECD/Food & Agriculture Organization of the United Nations, 2015).

The fuel blends of gasoline and ethanol are widely used in transportation sector. The most common ethanol-gasoline blend is known as "gasohol" or E10, a blend of 10% ethanol mixed with 90% gasoline. The blend of ethanol and gasoline will result in higher fuel consumption. This is because of the energy content in the blend. E10 has 3.3% less energy content per gallon than gasoline meanwhile, E85 has 24.7% less energy per gallon than gasoline (EIA, 2016). Ethanol-diesel blend, named as E-diesel which contains up to 15% v/v of ethanol and 0.2% v/v to 5.0% v/v of additive which is responsible to maintain the blend stability and certain fuel properties such as Cetane number, corrosion inhibition and lubricity. Such additive is very important because E-diesel blends is not stable and will separate after sometimes (Park *et al*., 2010). E-diesel fuels are still under testing and previous research has shown that the blends may reduce certain components of exhaust emission especially

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