

Particulate emission and composition from marine Diesel engines for different fuels

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There is only limited knowledge available today of particulate emission from marine Diesel engines. The emission of particulates in the marine environment, the detailed chemical composition and aerosol properties are widely unknown. Detailed particulate emission measurements and chemical analysis have been performed on large medium speed four stroke Diesel engines for different types of fuel.

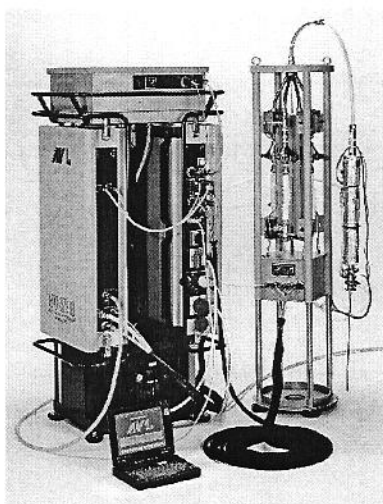


Figure 1: PM dilution system for Diesel exhaust gas

The particulate matter (PM) was measured according to ISO-8178 with a dilution system (Figure 1) and the PM was collected on quartz fiber filters for chemical characterization.

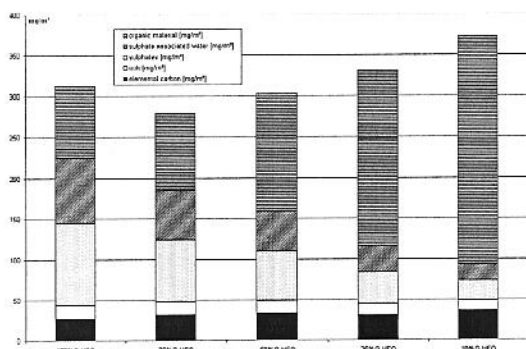


Table 1: PM chemical composition for different engine loads for heavy fuel oil (HFO)

The PM constituents have been analyzed by Germanischer Lloyd (GL) for elemental carbon (EC) and organic carbon (OC) thermographically and for sulfates (SO₄) ionchromatographically. The sulfate bound water (H₂O) and organic material (OM) has been calculated from the analyzed sulfates and organic carbon. The ash constituents have been calculated from the fuel ash content. The PM emission and chemical composition (Table 1) is shown here for one particular type of fuel and for different engine loads.

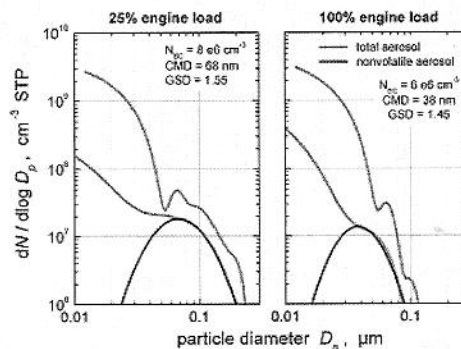


Table 2: PM size distribution for two engine loads

The PM number and size distribution (Table 2) was measured by Deutsches Zentrum für Luft- und Raumfahrt (DLR) with a differential mobility analyzer (DMA) coupled to a condensation particulate counter (CPC).

As can be seen from the tables, the PM emission from a large medium speed marine Diesel engine consists mainly of volatile organic material. Different fuels used for marine transport show significantly different amounts of sulfates, sulfate bound water and ash. Detailed PM emission and chemical composition for different load points of the engine and for different fuels e.g. heavy fuel oil, marine Diesel oil (MDO) and marine gas oil (MGO) will be presented.

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