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Investigation of Photochemical Smog Formation after Removal of Water Soluble Organic and Inorganic Fractions in the Diesel Exhaust Fume

Palliyaguru N.P.L.* and Jayaweera P.M.

Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka
**lalindapalliyaguru@gmail.com*

Abstract

The exhaust fume from internal combustion engines has been one of the largest pollutants in aquatic and atmospheric systems in the world[1]. The formation of oxides of nitrogen under high pressures and temperatures during the combustion process of the engine initiates a chain of reactions with volatile organic compounds (VOC's) in the presence of UV light to form photochemical smog in the atmosphere[3]. This research investigates the possibility to reduce the photochemical smog by removing a water soluble fraction of diesel fumes. In the general experimental set up of this research, the diesel exhaust line that comes out from Toyota 2C diesel engine is connected to a smog chamber equipped with UV light source. It was measured that the pH of the water drops to 2.9 from 5.8 in 20 min during the function of diesel engine at idle mode. The Fig. 1(a) shows the UV-Vis spectrum of diesel fumes directly purged into distilled water samples. It shows the dissolution of some VOC's in water. The Fig. 1(b) represents the UV-VIS spectrum of diesel fumes that initially go through the smog chamber and then purged into cyclohexane. Fig.1(c) represents the UV-VIS spectrum of the samples that were collected after the diesel fumes were fed into the water tank prior to sending it into the smog chamber. Fig. 1(c) demonstrates a good enhancement of a broad peak from 230 nm to 280 nm that corresponds to water insoluble portion of the diesel fume. The relative increase of the water insoluble fraction from Fig. (b) to (c) proves a deduction of water soluble fraction in the diesel fumes. This could in turn have a positive effect on the atmospheric pollution.

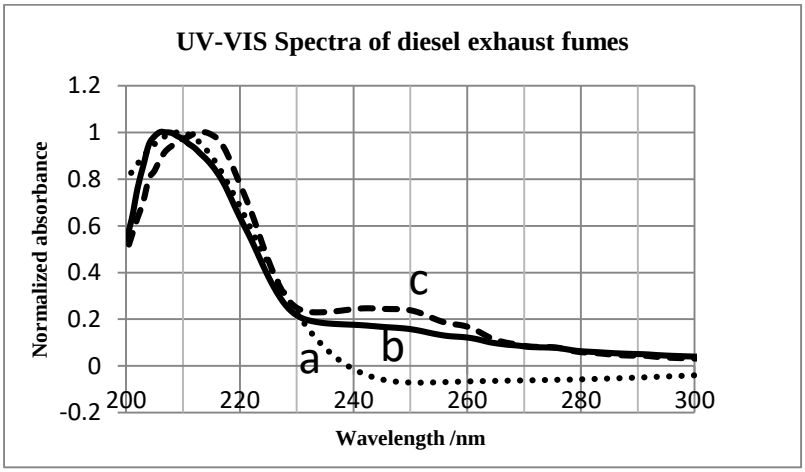

Figure 1: UV-VIS spectrum of diesel fumes (a) directly purged into distilled water (b) purged into cyclohexane after smog chamber (c) purged into cyclohexane after sending it through the water tank prior to the smog chamber

Keywords: Photochemical smog, Volatile organic compounds, UV-VIS spectrum