

INTISARI

Gangguan pada *engine* alat berat akibat kontaminasi bahan bakar dapat menurunkan produktivitas kerja, meningkatkan biaya perawatan, dan mempercepat kerusakan komponen sistem bahan bakar. Penelitian ini bertujuan menganalisis karakteristik partikulat pada bahan bakar Solar B40 menggunakan *Particle Size Analyzer* (PSA) serta hubungannya dengan gangguan sistem bahan bakar dan performa *engine* alat berat. Sampel diambil dari mobil tangki sebagai kontrol dan *drain pre-filter* pada empat unit alat berat yang mengalami gangguan. Hasil penelitian menunjukkan bahwa bahan bakar pada seluruh unit mengalami peningkatan ukuran rata-rata partikel dari sekitar 3 μm menjadi 4–6 μm , dengan peningkatan ukuran partikulat sekitar 34–103% dibandingkan sampel kontrol. Seluruh sampel juga memiliki nilai *Polydispersity Index* (PDI) di atas 0,50 yang menunjukkan distribusi ukuran partikel sangat heterogen. Kombinasi peningkatan ukuran partikel dan tingginya nilai PDI terbukti berhubungan dengan percepatan penyumbatan *fuel filter*, sehingga memicu gangguan seperti *engine misfire*, *low power*, dan *engine shutdown*. Analisis *Root Cause Analysis* (RCA) mengidentifikasi bahwa karakteristik Solar B40, proses distribusi bahan bakar, dan strategi perawatan merupakan faktor utama penyebab kontaminasi partikulat. Hasil penelitian ini diharapkan menjadi dasar dalam pengelolaan kualitas bahan bakar dan penyusunan strategi perawatan sistem bahan bakar untuk meningkatkan keandalan alat berat.

Kata kunci: *engine* alat berat, sistem bahan bakar, kontaminasi partikulat, *fuel filter*, *Particle size analyzer*, *Polydispersity Index*, *Root Cause Analysis*.

ABSTRACT

Heavy equipment engine failures caused by fuel contamination can reduce operational productivity, increase maintenance costs, and shorten the service life of fuel system components. This study aims to analyze the particulate characteristics of B40 diesel fuel using a Particle Size Analyzer (PSA) and evaluate their relationship with fuel system failures and engine performance. Fuel samples were collected from a fuel tanker as the control sample and from the pre-filter drain of four heavy equipment units. The results showed that the fuel samples from the equipment exhibited larger mean particle sizes, increasing from approximately 3 μm in the control sample to 4–6 μm , with an overall increase of about 34–103%. All samples also showed Polydispersity Index (PDI) values above 0.50, indicating highly heterogeneous particle size distributions. The combination of increased particle size and high PDI was associated with accelerated fuel filter clogging, leading to engine misfire, low engine power, and engine shutdown. Root Cause Analysis (RCA) identified three major causes of particulate contamination: the intrinsic characteristics of B40 fuel, contamination during fuel distribution, and maintenance practices that had not been adjusted to the actual characteristics of B40 fuel. These findings provide a basis for improving fuel quality management and fuel system maintenance to enhance the reliability and operational performance of heavy equipment.

Keywords: *heavy equipment engine, fuel system, particulate contamination, fuel filter, Particle size analyzer, Polydispersity Index, Root Cause Analysis.*