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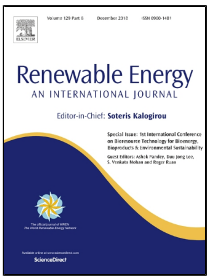

Performance Studies on Homogeneous Charge Compression Ignition (HCCI) Engine Powered with Alternative Fuels

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Performance Studies on Homogeneous Charge Compression Ignition (HCCI) Engine Powered with Alternative Fuels

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Abstract

Experiments were carried out on homogeneous charge compression ignition (HCCI) engine to study its performance at different hydrogen fuel energy ratio (HFER) and loads. The engine was powered with two fuels: Hydrogen (H_2) as inducted fuel along with air and diesel/Biodiesel fuel (BDF) as injected fuel. Diesel and BDF were injected into the cylinder using common rail direct injection (CRDI) facility developed. Electronic control unit (ECU) was developed to inject the fuel at any required crank angle (CA) for any magnitude of duration. At 80% load, engine operation was associated with severe knocking without exhaust gas recirculation (EGR), however engine operated well only for EGR percentage about 50% and 54% with diesel and BDFs respectively. Beyond this EGR level, HCCI engine showed misfiring and unstable combustion. At this condition, maximum HFER possible was less than 8% in both diesel and biodiesel HCCI operations and misfiring occurred beyond HFER of 8%. The maximum brake thermal efficiency (BTE) of 31.5%, 30.6% and 30.2% were reported with diesel, honge biodiesel (BHO) and cotton seed biodiesel (BCO) respectively in diesel hydrogen HCCI (DHHCCI) and biodiesel hydrogen HCCI (BHHCCI) modes. At 80% load, HCCI engine powered with BDFs showed 65 to 67% lower smoke, and 98 to 99% lower NOx emissions with HFER of 7% and EGR of 54% as compared to conventional compression ignition (CI) mode. However this engine operation resulted in nearly 11 times higher HC emissions with HFER of 7% and EGR of 54%. Hence HCCI mode of engine operation could be a feasible technological option to minimize the pollution levels besides improving the fuel economy.

Keywords: *Honge biodiesel (BHO); Cotton seed biodiesel (BCO); Hydrogen fuel energy ratio (HFER); Homogeneous charge compression ignition (HCCI); Emission characteristics.*