# Epidemiological Study on Health Risk Assessment of Exposure to $PM_{2.5}$-bound Toxic Metals in the Industrial Metropolitan of Rayong, Thailand

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**Table S1.** Recoveries of elements obtained from CRM No.28 Urban Aerosols and spiking method.

| Element | SRM 1648a (n = 7) | | | Spiking method (n = 7) |
|---|---|---|---|---|
| | Reference value* | Measured values | % Recovery± SD | % Recovery±SD 0.10 mg/L |
| As | 90.2 mg/kg | 70.3±0.8 mg/kg | 77.9±0.9 | 79.3±3.2 |
| Cd | 5.60 mg/kg | 3.81±0.10 mg/kg | 68.0±1.9 | 91.7±2.0 |
| Cr | 65.6 mg/kg | 46.9±0.7 mg/kg | 71.6±1.1 | 94.5±2.6 |
| Ni | 63.8 mg/kg | 44.6±0.5 mg/kg | 69.9±0.8 | 94.0±1.9 |
| V | 73.2 mg/kg | 49.8±0.6 mg/kg | 67.8±0.9 | 98.6±3.8 |
| Pb | 403 mg/kg | 392±6.18 mg/kg | 97.4 ±1.5 | 88.4±2.5 |
| Cu | 104 mg/kg | 95.6±1.6 mg/kg | 91.9±1.6 | 98.4±2.4 |
| Fe | 2.92% | 2.15±0.03% | 73.7±1.1 | 88.6±3.8 |
| K | 1.37% | 0.92±0.02% | 67.1±1.4 | 95.0±2.3 |
| Mn | 686 mg/kg | 597±9.34 mg/kg | 87.1±1.4 | 93.7±1.9 |
| Zn | 0.114% | 0.095±0.002% | 83.8±1.4 | 85.3±1.8 |

* Reference concentrations in CRM No.28 Urban Aerosols

**Table S2**. The limit of detection (LOD) and limit of quantitation (LOQ) of elements.

| Elements | Concentration (μg/m³) | |
|---|---|---|
| | LOD (n = 10) | LOQ (n = 10) |
| As | 0.010 | 0.034 |
| Cd | 0.005 | 0.017 |
| Cr | 0.022 | 0.074 |
| Ni | 0.011 | 0.035 |
| V | 0.000 | 0.000 |
| Pb | 0.009 | 0.029 |
| Cu | 0.006 | 0.021 |
| Fe | 0.044 | 0.147 |
| K | 0.141 | 0.470 |
| Mn | 0.005 | 0.017 |
| Zn | 0.006 | 0.021 |

**Table S3.** Meteorological parameters in Rayong city during dry season (November 2021 to April 2022).

| Parameters | | Nov.2021 | Dec.2021 | Jan.2022 | Feb.2022 | Mar.2022 | Apr.2022 |
|---|---|---|---|---|---|---|---|
| **Temperature (°C)** | Mean±SD | 27.0±0.6 | 26.3±1.4 | 26.4±0.8 | 27.1±0.9 | 28.5±0.9 | 28.5±1.8 |
| | Range | 25.6-27.8 | 23.3-28.1 | 25.1-28.1 | 25.7-28.7 | 26.1-29.6 | 23.3-30.6 |
| **Relative Humidity (%)** | Mean±SD | 77.5±7.4 | 64.7±8.4 | 78.5±7.5 | 77.5±10.4 | 82.4±2.4 | 79.1±6.6 |
| | Range | 66.0-90.0 | 55.0-84.0 | 68.0-89.0 | 54.0-89.0 | 78.0-87.0 | 65.0-90.0 |
| **Wind Speed (m/s)** | Mean±SD | 5.86±1.75 | 7.20±1.35 | 1.10±0.44 | 5.81±1.96 | 5.59±1.68 | 6.45±2.18 |
| | Range | 3.60-9.26 | 4.63-9.77 | 0.50-2.03 | 1.54-9.26 | 4.12-9.26 | 4.12-9.77 |
| **Total precipitation (mm)** | Sum | 58.3 | 15.9 | 0.2 | 33.5 | 75.6 | 118 |

**Table S4.** EDS atomic percentage for individual $PM_{2.5}$ samples in Rayong city.

| Elements | Atomic % of element for $PM_{2.5}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** |
| C | 50.4 | 43.0 | 26.6 | - | 27.2 | 68.1 | 47.4 | 32.3 |
| O | 24.8 | 31.7 | 37.3 | 49.6 | 32.1 | 22.4 | 27.9 | 31.1 |
| Al | 4.87 | 0.62 | 1.34 | 7.90 | 0.24 | 0.90 | 0.04 | 1.12 |
| Si | 15.3 | 16.8 | 31.0 | 19.9 | 39.6 | 4.70 | 20.3 | 25.1 |
| Na | 0.77 | 0.39 | 0.13 | 3.57 | 0.25 | 2.22 | 0.62 | 0.73 |
| Ca | 0.13 | 0.07 | - | 3.69 | - | - | - | 0.08 |
| Mg | - | 0.07 | - | 3.00 | - | - | - | 0.05 |
| Cl | - | - | 0.16 | 3.12 | - | 1.29 | - | - |
| K | 1.05 | 3.12 | - | 1.59 | - | 0.25 | 0.01 | 0.44 |
| Fe | 0.42 | 0.24 | 0.59 | 3.26 | 0.55 | 0.18 | 0.82 | 1.64 |
| Cu | 1.94 | 2.09 | 1.28 | 2.22 | - | - | 1.02 | 1.73 |
| Zn | - | 0.95 | 0.87 | - | - | - | 1.64 | 4.60 |
| V | 0.33 | - | 0.14 | - | - | - | 0.08 | 0.15 |
| Cr | 0.02 | - | - | 0.77 | - | - | 0.19 | 0.05 |
| Mn | - | - | - | 1.02 | - | 0.02 | 0.04 | 0.51 |
| Ni | - | 0.93 | 0.66 | - | - | - | - | - |
| Ti | - | - | - | 0.36 | - | - | - | 0.37 |