

COMPARATIVE STUDIES OF BIOETHANOL FUEL
PRODUCTION AND ENGINE EMISSION FROM DIFFERENT
ROTTEN FRUITS BIOMASSES

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ABSTRACT

The unsustainable energy resources like fossil fuel are going to be depleted in the next few decades and the trends in biofuel production from biomass are gaining popularity to encounter the expected energy crisis in the world. Ethanol is the most widely used liquid biofuel and is produced as a result of fermentation process from sugars, starches or cellulose biomass including fruit wastes. In this study rotten rambutan, mango, banana and pineapple fruits were utilized for bioethanol production.

Rotten fruits were used to produce bioethanol by fermentation using yeast (*Saccharomyces cerevisiae*). Different parameters including pH, TSS, glucose concentration, retention time and ethanol production at different temperatures were studied. In addition to this, the study also encompassed parameters such as parts of the fruits, optimum yeast concentration, enzymatic digestion to facilitate the fermentation. A comparative study was made to compare the production of biofuel from rambutan, mango, apple and banana. The highest bioethanol production was obtained from experiments using 4g/L of yeast for 2 days producing bioethanol 9.4 (v/v)%. A detailed analysis was made regarding reducing sugar contents using digital refractometer, and total soluble solid (TSS) were found to reduce after fermentation. The pH of the experimental mixture was found to decrease as a result of the conversion of waste fruits into bioethanol. The produced bioethanol was also subjected to a detailed chemical analysis of metal content (Fe, Pb, Cu, Na, Mg, Ca, etc). The bioethanol obtained as a result of fermentation was subjected to an engine test using multicylinder Proton Gen 2 engine and it revealed a remarkable reduction in the production of hazardous gases (NO_x) in the blends of bioethanol (E10, E5). The optimum values for the parameters investigated were found to be 30°C, yeast concentration of 4g/L, pH 5-5.8 for rotten fruit as compared to fresh fruit at fermentation time of 48 hours. In the enzymatic study

using rotten fruits, commercial cellulase and amylase were used to hydrolyze the carbohydrates into simple sugars which were then utilized by the yeast to produce bioethanol. The bioethanol produced from rotten rambutan fruit was found to be of high quality, which can be utilized as a fuel in the engine and met the ASTM standards with regards to emission standards, viscosity and metal content. Hence, it is concluded that good quality bioethanol can be produced using rotten rambutan, mango, banana and pineapple.

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List of Publications

- HADEEL, A., HOSSAIN, A., LATIFA, K., ALNAQEB, H., ABEAR, J. & NORAH, A. H. 2011. Bioethanol fuel production from rambutan fruit biomass as reducing agent of global warming and greenhouse gases. *African Journal of Biotechnology*, 10, 10157-10165.
- Norah, HA. Sharif, ABMH and Hadeel, MA. 2011. Bioethanol production from rotten apple fruit biomass. Scientific Research and Essay (Submitted).
- Sharif, ABMH, Hadeel, MA. and Norah, HA. 2011. Bioethanol production from rotten banana fruit biomass. 2011. African Journal of Microbiology. (Accepted).
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