

PA42) Properties of Airborne Particles Nearby Urban Roadway in Fukuoka, Japan

Hiroko Kitani, Chang-Jin Ma and Koichiro Sera¹⁾

Department of Environmental Science, Fukuoka Women's University, Japan

¹⁾Cyclotron Research Center, Iwate Medical University, Japan

1. INTRODUCTION

Emissions from engines powered by diesel and gasoline fuels are major sources of ambient particles (Ma *et al.*, 2004). Dust from paved roads, brake-lining dust, tire wear debris, and vegetative detritus from the dead leaves of urban plants can be also indirect materials of motor vehicle emissions. Diesel exhaust PM has been declared a probable human carcinogen by many agencies and organizations like the US Environmental Protection Agency (EPA) and the World Health Organization (WHO). Recently, concerns about the health effects associated with motor vehicle exhausts have also been raised. The primary goal of this study is to report the physicochemical properties of the size-resolved particles collected nearby urban roadway in Fukuoka, Japan.

2. METHODS

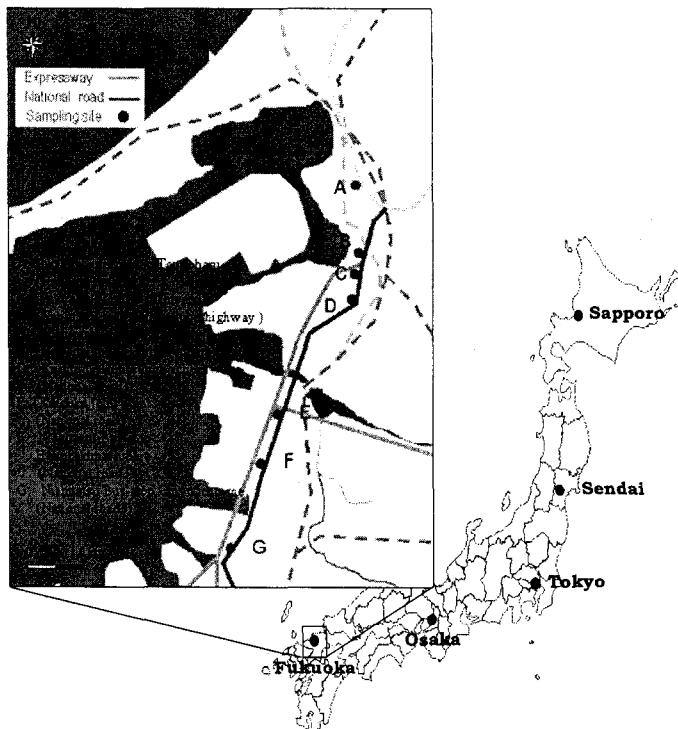


Fig. 1. Map showing the traffic network and each sampling point.

Map showing the traffic network and each sampling point is drawn in Figure 1. For sampling of

ambient aerosols, a multi nozzle cascade impactor (MCI) sampler (Tokyo Dylec Co.) was operated at a height of 1.5 m above ground level of Fukuoka Women's University located at Fukuoka City (33.40 ° N, 130.26 ° E) in the northwest part of Fukuoka Prefecture, Japan (see Fig. 1) in the end of May, 2005. This 3-stage MCI sampler collected the giant ($> 10 \mu\text{m}$), coarse ($2.5 \mu\text{m}$ - $10 \mu\text{m}$) and fine ($< 2.5 \mu\text{m}$) particles separately on the first and second stages (47 mm diameter quartz fiber filters with a 2 cm diameter center hole) and the back-pu stage (a 47 mm diameter quartz fiber filter). The number-size distribution of aerosol particles was measured using an optical particle counter (OPC). PM_{2.5} mass concentration was also monitored by the Dust scan monitor (R&P). Furthermore, a Dust scan monitor was run at other different six locations as indicated by the filled circles in Figure 1. Particulate OC and EC concentrations were measured using an automated TOT carbon analyzer (Sunset Laboratory, Forest Grove, OR). Two 1.5 cm² punches were taken from the quartz filter on each stage of the MCI sampler and placed in analyzer.

3. RESULTS AND DISCUSSION

Though the elemental concentration was also determined by PIXE installed at the Cyclotron Research Center of Iwate Medical University, Japan, the results of PM_{2.5} monitoring and carbon analysis are mainly reported here. Figure 2 describes PM_{2.5} mass concentration and vehicle's amount at each sampling site. PM_{2.5} mass concentrations are violently fluctuated. However, the relationship between PM_{2.5} mass concentration and vehicle's amount was not found. Hence, in order to estimate the vehicle originated fine particles, one has to consider not only vehicle's amount, but also other parameters such as the traffic stream, wind and other sources nearby sampling site.

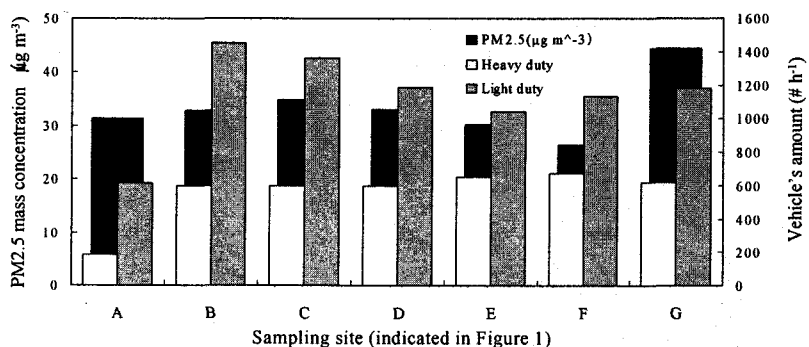


Fig. 2. PM_{2.5} mass concentration and vehicle's amount at each sampling site.

Table 1. Particulate carbon concentration as a function of vehicle's running time

	EC (µg m ⁻³)			OC (µg m ⁻³)			TC (µg m ⁻³)						
	Fine ^a	Coarse ^b	a/b	Fine ^a	Coarse ^b	a/b	Fine ^a	Coarse ^b	a/b				
Day Time ^c	0.189?	.11	0.001?	.001	264.3	0.322?	.128	1.264?	.483	0.25	0.511	1.265	264.5
Night Time ^c	0.218?	.081	0.019?	.032	11.1	0.367?	.069	1.077?	.442	0.34	0.585	1.097	11.5
Even Day	0.188?	.089	0.015?	.028	12.8	0.323?	.105	1.187?	.423	0.27	0.511	1.202	13.0
Saturday	0.078?	.037	0.003?	.004	28.2	0.243?	.135	1.085?	.164	0.22	0.321	1.087	28.5
Sunday	0.067?	.094	0.401?	.567	0.2	0.218?	.078	1.849?	.675	0.12	0.285	2.250	0.3

a: Particles smaller than 2.5 µm

b: Particles from 2.5 µm to 10 µm

c: Even day

Table 1 shows the variation of EC OC TC concentrations as the functions of particle size and vehicle's running time. EC concentration marks high levels in fine fraction with the exception of Sunday. On the contrary, OC concentration shows high concentrations in coarse fraction. Though there is no remarkable difference of EC in fine fraction between day and night time, the value of EC on even day is highly elevated compared to those of Saturday and Sunday.

REFERENCE

Ma, C.J., S. Tohno and M. Kasahara (2004) A case study of the single and size-resolved particles in roadway tunnel in Seoul, Korea, Atmospheric Environment, 38, 6673-6677.