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Distribution characteristics of total mercury and methylmercury in the topsoil and dust of Xiamen, China

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Abstract

The levels and distribution of mercury (Hg) species, including total mercury (THg) and methylmercury (MeHg) in the topsoil and dust collected from twenty sampling stations located in different land function areas of Xiamen, China, were investigated. The THg concentrations in topsoil ranged from 0.071 to 1.2 mg/kg, and in dust ranged from of 0.034 to 1.4 mg/kg. For stations where the THg of dust was less than 0.31 mg/kg, THg concentrations in the topsoil were significantly correlated to those in the corresponding dust (r = 0.597, n = 16, P = 0.014). The MeHg concentrations in topsoil were varied between 0.14 and 5.7 μg/kg. The ratios of MeHg/THg in the topsoil ranged from 0.069% to 0.74%. The range of MeHg concentration in the dust were 0.092–2.3 μg/kg. The ratios of MeHg/THg in the dust were at the same level as those in the topsoil. The MeHg concentrations in both topsoil and dust were linked to corresponding THg concentrations and soil organic matter. Neither THg nor MeHg concentration in the topsoil and dust was obviously linked to the land function.

Key words: total mercury; methylmercury; topsoil; dust; Xiamen
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Introduction

Mercury (Hg) is one of the most toxic heavy metals commonly found in the global environment. Hg and mercurial compounds are receiving great attention so as to better understand their potential impacts on the environment and public health (Lin and Pehkonen, 1999; Fitzgerald *et al*., 2007). Soils are very important pools for the Hg global biogeochemical cycle, acting alternatively as a sink or a source (Gillis and Miler, 2000; Stein *et al*., 1996). Dust is a mixture of air particles whose diameter are larger than 10 μm and is generally composed of coal dust, fine dust and secondary dust (Zhang *et al*., 2006). The dust is interrelated with human activities, local geography and the geological environment in particular areas. Topsoil and dust play important roles in human health due to the possibility of them re-emitting Hg to the atmosphere. Therefore, more and more studies now focus on Hg concentrations in urban soil or dust. Zhang *et al*. (2006) studied total mercury (THg) concentrations in the topsoil and dust of Beijing, and reveal that the THg concentration in topsoil and dust ranged from 0.019 to 0.97 mg/kg and from 0.053 to 1.4 mg/kg, respectively. Fang *et al*. (2004) working on THg in the urban soil of Changchun, China, show that the THg concentration range was 0.14–0.15 mg/kg. Rodrigues *et al*. (2006) reported THg concentrations in soil from six European cities, which varied from 0.015 to 6.3 mg/kg. Other researchers also reported Hg concentrations in soil from various places (McGrath, 1995; Chatterjee and Banerjee, 1999; Manta *et al*., 2002; Kongchum *et al*., 2006; Millán *et al*., 2006; Aeliona *et al*., 2008; Grimaldi *et al*., 2008).

Most of the above-mentioned publications only refer to the concentration of THg, but not methylmercury (MeHg). As the most toxic Hg form, MeHg is more easily absorbed and biomagnified by organisms, and eventually enters the food chain (Eisler, 1987). Human exposure to MeHg has become a major public health concern in recent years. To assess Hg pollution in an area, not only THg but also MeHg should be considered. This study aimed to investigate the levels and distribution of THg and MeHg in the topsoil and dust of Xiamen, China, and to discuss the correlations between Hg species and environmental parameters such as pH and soil organic matter (SOM). This is the first report on THg and MeHg in Xiamen topsoil and dust. It will be helpful for understanding the situation of Hg pollution in Xiamen.

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1 Materials and methods

1.1 Sampling and sample processing

The study area (Fig. 1) is the principal part of Xiamen Island (latitude 24°25′33″N –24°33′32″N, longitude 118°3′22″E–118°11′50″E). Xiamen is a scenic coastal city in southeast China, covering an area of 132.5 km^2, with a length of 13.7 km from south to north and a width of 12.5 km from east to west. The population is about 728000. Commerce and tourism are the main economic support of Xiamen. There are a few industrial enterprises in Xiamen, including electronics, toy and clothing manufacturers. There also are two coal-fired power plants located on other islands about 5 km (southwest direction) and 15 km (south direction) away from Xiamen Island.

The topsoil and dust samples were collected in June, 2008. As shown in Fig. 1, twenty sampling stations were set in land area with different functions, including four beauty spots at Nanputuo Hill, Huli Park, Zhongshan Park and beach music square; two belts of farm croplands at Huangcuo and Dadongshan; six residential areas at Qianpu, Jinshang, Sanhang, Ruijing, Lianhua and Changle; three industrial estates at Caitang, Xiahua factory and Longshan; two shopping centers at Hexiang Street and Zhongshan Street; and three other public areas at Xiada bus station, Huli Government Offices and Gaoqi Airport. In addition to the above sampling stations, three topsoil samples were collected from vegetable land, orchard and native bush, respectively, at Dadongshan, and a sludge sample was taken from the city municipal sewage treatment plant.

In each sampling station, topsoil samples were collected from a depth of 0–10 cm. The final topsoil sample was a mixture of five sub-samples taken from five sub-stations at the sampling station. Sampling was performed with a clean bamboo shovel. The dust was collected from the paved road surface near the topsoil sampling station with a clean plastic broom and dustpan. Both topsoil and dust samples were placed in high-density polyethylene bags and sent to the laboratory quickly, where the topsoil and dust samples were air dried at room temperature. Stones were removed and aggregates were crushed and homogenized. The dried samples were sieved to 2 mm using a nylon sieve and ground to <149 μm using a mortar and pestle, and then were kept in a double-bagged glass bottle at 4°C.

1.2 Determination of THg and MeHg

THg analysis was based on USEPA method 1631, the method of Gill and Fitzgerald (1987), and appendix to USEPA method 1631. Briefly, 0.3–0.5 g sample was digested for more than 8 h at 60°C using 5 mL mixed acid consisting of 70% (*V/V*) concentrated H_2SO_4 (Merck, Germany) and 30% (*V/V*) concentrated HNO_3 (Fluka, Germany) to ensure complete digestion of the organic matter (Bloom and Crecelius, 1987). The solution was diluted to approximately 50 mL, and then 1 mL of BrCl

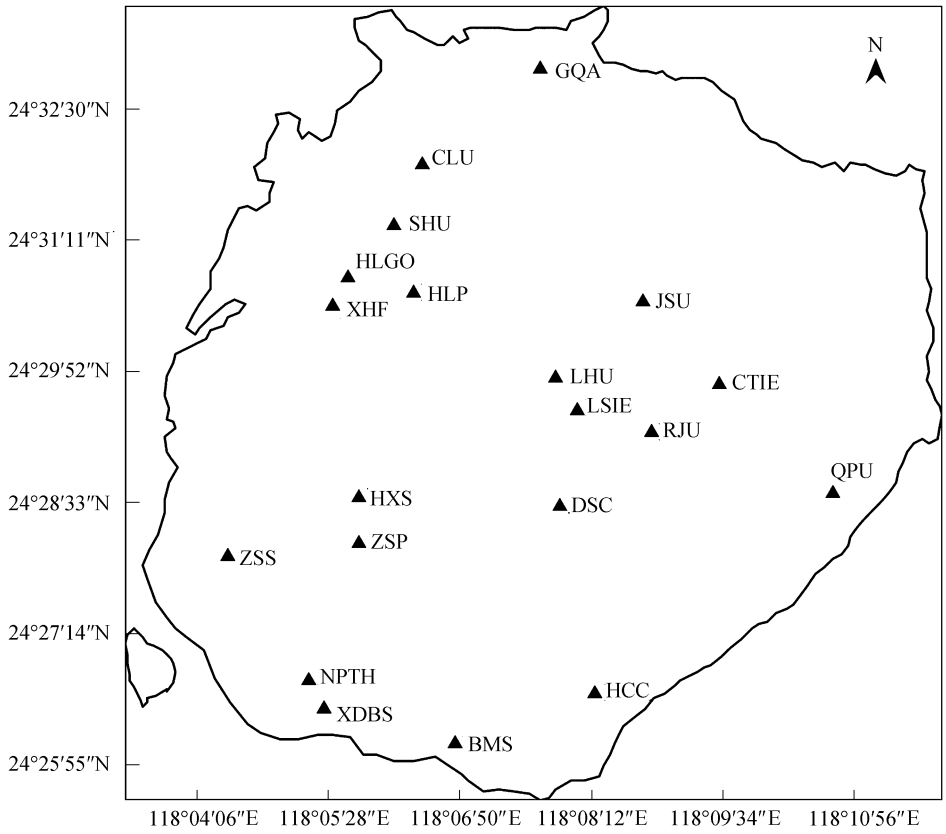

Fig. 1 Sampling stations in the study area (Xiamen Island). NPTH: Nanputuo Hill; HLP: Huli Park; ZSP: Zhongshan Park; BMS: beach music square; HCC: Huancuo cropland; DSC: Dadongshan cropland; QPU: Qianpu uptown; JSU: Jinshang uptown; SHU: Sanhang uptown; RJU: Ruijing uptown; LHU: Lianhua uptown; CLU: Changle uptown; CTIE: Caitang industrial estate; XHF : Xiahua factory; LSIE: Longshan industrial estate; HXS: Hexiang Street; ZSS: Zhongshan Street; XDBS: Xiada bus station; HLGO: Huli Government Offices; GQA: Gaoqi Airport.

made from KBr, $KBrO_3$ and HCl (Merck, Germany) was added. A small aliquot of the digestate was placed in a bubbler with $SnCl_2$ and the reduced Hg was purged from the solution onto a gold-coated sand (Frontier Geosciences Inc., Seattle, USA) trap. The gold trap was heated in a stream of argon and the released Hg was fed into an AF-610B cold vapor atomic fluorescence spectrometry (CVAFS) detection unit (Beijing Beifenruili Analytic Instrument (Group) Co., Ltd., China) equipped with a dual-trap amalgamation system (made by ourselves according to USEPA method 1631).

MeHg in soil and dust was analyzed based on the method described in previous reports (Horvat *et al*., 1993; Bloom, 1989; Mason and Lawrence, 1999) and USEPA method 1630. Briefly, an aliquot of sample was distilled with a mixed solution of H_2SO_4 and KCl. An appropriate amount of distillation was poured into a bubbler with acetate buffer to be ethylated using $NaBEt_4$ (Strem Chemicals, Inc., USA). The ethylated Hg species were purged from the solution and trapped on a Tenax® (Supelco, 60–80 mesh) trap. The Tenax® trap was flash heated in a stream of argon and the thermally released Hg species were separated in a gas chromatography packed column (1.5 m column length × 4 mm i.d., packed with 60/80 mesh 10% OV-101 (Supelco, USA). The Hg complexes were all converted to Hg^0 in a pyrolytic column and measured by CVAFS.

Other mentioned but not indicated reagents were A.R reagents made in China. Water content in the topsoil and dust was determined based on the weight method (Lu, 1999). All of the topsoil and dust determinations were expressed as a dry weight in this study.

1.3 Determination of ancillary parameters

The pH (H_2O) of topsoil and dust was determined, respectively, in the laboratory using standard techniques (Lu, 1999). SOM was determined using the H_2SO_4-$K_2Cr_2O_7$ oxidation method (Lu, 1999).

1.4 Quality control of sample analysis

For the determination of THg and MeHg in this study, the correlation coefficients r^2 of the calibration curve were higher than 0.996. One method blank, one or two pairs of matrix spike/matrix spike duplicates and one or two sample duplicates were used in each sample batch (up to 20 samples) for analysis. Besides, a soil CRM (ESS-4, (0.021 ± 0.004) mg/kg THg) from the Institute for Reference Materials of the State Environmental Protection Administration of China was also used for quality control, and the result was within the 95% confidence interval values. In all method blanks, THg and MeHg were below method detection limits (THg, 0.78 ng/g as Hg; CH_3Hg, 4.3 pg/g as Hg). Recoveries for matrix spikes were within the acceptable ranges (70%–130% for THg and 65%–135% for MeHg). The relative percentage difference (RPD) of matrix spike duplicates and sample duplicates were also acceptable (< 30%). The instrument performance was checked by running ongoing precision and recovery (OPR) solution (a standard solution), and the OPR precision and recovery were within the acceptable ranges regulated in USEPA method 1631 and USEPA method 1630.

1.5 Statistical analysis

Summary statistics were used to obtain the averages and standard deviations of all studied parameters. Student's *t*-test was used to detect significant difference between means of THg (or MeHg) in the topsoil and dust collected from different land function areas. Linear correlation analysis was used to examine the correlation between two parameters. All statistical analyses were performed using the software Microsoft Excel and Origin 6.1.

2 Results and discussion

2.1 THg concentration and distribution in topsoil and dust

2.1.1 THg concentration in topsoil

The THg concentrations in topsoil and dust are displayed in Fig. 2. The THg concentrations in the topsoil ranged from 0.071 to 1.2 mg/kg, with a mean of 0.46 mg/kg and a median of 0.46 mg/kg. In comparison with the background THg of 0.065 mg/kg for soil in China (SEPAC, 1990), the mean concentration of THg was about

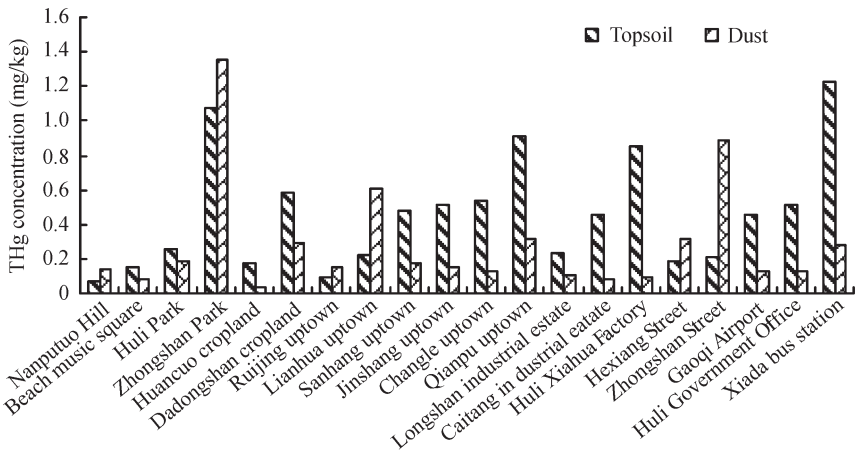

Fig. 2 Concentrations of THg in the topsoil and dust of Xiamen Island.

6 times higher, and THg concentrations in most of the sampling stations were more than 2 times higher. However, abnormally high THg concentrations in samples were obtained in 4 sampling stations (Zhongshan Park, Qianpu uptown, Xiahua Factory and Xiada bus station), which were about 12 times higher than the background value.

Concentrations of THg reported in some urban soils are summarized in Table 1. The median of THg in Xiamen soil was about 8 times higher than the median value of world soils. It was higher than that of other reported Chinese urban soils except Baoji, and at the mid level of the world urban soils investigated. In comparison, it was slightly less than those of urban soils in Pittsburg (USA) (0.51 mg/kg), Palermo (Italy) (0.68 mg/kg), Wexford (Ireland) (0.68 mg/kg) and Cornwall (Canada) (0.70 mg/kg), but much less than that in Glasgow (Scotland) (1.2 mg/kg).

Among all samples collected in this work, only those from Nanputuo Hill and Ruijing uptown met the first level criterion for soil quality in China (0.15 mg/kg) (GB15618-1995). The concentrations of THg in the topsoil collected in Zhongshan Park and Xiada bus station exceeded the limit prescribed as the second level criterion for soil quality in China (1.0 mg/kg). The concentrations of THg in the rest of the topsoil samples were below the limit prescribed as the second level criterion for soil quality in China. These observations suggested that the urban topsoil in Xiamen has been polluted by Hg.

It should be indicated that most of the samples were collected from the city landscaping belt. In past years, the sludge collected from the city municipal sewage treatment plant was used for cultivating some urban landscaping belts and the fertilizer for croplands in Xiamen. The concentration of Hg in the sludge was found to be higher than 1.0 mg/kg, at the same level as the maximum concentration of the topsoil samples. Therefore, the higher Hg concentration in the topsoil of some stations, such as Zhongshan Park, Xiada bus station, Dadongshan cropland and some uptowns, could probably be due to this sludge and fertilizer.

To further confirm that, three additional topsoil samples, collected from vegetable land, orchard and native bush at Dadongshan where sludge was once used as fertilizer, were analyzed for THg. The THg concentration in the topsoil of native bush was 0.069 mg/kg, the same level as the background THg for soil in China. However, THg concentrations of topsoil in cultivated areas, such as vegetable land and orchard, were 0.57 and 0.66 mg/kg, respectively. Those were much higher than that in the native bush. On the other hand, in other croplands where the sludge had not been applied, no abnormal high concentration of THg was observed. Sludge used as fertilizer was concluded to be the main source of Hg in the topsoil at Dadongshan cropland. It is advisable that municipal sludge should not be used as fertilizer on plant cultivating soil due to the probable Hg pollution.

2.1.2 THg concentrations in dust

As shown in Fig. 2, THg concentrations in the dust were in the range of 0.034–1.4 mg/kg. The mean and median values were 0.28 and 0.16 mg/kg, respectively. This average was less than that of the topsoil in Xiamen, indicating that Hg could be enriched by the soil. Compared with the other urban dusts, the average THg concentrations in Xiamen were at the same level as those in Beijing (mean 0.28 mg/kg, median 0.18 mg/kg) (Zhang *et al*., 2006), much lower than that in Xi'an (mean 0.64 mg/kg, median 0.43 mg/kg) (Han *et al*., 2006), and higher than that in Ottawa (mean 0.029 mg/kg, median 0.018 mg/kg) (Rasmussen *et al*., 2001). No statistically significant correlation was observed for THg concentrations in the topsoil and dust (r = 0.307, n = 20, P = 0.189) in the whole study area. However, by omitting four stations (Zhongshan Street, Hexiang Street, Zhongshan Park, Lianhua uptown),

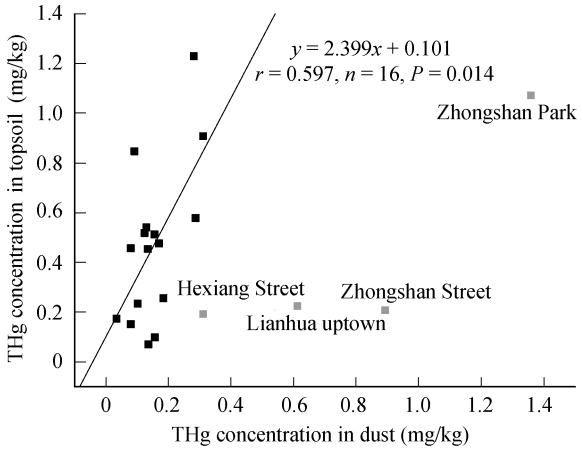

Fig. 3 Correlation between THg concentrations in the topsoil and dust.

Table 1 Median or mean value of total mercury (THg) concentrations C_{THg} in different urban topsoils

City	C_{THg} mean or median (mg/kg)	Reference	City	C_{THg} mean or median (mg/kg)	Reference
Changchun	0.16	Fang *et al*., 2004	Khabarovsk	0.080	Kot and Matyushkina, 2002
Xi'an	0.17	Jin *et al*., 2008	Jakobstad	0.093	Peltola and Åström, 2003
Xuzhou	0.18	Wang and Qin, 2005	Trondheim	0.13	Reimann and Caritat, 1998
Beijing	0.18	Zhang *et al*., 2006	Amursk	0.18	Kot and Matyushkina, 2002
Wuhan	0.31	Zhang and Wong, 2007	Berlin	0.19	Birke and Rauch, 2000
Chongqing	0.32		Pittsburg	0.51	Carey *et al*, 1980
Xiamen	0.46	This work	Palermo	0.68	Manta *et al*., 2002
Baoji	0.61	Yang and Wang, 2008	Wexford	0.68	McGrath, 1995
Averio	0.055	Rodrigues *et al*., 2006	Cornwall	0.70	Sherbin, 1979
Oslo	0.060	Tijhuis *et al*., 2002	Glasgow	1.2	Rodrigues *et al*., 2006
Median value of world soils	0.050	Reimann and Caritat, 1998			

where THg concentrations in the dust were higher than 0.311 mg/kg, and where THg concentrations in the topsoil were significantly correlated to those in the corresponding dust (r = 0.597, n = 16, P = 0.014), as shown in Fig. 3.

2.1.3 THg distribution in the topsoil and dust

The range and mean of THg concentrations in the different types of topsoil and dust are listed in Table 2. Except for the shopping centers, no significant differences of the THg means among different areas were observed, and this was illustrated that the land function was not the main factor affecting the topsoil THg concentration. As shown in Fig. 4a, higher THg concentrations in the topsoil were determined in several separated regions, however, no obvious spatial distribution characteristics were found. The sludge containing a high concentration of Hg from the municipal sewage treatment plant had been randomly used as cultivating soil and fertilizer in this area for a long time (details were given in Section 2.1.1).

However, THg distribution in the dust was slightly linked to land functions. The mean of THg concentrations in the dust from different types of land were ranked in the following order: shopping center > beauty spot ≫ residential area > the other public areas > farm belt > industrial estate. High THg concentrations in the dust were only found in southwest Xiamen Island, and the concentrations gradually decreased from southwest to northeast (Fig. 4b). The possible Hg source include the coal-fired plant located 5 km southwest of Xiamen Island and heavy traffic on the island.

2.2 MeHg concentrations and distribution in topsoil and dust

2.2.1 MeHg concentrations in topsoil

As can be seen from Table 3, low MeHg concentrations were observed in the study area topsoils, ranging from 0.14 to 5.7 μg/kg, with a mean of 1.2 μg/kg and a median of 0.74 μg/kg. The ratios of MeHg/THg in the topsoil were in the range 0.069%–0.74%, with a mean of 0.28% and a median of 0.26%. The ratios of MeHg/THg in Xiamen were much lower than that in wetland (Kongchum *et al*., 2006), but much higher than that in soils heavily polluted by Hg (Horvat *et al*., 2003).

Figure 5 reveals significant linear correlation between MeHg and THg in topsoil (r = 0.510, n = 20, P = 0.022). This result showed that THg concentration was of benefit to Hg methylation. In general, MeHg could come either from *in situ* Hg methylation or from a MeHg pollution source. The significant correlation between MeHg and the corresponding THg values was likely to indicate that *in situ* Hg methylation was the main source of MeHg in Xiamen topsoil.

Table 3 Methylmercury (MeHg) concentration (C_{MeHg}) and ratios of MeHg/THg in the topsoil and dust

Sampling station	Topsoil		Dust	
	C_{MeHg} (μg/kg)	MeHg/THg (%)	C_{MeHg} (μg/kg)	MeHg/THg (%)
Nanputuo Hill	0.19	0.26	0.13	0.094
Huli Park	1.0	0.40	0.52	0.28
Zhongshan Park	1.9	0.18	2.3	0.17
Beach music square	0.15	0.096	0.49	0.61
Huancuo cropland	0.45	0.26	0.092	0.27
Dadongshan cropland	0.53	0.091	0.17	0.060
Qianpu uptown	1.2	0.13	0.42	0.13
Jinshang uptown	0.76	0.15	0.57	0.37
Sanhang uptown	2.2	0.46	0.59	0.34
Lianhua uptown	0.67	0.30	0.68	0.11
Ruijing uptown	0.73	0.74	0.47	0.30
Changle uptown	1.6	0.30	0.67	0.52
Caitang industrial estate	1.8	0.39	0.26	0.33
Xiahua Factory	5.7	0.67	0.58	0.63
Longshan industrial estate	0.29	0.12	0.26	0.25
Hexiang Street	0.61	0.32	0.43	0.14
Zhongshan Street	0.14	0.069	0.84	0.094
Xiada bus station	1.2	0.094	0.69	0.24
Huli Government Offices	2.2	0.43	0.33	0.27
Gaoqi Airport	0.61	0.14	0.49	0.37
Mean	1.2	0.28	0.55	0.28
Median	0.74	0.26	0.49	0.27

2.2.2 MeHg concentrations in dust

The range, mean and median of MeHg concentrations in the dust were 0.092–2.3 μg/kg, 0.55 μg/kg and 0.49 μg/kg, respectively. The average MeHg concentration in dust was about half that in the topsoil. The ratios of MeHg and THg in the dust were in the range of 0.060%–0.63% (Table 3), with a mean of 0.28% and a median of 0.27%, that are almost at the same levels as the topsoil. A positive correlation between THg and MeHg concentrations was found in the dust (r = 0.855, n = 20, p < 0.0001) (Fig. 6), but there was no significant relationship between MeHg concentrations in the topsoil and those in the dust, indicating that *in situ* Hg methylation was also the main source of MeHg in the dust.

2.2.3 MeHg distribution in topsoil and dust

Table 4 indicates that the means of MeHg concentrations in the topsoil of different function land areas varied. Although the mean THg concentration in the topsoil of the industrial estate was not the highest one (Table 2),

Table 2 Range and mean of THg concentrations in the topsoil and dust of different land function areas

Land function	Sample number	C_{THg} in topsoil (mg/kg)		C_{THg} in dust (mg/kg)	
		Range	Mean ± SD	Range	Mean ± SD
Beauty spot	4	0.071–1.1	0.39 ± 0.46	0.080–1.4	0.44 ± 0.61
Farm belt	2	0.17–0.58	0.38 ± 0.29	0.034–0.29	0.16 ± 0.18
Residential area	6	0.098–0.91	0.46 ± 0.28	0.13–0.61	0.26 ± 0.19
Industrial estate	3	0.23–0.85	0.51 ± 0.31	0.079–0.10	0.091 ± 0.011
Shopping center	2	0.19–0.21	0.20 ± 0.01	0.31–0.89	0.60 ± 0.41
Other public areas	3	0.45–1.2	0.73 ± 0.43	0.12–0.28	0.18 ± 0.09

SD: standard deviation.

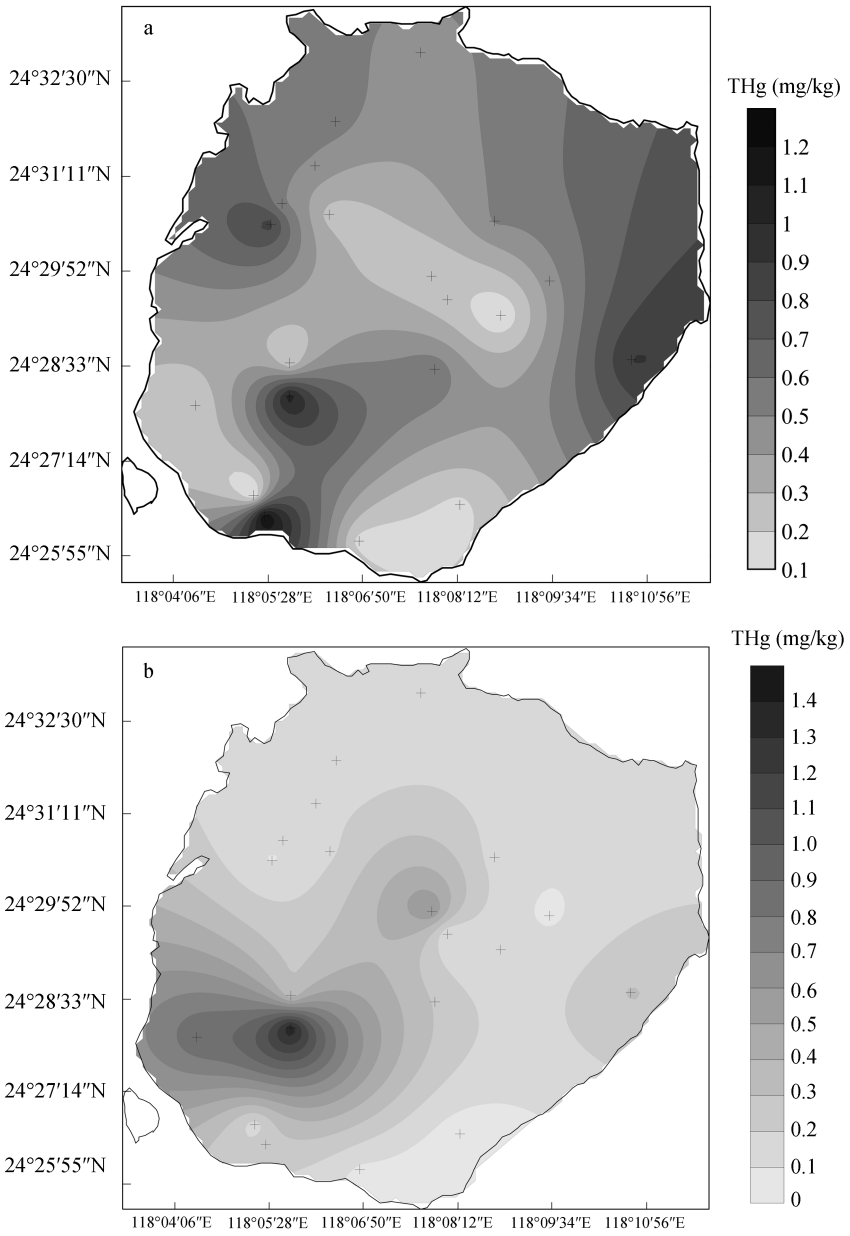

Fig. 4 Spatial distribution of THg in Xiamen topsoil (a) and dust (b).

the maximum mean of MeHg was observed, which was about 7 times the minimum value determined in the shopping center. This result showed that the environmental conditions in the topsoil of the industrial estate were more beneficial for *in situ* Hg methylation. Compared with the topsoil, the means of MeHg concentration in dust of the different land function areas were relative invariable (Table 4). Except for the beauty spot, the mean MeHg concentration in the dust was significantly different from that in the corresponding topsoil, but the mean of MeHg/THg ratios in the dust was similar to that found in the topsoil in the same land function area (Fig. 7). These results indicated that the topsoil and dust of the same land function area had the same environmental conditions for *in*

Table 4 Range and mean MeHg concentrations in the topsoil and dust of different land function areas

Land function	Sample number	C_{MeHg} in topsoil (μg/kg)		C_{MeHg} in dust (μg/kg)	
		Range	Mean ± SD	Range	Mean ± SD
Beauty spot	4	0.15–1.9	0.81 ± 0.82	0.13–2.3	0.85 ± 0.96
Farm belt	2	0.45–0.53	0.49 ± 0.05	0.092–0.17	0.13 ± 0.06
Residential area	6	0.67–1.6	1.2 ± 0.6	0.42–0.68	0.57 ± 0.11
Industrial estate	3	0.29–5.7	2.6 ±2 .8	0.26–0.58	0.36 ± 0.18
Shopping center	2	0.14–0.61	0.38 ± 0.33	0.43–0.84	0.64 ± 0.29
Other public areas	3	0.61–2.2	1.3 ± 0.8	0.33–0.69	0.50 ± 0.18

SD: standard deviation.

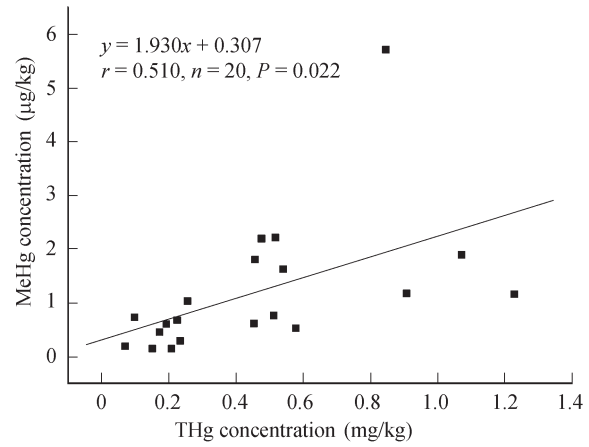

Fig. 5 Correlation between MeHg and THg concentrations in the topsoil.

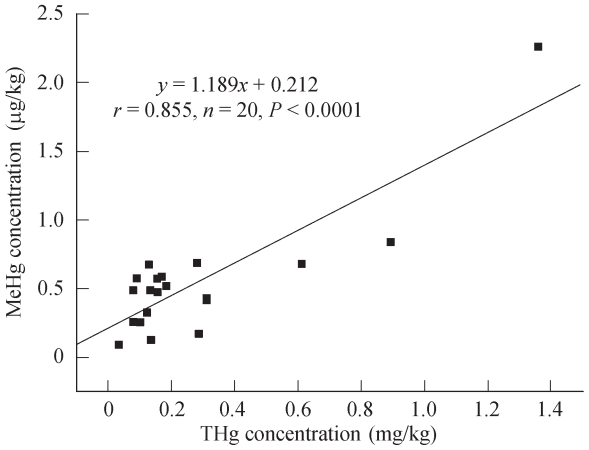

Fig. 6 Correlation between MeHg and THg concentrations in the dust.

situ Hg methylation.

2.3 Relationships of THg, MeHg and relative environmental parameters

The Hg deposited onto the topsoil is known to be affected by a wide array of chemical and biological transformation processes such as Hg^0 oxidation, and Hg(II) reduction or methylation depending on various soil parameters (Weber, 1993). Studies have shown that Hg species are bound to organic matter in soil (Schuster, 1991; Yin *et al*., 1997; Wallschläger, 1998), and THg or MeHg is obviously correlated with organic matter in soil (Qiu *et al*., 2005).

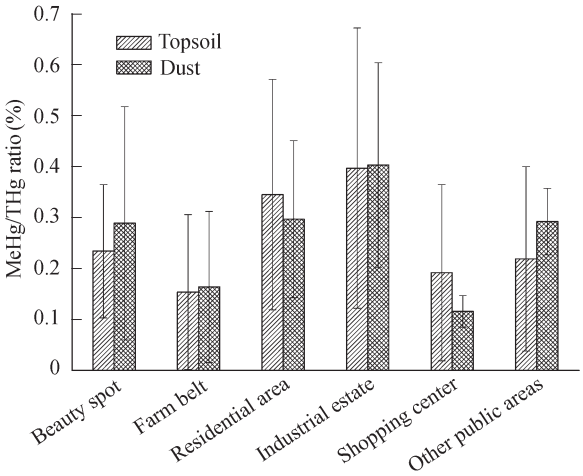

Fig. 7 Mean MeHg/THg ratios in the topsoil and dust of different land function areas.

In this study, there was a significant linear correlation between THg and SOM in the topsoil (r = 0.481, n = 20, P = 0.032, Fig. 8a). A weak positive correlation was shown between MeHg concentrations and the corresponding SOM in the topsoil (r = 0.425, n = 20, P = 0.062, Fig. 8b). As displayed in Fig. 9, both THg (r = 0.448, n = 20, P = 0.047, Fig. 9a) and MeHg (r = 0.515, n = 20, P = 0.020, Fig. 9b) in the dust had statistically positive relationships with SOM. These results showed that SOM could increase the absorption of Hg in the topsoil and dust, and help *in situ* Hg methylation. Figures 8c and 9c show that no statistical correlation between MeHg/THg ratios and SOM was observed in either the topsoil or dust sample of Xiamen, which agreed with the result of Remy *et al*. (2006).

The pH (H_2O) of the topsoil in Xiamen ranged from 6.10

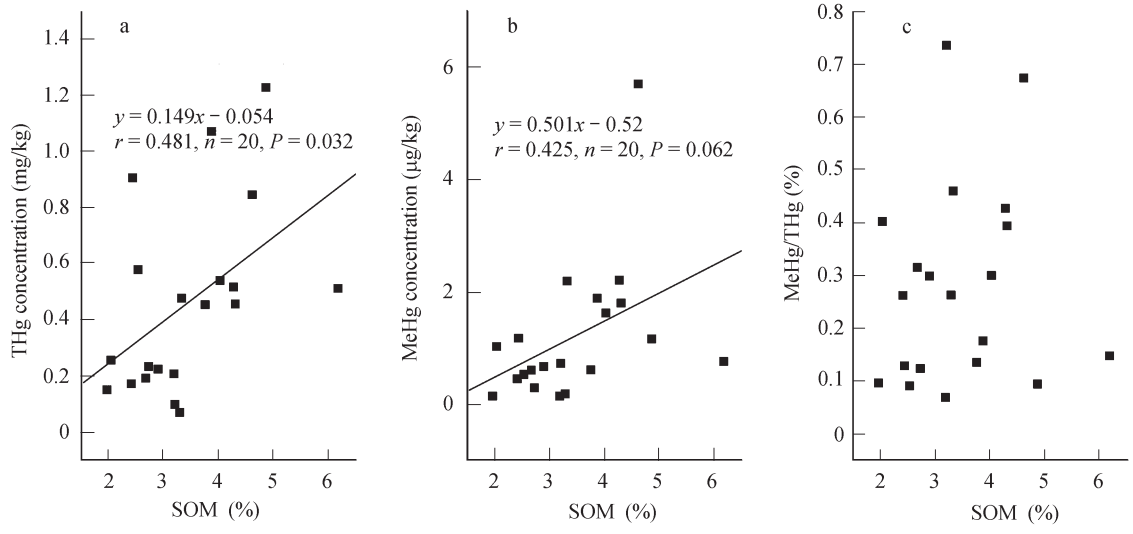

Fig. 8 THg (a), MeHg (b) concentrations and the ratios of MeHg/THg (c) vs. soil organic matter (SOM) in the topsoil.

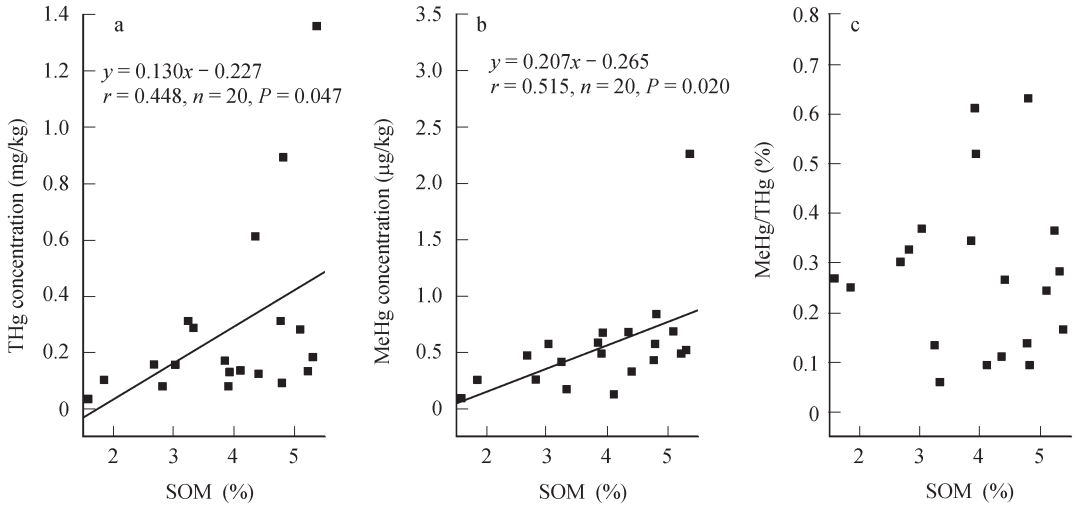

Fig. 9 THg (a), MeHg (b) concentrations and the ratio of MeHg/THg (c) vs. SOM in the dust.

to 8.16, and that of the dust from 6.88 to 8.14. A strong relationship between THg and pH was also reported by Qiu *et al*. (2005). In this study, neither THg nor MeHg was correlated with pH values in either the topsoil or dust.

3 Conclusions

THg content in Xiamen urban topsoil was high, compared with other soil studies. Hg seemed to be more enriched in the topsoil than in the adjacent dust. Higher THg concentrations in the topsoil were determined in the areas where municipal sludge was used for cultivating the soil or as a fertilizer. Both topsoil and dust MeHg concentrations were linked to the corresponding THg. It was noticed that THg concentrations would benefit the production of MeHg in Xiamen urban topsoil and dust. For both topsoil and dust samples, THg and MeHg concentrations depended on the corresponding SOM, but were independent of the corresponding pH. Compared with the high THg in Xiamen urban topsoil and dust, MeHg concentrations in both topsoil and dust were low, resulting in lower MeHg/THg ratios in comparison with other studies.

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