

Analisis performa dan emisi mesin diesel dengan simulasi satu dimensi pada variasi biodiesel = Performance and emission analysis of diesel engine using One-Dimensional simulation on biodiesel variation

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Abstrak

Penggunaan bahan bakar biodiesel sebagai alternatif bahan bakar fosil pada mesin diesel menjadi salah satu solusi untuk mengurangi emisi gas rumah kaca dan mendukung diversifikasi energi. Penelitian ini menganalisis pengaruh variasi campuran biodiesel terhadap performa dan emisi gas buang pada mesin diesel Kubota RD85 DI-2S melalui simulasi satu dimensi menggunakan perangkat lunak Avl Boost. Simulasi dilakukan pada campuran biodiesel B20, B35, B50, dan B100, serta solar murni (B0). Hasil simulasi menunjukkan bahwa tekanan silinder maksimum tertinggi dicapai oleh bahan bakar B0 yaitu sebesar 8726,2 kPa pada fuelling 25,85 mg/injeksi, sedangkan campuran biodiesel B20, B35, B50, dan B100 menghasilkan tekanan silinder lebih rendah. Efisiensi thermal, pada rentang fuelling 10–30 mg/injeksi, B0 menunjukkan efisiensi termal tertinggi dibanding campuran biodiesel lainnya. Namun, pada fuelling tinggi 35 mg/injeksi, efisiensi termal B20 dan B35 dapat mencapai 33,7%, sedikit melebihi B0 yang hanya mencapai 33,58%. Secara keseluruhan, biodiesel B50 dan B100 mampu menghasilkan emisi soot, CO, dan CO₂ yang lebih rendah dibandingkan bahan bakar lainnya. Dengan demikian, penelitian ini memberikan gambaran mengenai potensi biodiesel sebagai bahan bakar alternatif yang lebih ramah lingkungan, serta menjadi dasar evaluasi performa dan emisi mesin diesel di masa depan.

.....The use of biodiesel as an alternative fuel for diesel engines has become one of the solutions to reduce greenhouse gas emissions and support energy diversification. This study analyzes the effect of various biodiesel blends on the performance and exhaust emissions of the Kubota RD85 DI-2S diesel engine using one-dimensional simulation with AVL Boost software. Simulations were carried out for biodiesel blends B20, B35, B50, and B100, as well as pure diesel (B0). The simulation results showed that the highest peak cylinder pressure was achieved by B0 fuel at 8726.2 kPa with a fueling of 25.85 mg/injection, while the biodiesel blends B20, B35, B50, and B100 produced lower cylinder pressures. In terms of thermal efficiency, within the fuelling range of 10–30 mg/injection, B0 shows the highest thermal efficiency compared to other biodiesel blends. However, at a higher fuelling rate of 35 mg/injection, the thermal efficiency of B20 and B35 can reach 33.7%, slightly exceeding that of B0 at 33.58%. Overall, B50 and B100 biodiesel blends were able to produce lower soot, CO, and CO₂ emissions compared to other fuels. Thus, this study provides an overview of the potential of biodiesel as a more environmentally friendly alternative fuel and serves as a basis for evaluating diesel engine performance and emissions in the future.