Analysis of the Effect of Piston Dome Surface Modification with Fuel Variations on Engine Performance and Exhaust Emissions

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ABSTRACT

This study aims to analyze the effect of piston dome surface modification on engine performance and exhaust gas emissions in a four-stroke motorcycle engine using Mobil Gasoline RON 92. The research employed an experimental method, testing both standard pistons and modified dome pistons with a diameter of 63.5 mm, and compression ratios of 9.2:1 and 12:1. The measured parameters included torque, power, fuel consumption, and exhaust emissions (CO and HC), using a dynamometer and gas analyzer. The results showed that the piston dome modification with a 12:1 compression ratio provided the highest performance, achieving a torque of 18.46 Nm at 6220 rpm and a maximum power of 18.22 HP at 7820 rpm. However, this performance improvement came with increased fuel consumption of 0.399 kg/h and higher emissions—CO at 4.76% and HC at 700 ppm. In contrast, the standard piston offered better fuel efficiency and lower emissions, albeit with reduced performance.

It is concluded that piston dome modification effectively enhances engine performance, but it should be supported by high-octane fuel usage and emission control to comply with environmental standards.

Keywords: piston dome, engine performance, compression ratio, exhaust emissions, fuel consumption.