The distribution of PM_{10}, $PM_{2.5}$, and PM_1 concentrations in primary schools in Kaohsiung, Taiwan

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PM_{10}, $PM_{2.5}$ and PM_1 may increase the risk of heart attack, stroke and some cardiovascular diseases. Lung function of school children, the susceptible groups, could be decreased by particulate matter. So far, there's little study aiming the particular matter exposure of the elementary school children in classroom. Therefore, the purpose of this study is to evaluating PM_{10}, $PM_{2.5}$, and PM_1 concentration profiles in school children's classrooms in Kaohsiung, an industrial city in Taiwan.

Three primary schools, industry, traffic, and reference school, were selected to assess PM_{10}, $PM_{2.5}$, and PM_1 concentration profiles. Real-time monitoring of PM_{10}, $PM_{2.5}$, PM_1 from 08:00 to 16:00 was held in the classroom to a total of 26 and 35 classrooms during April 13th to Jun 13th, 2009 and September 7th to November 6th, 2009, respectively (DUSTTRAK™ Aerosol Monitor ; Model 8520, TSI USA). In addition, PM_{10}, $PM_{2.5}$, and PM_1 concentration were simultaneously monitoring indoor and outdoor in the morning and afternoon.

The concentrations of PM_{10}, $PM_{2.5}$, and PM_1 in fall were significantly higher than that in spring. The differences of seasons in industry and traffic school were more obvious than that of reference school. In Spring, the mean value of PM_1/PM_{10} was 0.84, 0.81, and 0.86 in industry, traffic, and reference school, respectively; whereas the mean values of $PM_{2.5}/PM_{10}$ was 0.87, 0.84, and 0.88 in industry, traffic, and reference school, respectively. In fall, the mean values of PM_1/PM_{10} was 0.91, 0.90, and 0.88, in industry, traffic, and reference school, respectively; whereas the mean values of $PM_{2.5}/PM_{10}$ was 0.93, 0.91, and 0.88 in industry, traffic, and reference school, respectively. The mean of the ratio in fall was significantly higher than that in spring. There was no significant correlation of the PM_{10} concentration between monitoring stations and classroom in spring. But in fall, there was significantly medium positive correlation of the PM_{10} concentration between monitoring stations and classroom in traffic and industry school.

The concentrations of PM_{10}, $PM_{2.5}$, and PM_1 and the ratios of the PM_1/PM_{10}, and $PM_{2.5}/PM_{10}$ were higher in fall than in spring. The correlation between the concentration of PM_{10} in the classrooms and data from air monitoring station indicated that the data from the air monitoring station may not exactly represent the exposure of school children in the classroom.

Table 1. Concentration of PM in three primary schools in Spring and Autumn

	Spring				Autumn				Difference
	N	Mean	S.D	Range	N	Mean	S.D	Range	
Industry school									
PM_{10}(mg/m^3)	862	0.09	4.70	0.02－0.24	1055	0.15	5.55	0.06－0.22	Autumn>Spring*
$PM_{2.5}$(mg/m^3)	862	0.08	4.60	0.01－0.22	1055	0.14	5.18	0.05－0.21	Autumn>Spring*
PM_1 (mg/m^3)	862	0.08	4.50	0.01－0.22	1055	0.14	5.21	0.05－0.20	Autumn>Spring*
Traffic school									
PM_{10}(mg/m^3)	857	0.08	3.80	0.02－0.20	1160	0.18	6.80	0.05－0.41	Autumn>Spring*
$PM_{2.5}$(mg/m^3)	857	0.07	3.30	0.01－0.18	1160	0.16	6.72	0.04－0.39	Autumn>Spring*
PM_1 (mg/m^3)	857	0.07	3.30	0.01－0.18	1160	0.16	6.72	0.04－0.39	Autumn>Spring*
Reference school									
PM_{10}(mg/m^3)	782	0.08	5.24	0.01－0.15	1163	0.10	5.61	0.02－0.30	Autumn>Spring*
$PM_{2.5}$(mg/m^3)	782	0.07	5.06	0.01－0.14	1163	0.09	5.27	0.02－0.29	Autumn>Spring*
PM_1 (mg/m^3)	782	0.07	5.05	0.01－0.14	1163	0.09	4.92	0.02－0.29	Autumn>Spring*