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Abstract
This experimental research consists of two parts. In the first part, various gasoline-ethanol blends (E0, E5, E10, E20, E30, E40) were tested at the engine startup period for engine performance and emissions. In the second part, a separate injector was installed at the intake manifold to provide aqueous alcohol to the engine parallel to the original gasoline supply. This way aqueous alcohol with higher water content could be utilized, compared to only trace of water can be allowed in the gasoline-ethanol blended fuel. The engine management system took care of the air-fuel ratio adjustment with the oxygen sensor feedback signal. The effects of the addition of aqueous alcohol on the torque and emissions of the engine were evaluated and compared with the performance without aqueous alcohol addition.
In the engine startup period, with the increase of the ethanol content in the blended fuel, the air-fuel ratio would increase and this would lead to the decrease of HC and CO emissions. For E5 and E10, the engine RPM was not affected much because both fuels have higher RVP than gasoline and also negligible leaning effects. For E20, however, due to high leaning effects, the engine RPM became unstable.
The experiments on the dual-injector dual-fuel system revealed the following findings. First, the aqueous alcohol injection system was not integrated originally in the engine management system. For engine conditions requiring fuel-lean combustion, the gasoline supply rate would be reduced by the addition of the aqueous alcohol. However, for engine conditions requiring fuel-rich combustion, such as high load, the gasoline supply rate would remain the same even with the addition of aqueous alcohol. Second, the water content in the aqueous alcohol could effectively lower the NO emission. Third, the HC emission could be lowered slightly with the increase of ethanol content in the mixed fuels. Fourth, for mixed fuels containing moderate water content, the engine torque was almost unaffected.
Keywords: Ethanol, Dual Injector, Dual Fuel, Gasoline, SI engine, Emissions.
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