

Characterizing elements in particulate emissions from recent gasoline, liquefied petroleum gas and diesel passenger cars and engine oil

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Abstract

Fine particles emitted from recent passenger cars were collected and particulate mass and elements were measured. Two gasoline port injection (GPI) cars, two liquefied petroleum gas (LPG) port injection cars (liquid and gas injections), and a diesel car equipped with diesel particulate filter and oxidation catalyst were tested. Elements in particulate emissions were measured by particle induced X-ray emission (PIXE). Elements in the engine oils were measured by in-air-PIXE. Particulate mass emission factors of the GPI, LPG, and diesel passenger cars were one fifth or smaller than the emissions from gasoline direct injection (GDI) passenger cars. Particulate mass emission factors of the LPG cars were equal to or smaller than those of the GPI cars with same types of engines. Particulate mass emission factors of the liquid-injection LPG car were larger than the gas-injection LPG car. The oil contributions to the particulate phase total measured elements estimated from Ca and Zn were 35–65%.