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Gaseous sulfuric acid and volatile nanoparticle formation by modern diesel vehicles

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Diesel vehicles are presently becoming increasingly fitted and refitted with modern oxidation catalyst Diesel filter (CDF) systems which remove from the exhaust most soot particles and organic molecules. However during recent time it was found that CDF, as an undesired side effect, promote the emission of large numbers of volatile nanometer sized aerosol particles (VNP) whose nature is not well known. Due to their small diameters (around 10 nm) VNP have a maximum efficiency of intruding to the deepest and most vulnerable region (alveolae or air sacks) of the human lung. Therefore VNP are potentially harmful and their chemical nature and formation need to be investigated. Here we report on pioneering measurements and accompanying model calculations which reveal that these VNP are formed by gaseous sulphuric acid (GSA) nucleation and grow by condensational uptake of GSA and organics. Our measurements indicate that the conversion of fuel sulphur is mostly mediated by the CDF, that the conversion fraction reaches up to about 20%, and that condensable organics are not sufficiently removed by the CDF. Since the condensable organics probably include also carcinogenic compounds VNP may act as a “Trojan Horse” transporting harmful organics into the alvaeolic region of the human lung. Our findings indicate that present obligatory regulations of diesel vehicle exhaust are insufficient to avoid

VNP emissions.