Characterization and control of ash from diesel engine exhaust

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INTRODUCTION

- ✓ Ship emissions, particularly fine particulate matter (PM2.5), have a negative impact on air quality and pose serious health risks.
- ✓ This study examines whether a diesel generator can produce particulate emissions similar to those of a marine engine and the possibility to use the generator in further research related to Diesel Particulate Filters (DPFs).
- ✓ The primary goal of the study was to characterize the ash produced by the diesel generator.

EXPERIMENTAL

In the experimental part of the study, exhaust ash was generated using a diesel generator running on DMB fuel (a distillate marine fuel blend) mixed with ash-forming lubricating oil. The quantity and quality of ash was measured. The physical properties and the chemical composition of the exhaust ash were analysed using scanning electron microscopy (SEM), transmission electron microscopy (TEM), and energy dispersive X-ray spectroscopy (EDS). Additionally, gas emissions, soot levels, and particle number concentration and distribution were measured.

RESULTS

The analysis found that using lubricating oil doped fuel increased the number of particles in the exhaust gas. Morphological studies identified various particle types, including nano-sized fuel particles, agglomerated soot particles and spherical lubricating oil particles. The EDS analysis showed that the spherical particle contained mainly elemental calcium, a lubricating oil marker, and a small amount of S, Si, C, and O.

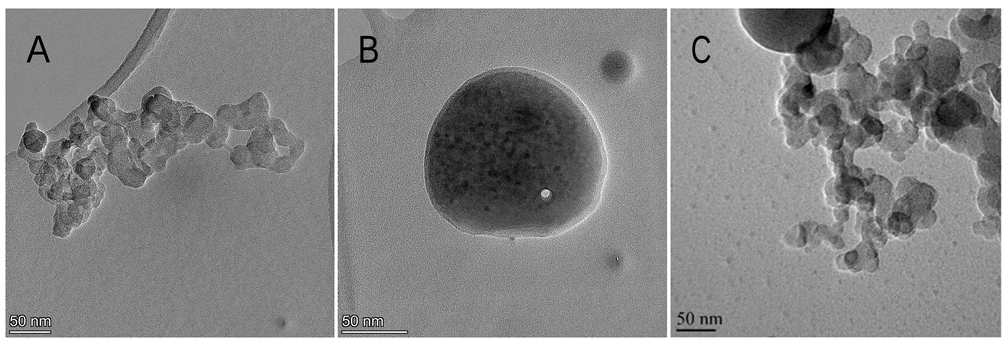

Figure 1. Magnification of soot agglomerate (A) and a spherical particle (B) from a diesel generator, using DMB and oil blend as a fuel. On right (C), soot agglomerate and a spherical particle from a ship engine, using MDO as a fuel (Alanen et al. 2020).

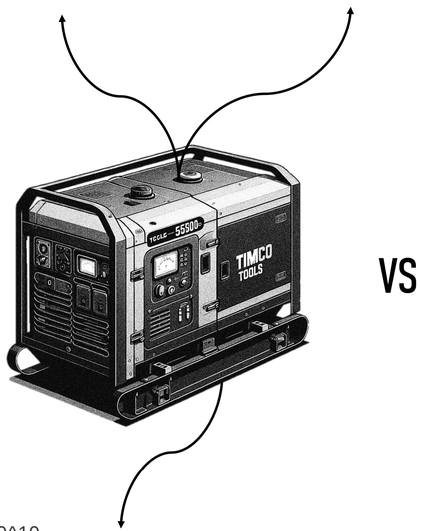

Figure 2. The particle size distribution of non-volatile exhaust particles. The particle emissions were studied from diesel generator with 1,6kW load, using two different fuel blends.

Figure 3. The particle size distribution of fresh and non-volatile exhaust particles. The particle emissions were studied from a 1.4 MW marine engine with an engine load of 85 %. (Alanen et al. 2020)

This was consistent with particulate studies of Alanen et all (2020) from 1.4 MW marine engine. Based on findings the properties of the particles generated by the diesel generator resemble to those obtained with marine engines using similar fuels.

CONCLUSIONS

- ✓ Fuel composition impacts the particulate emission formation during combustion.
- ✓ Diesel generators can be used in place of a large ship engines for future particulate emission and DPF studies.

Acknowledgements

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References

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