

Performance and Specific Emissions of an SI Engine Using Anhydrous Ethanol-Gasoline Blends in the City of Bogota

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Abstract : The government of Colombia has promoted the use of biofuels in the last 20 years through laws and resolutions, which regulate their use, with the objective to improve the atmospheric air quality and to promote Colombian agricultural industry. However, despite the use of blends of biofuels with fossil fuels, the air quality in large cities does not get better, this deterioration in the air is mainly caused by mobile sources that working with spark ignition internal combustion engines (SI-ICE), operating with a mixture in volume of 90 % gasoline and 10 % ethanol called E10, that for the case of Bogota represent 84 % of the fleet. Another problem is that Colombia has big cities located above 2200 masl and there are no accurate studies on the impact that the E10 mixture could cause in the emissions and performance of SI-ICE. This study aims to establish the optimal blend between gasoline ethanol in which an SI engine operates more efficiently in urban centres located at 2600 masl. The test was developed on SI engine four-stroke, single cylinder, naturally aspirated and with carburettor for the fuel supply using blends of gasoline and anhydrous ethanol in different ratios E10, E15, E20, E40, E60, E85 and E100. These tests were conducted in the city of Bogota, which is located at 2600 masl, with the engine operating at 3600 rpm and at 25, 50, 75 and 100% of load. The results show that the performance variables as engine brake torque, brake power and brake thermal efficiency decrease, while brake specific fuel consumption increases with the rise in the percentage of ethanol in the mixture. On the other hand, the specific emissions of CO₂ and NO_x present increases while specific emissions of CO and HC decreases compared to those produced by gasoline. From the tests, it is concluded that the SI-ICE worked more efficiently with the E40 mixture, where was obtained an increases of the brake power of 8.81 % and a reduction on brake specific fuel consumption of 2.5 %, coupled with a reduction in the specific emissions of CO₂, HC and CO in 9.72, 52.88 and 76.66 % respectively compared to the results obtained with the E10 blend. This behaviour is because the E40 mixture provides the appropriate amount of the oxygen for the combustion process, which leads to better utilization of available energy in this process, thus generating a comparable power output to the E10 mixing and producing lower emissions CO and HC with the other test blends. Nevertheless, the emission of NO_x increases in 106.25 %.

Keywords : emissions, ethanol, gasoline, engine, performance

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