

ABSTRAK

Penggunaan bioetanol sebagai campuran bahan bakar bensin dapat meningkatkan pemanfaatan energi terbarukan, namun perbedaan karakteristik etanol dibandingkan bensin konvensional berpotensi memengaruhi performa mesin dan keandalan sistem injeksi. Penelitian ini bertujuan untuk menganalisis perubahan karakteristik campuran etanol pada bahan bakar bensin, pengaruhnya terhadap performa sepeda motor injeksi, serta tingkat risiko kegagalan komponen menggunakan metode *Failure Mode and Effect Analysis* (FMEA). Penelitian dilakukan secara eksperimental menggunakan sepeda motor Honda Vario 125 dengan bahan bakar Pertamina murni, campuran etanol 5% (E5), dan campuran etanol 10% (E10). Pengujian meliputi pengamatan karakteristik bahan bakar selama tiga minggu, pengujian performa menggunakan *dyno test*, serta analisis risiko kegagalan komponen sistem injeksi dengan metode FMEA berdasarkan nilai *Severity*, *Occurrence*, dan *Detection*. Hasil penelitian menunjukkan bahwa campuran E5 dan E10 membentuk endapan selama penyimpanan, sedangkan nilai pH tidak mengalami perubahan yang signifikan. Hasil *dyno test* menunjukkan bahwa Pertamina murni menghasilkan performa terbaik dengan torsi maksimum 19,5 N.m dan daya maksimum 11,4 HP. Analisis FMEA menunjukkan bahwa potensi korosi pada sistem bahan bakar memiliki nilai *Risk Priority Number* (RPN) tertinggi sebesar 126, sedangkan tekanan *fuel pump* tidak stabil memiliki nilai RPN terendah sebesar 14. Penambahan etanol pada bahan bakar bensin memengaruhi karakteristik bahan bakar, menurunkan performa mesin, serta meningkatkan risiko kegagalan pada beberapa komponen sistem injeksi.

Kata kunci: etanol, sistem injeksi, performa mesin, *dyno test*, *Failure Mode and Effects Analysis* (FMEA), *Risk Priority Number* (RPN).

ABSTRACT

The use of bioethanol as a gasoline additive has become an alternative to reduce dependence on fossil fuels and lower exhaust emissions. However, the different physical and chemical properties of ethanol compared to conventional gasoline may affect engine performance and the reliability of motorcycle fuel injection systems. This study aims to analyze the changes in the characteristics of ethanol-blended gasoline, evaluate its effect on motorcycle engine performance, and assess the failure risks of injection system components using the Failure Mode and Effects Analysis (FMEA) method. This research employed an experimental approach using a Honda Vario 125 motorcycle with three fuel variations: pure Pertamax, Pertamax blended with 5% ethanol (E5), and Pertamax blended with 10% ethanol (E10). The tests included observations of fuel characteristics over a three-week period, engine performance measurements using a dynamometer (dyno test), and failure risk analysis of injection system components based on the Severity (S), Occurrence (O), and Detection (D) parameters of the FMEA method. The results showed that E5 and E10 fuels formed deposits during storage, while no significant changes in pH values were observed. The dyno test results indicated that pure Pertamax produced the highest performance, with a maximum torque of 19.5 N·m and a maximum power output of 11.4 HP. FMEA analysis revealed that the potential corrosion of the fuel system had the highest Risk Priority Number (RPN) value of 126, whereas unstable fuel pump pressure had the lowest RPN value of 14. It can be concluded that the addition of ethanol to gasoline affects fuel characteristics, reduces engine performance, and increases the risk of failure in several fuel injection system components.

Keywords: ethanol, fuel injection system, engine performance, dyno test, Failure Mode and Effects Analysis (FMEA), Risk Priority Number (RPN).