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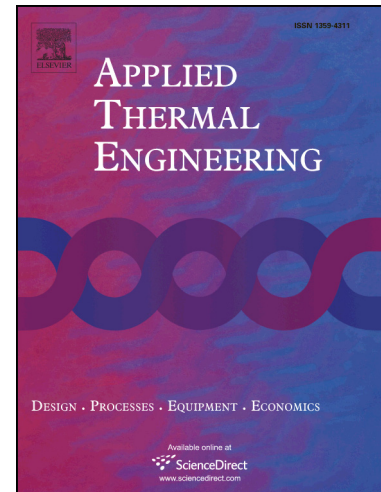
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Determination of optimal wet ethanol composition as a fuel in spark ignition engine

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Abstract

Studies are unanimous that the greatest fraction of the energy necessary to produce hydrous ethanol fuel (HEF), i.e. above 95% v/v of ethanol in water, is spent on water removal (distillation). Previous works have assessed the energy efficiency of HEF; but few, if any, have done the same for wet ethanol fuel (sub-azeotropic hydrous ethanol). Hence, a new metric called net energy factor (NEF) is proposed to calculate the energy efficiency of wet ethanol and HEF. NEF calculates the ratio of Lower Heating Value (LHV) derived from ethanol fuel, total energy out, to energy used to obtain ethanol fuel as distillate, total energy in. Distillation tests were performed batchwise to obtain as distillate HEF and four different fuel blends of wet ethanol with a range from 60%v/v to 90%v/v of ethanol and the amount of energy spent to distillate each ethanol fuel calculated. The efficiency parameters of a SI engine operating with the produced ethanol fuels was tested to calculate their respective conversion efficiency. The results of net energy factors show a clear advantage of wet ethanol fuels over HEF; the optimal efficiency was wet ethanol fuel with 70%v/v of ethanol.

Keywords: Net Energy Factor; Optimization; Wet Ethanol; Biofuels; Batch Distillation; Spark-Ignition Engine

Nomenclature

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