ANALYSIS OF COMBUSTION AND NO\textsubscript{x} FORMATION IN A SI ENGINE FUELED WITH HHO ENRICHED BIOGAS

Bui Van Ga*, Bui Thi Minh Tu, Nguyen Van Dong, Bui Van Hung

Danang University of Science and Technology-The University of Danang
54, Nguyen Luong Bang Street, Danang, Vietnam

Abstract

A numerical simulation was conducted to investigate the combustion characteristics and effects of HHO addition on performance and NO\textsubscript{x} emission of a biogas SI engine. At a given operating condition, indicative work cycle Wi increases with increase of HHO, CH\textsubscript{4} concentrations and load rate; but it decreases with engine speed increase and reaches peak value as variation of equivalence ratio and advanced ignition timing. Combustion temperature T and NO\textsubscript{x} concentration in exhaust gas also increase with increase of HHO, CH\textsubscript{4} concentrations, load rate and advanced ignition timing; but it decreases with engine speed increase, and reaches peak value as variation of equivalence ratio. The increase rate of NO\textsubscript{x} concentration with equivalence ratio is much higher than that of Wi and T. When HHO concentration in biogas is lower than 30%, the gain of Wi is advantageous before the increase of NO\textsubscript{x}. The addition HHO is more interesting as biogas engine operates with lean mixture. At a given engine speed, optimal ignition timing reduces 6 crankshaft angle degrees as adding 30% HHO to biogas. A compromise between performance and NO\textsubscript{x} emission can be obtained by appropriate adjustment of operating conditions of the engine fueled with HHO enriched biogas.

Keywords: alternative fuels, biogas, biogas engines, HHO gas, renewable energy

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* Author to whom all correspondence should be addressed: e-mail: buivanga@ac.udn.vn