Bioethanol production from date fruit waste and its usage in petrol engine

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ABSTRACT

Biofuel is biodegradable, nontoxic and suitable substitute for fossil fuels, and capable to reduce greenhouse gas like CO_2, CO, HC and NO_X emissions. The study investigated the use of waste date from date palm tree (*Phoenix dactylifera*) as a source of bio-ethanol production that could be used as a fuel. The bioethanol was produced by fermentation process using the waste dates as a substrates for yeast and enzymes such as cellulase and amylase. The effects of different fermentation parameters such as yeast concentration, pH, temperatures, fermentation periods, water content and substrate components on bioethanol production were investigated. From the results, the maximum yield of bioethanol (25%) was achieved at Yeast concentration of 5g/l under pH 5.8 at 28°C for 5 days. Crushed/ground seed showed second highest yield compared to whole seed which was treated by cellulase and amylase. Viscosity and acid value were found within the limits prescribed by the latest American Standards for Testing Material (ASTM). Based on ASTM standardized tests, the produced bioethanol was found be acceptable as a transportation fuel. Though, the bioethanol samples analyses revealed no toxic elements, it did contained metals such as Fe, Cu, Sn, Mn, Ag, Mo, Zn, P, Ca, Mg, Si and Na. Fuel consumption was observed to reduce when 10% (v/v) produced bioethanol blend in gasoline was used as compared to 5% bioethanol blend. The greenhouse gas emissions such as hydrocarbons (HC), sulphur dioxide (SO_2), carbon dioxide (CO_2) and nitrogen oxides (NO_x) were lower in bioethanol blended with fuel (E_5 and E_{10}) than 100% gasoline. From the results stated herein, it could be suggested that waste dates could be used as a potential feedstock for bioethanol production that could be an appropriate substitute fuel for engine use.

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LIST OF ABBREVIATION AND SYMBOLS

ANOVA	=	Analysis of Variance
cm	=	Centimeter
°C	=	Degree Celcius
CO_2	=	Carbon Peroxide
CO	=	Carbon monoxide
df	=	Degree of Freedom
h	=	Hour
mg	=	Milligram
ml	=	Millilitre
mM	=	Millimolar
mm	=	Millimeter
min	=	Minute
ppm	=	Part per million
rpm	=	Revolution Per Minute
SD	=	Standard Deviation
SE	=	Standard Error
SPSS	=	Statistical Package for Social Science
TSS	=	Total Soluble Solids
µg	=	Microgram
µL	=	Microlitre
µm	=	Micrometer