Data Article

Mercury concentration data from Matang Mangrove Forest Reserve, Malaysia

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A B S T R A C T
This paper presents the results of mercury analysis on 786 abiotic (surface sediments) and biotic (plant and animal tissues) samples collected from 10 sites at Matang Mangrove Forest Reserve in Peninsular Malaysia. Sediment samples were collected at the surface level from both river bank and forest understory. Whereas plant tissues obtained from Rhizophora apiculata Blume and Rhizophora mucronata L. consisted of leaves (in four stages namely young, mature, senescent and decomposing), bark and roots (divided into xylem, cortex and epidermis), the animal samples were represented by muscle tissue of the gastropod Cassidula aurisfelis Bruguière and the cockle Tegillarca granosa L. The mercury concentration measurements were obtained through a cold vapor atomic absorption spectrometer. The core data have been

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analysed and interpreted in the paper “Distribution of mercury in sediments, plant and animal tissues in Matang Mangrove Forest Reserve, Malaysia” [1].

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Specifications Table

| Subject                  | Environmental Science |
|--------------------------|-----------------------|
| Specific subject area    | Pollution             |
| Type of data             | Table                 |
| How data were acquired   | Cold vapor atomic absorption spectrometer (MA-3000 Nippon Instruments Corp., Japan) |
| Data format              | Raw                   |
| Parameters for data collection | 1. Surface sediment samples from river bank and understory |
|                          | 2. Plant tissue samples from Rhizophora apiculata and R. mucronata leaves (young, mature, senescent and decomposing stages), bark and roots (xylem, cortex and epidermis) |
|                          | 3. Animal muscle tissue samples from Cassidula aurisfelis and Tegillarca granosa |

Description of data collection

Both abiotic and biotic samples were collected during June–July 2018 from 10 sites within Kuala Sepetang administrative range of Matang Mangrove Forest Reserve. All biotic samples were first washed with distilled Milli Q water (Millipore Corporation, USA) and then freeze-dried (−40 °C) (LABCONCO Freeze Dry System/Freezezone 4.5) before grinding to fine powder with mortar and pestle. The sediment samples were subjected to manual sieving with 60 µm mesh size. Grounded samples were finally analyzed for mercury concentration with the help of a cold vapor atomic absorption spectrometer (MA-3000 Nippon Instruments Corp., Japan).

Data source location

Kuala Sepetang, Matang Mangrove Forest Reserve, Perak, Malaysia

Station 1: N04°50′36.6″, E100°38′02.1″
Station 2: N04°50′19.2″, E100°37′05.8″
Station 3: N04°50′24.7″, E100°35′38.9″
Station 4: N04°51′09.4″, E100°33′24.6″
Station 5: N04°49′15.1″, E100°35′14.8″
Station 6: N04°49′32.2″, E100°33′39.4″
Station 7: N04°48′56.4″, E100°37′19.2″
Station 8: N04°47′25.3″, E100°37′34.6″
Station 9: N04°47′59.9″, E100°38′41.8″
Station 10: N04°45′46.7″E100°36′18.0″

Cockle culture: N04°51′29.4″, E100°34′43.6″

Data accessibility

With the article

Related research article

Giovanna Wolswijk, Behara Satyanarayana, Le Quang Dung, Yin Fui Siau, Ahmad Nazila Bin Ali, Ibrahim Sunkammi Salii, Muhammad Amir Bin Fisol, Cristina Gonnelli, Farid Dahdouh-Guebas, 2019, Distribution of Mercury in sediments, plant and animal tissues in Matang Mangrove Forest Reserve, Malaysia. Journal of Hazardous Materials, https://doi.org/10.1016/j.jhazmat.2019.121665.

Value of the Data

- The data represents, for the first time, an in-depth analysis of Hg pollution at Matang mangroves in Peninsular Malaysia. The large sample size (n = 786) allows to get reliable information on the distribution of mercury in Rhizophora spp.
- The data is beneficial to a wider scientific community as few detailed investigations are available on the subject, making this study a benchmark for future research. In addition, the data enables the scientific and local management community to understand the levels of mercury pollution in one of the longest silviculturally managed mangrove forests in the world.
- At a local scale, the data can help to take necessary measures for controlling/monitoring the pollution (especially of industrial origin) by concerned authorities like National Hydrological Research Institute of Malaysia, Department of Irrigation and Drainage, Forestry Department, etc.
- The present data can be a strong baseline for future studies to define mercury pathways in the mangroves. In addition, the data can be compared with other toxic elements and offer appropriate safety guidelines for the environment as well as the public.
- The collection of 786 samples requires time (sample collection and preparation) and energy (manpower and analyses) that can be saved in the planning for future studies on mercury in Matang by other scientists.
1. Data description

The data reported in Table 1 consists of raw data on mercury concentrations (n = 786) obtained from 10 sampling sites at Matang Mangrove Forest Reserve in Peninsular Malaysia, that were analyzed and discussed in the study by Wolswijk et al. [1]. The data are subdivided according to the sampling sites (St 1 to St 10). The Hg concentrations in plant tissues are from *R. apiculata* for all sampling sites except St 4 and St 6 (located seaward side) where *R. mucronata* was collected. The value of mercury concentration in sediments collected from the riverbank and inside the forest is the result of the analysis of 5 replicates each. For mangrove leaves we used 10 replicates for each of the four stages (young, mature, senescent and decomposing) considered, and for bark and root samples 6 replicates. For the xylem tissue, the measurements were repeated twice due to difficulty in obtaining a fine powder from the sample grinding. The gastropod - *Cassidula aurisfelis* samples were analysed in 6 replicates per station (found in St 1 to St 6). The measurement of Hg concentration of 10 samples of the mangrove cockle *Tegillarca granosa*, collected from a cockle culture farm in Sangga Besar River, are reported in Table 2. The data accuracy assessment through recovery of the certified reference materials (CRMs) is reported in Table 3.

2. Experimental design, materials, and methods

At each sampling station, surface sediments (upper 2–5 cm) were collected (with a hand shovel) from both the riverbank (at the water edge) and the inside of the mangrove forest (10–15 m) in 10 replicates, at a distance of 3–5 m following a linear geometry. For the plant tissues, leaves and roots were collected from *Rhizophora apiculata* in all stations except for St 4 and 6, where *R. mucronata* was abundant instead. Samples were taken from ten randomly chosen adult trees inside the forest. Leaf samples were collected in relation to the young, mature, senescent and decomposing stages. Ten replicates were taken per leaf stage per site. Young and mature leaves were hand-collected from the trees, while senescent and decomposing leaves were collected from the forest floor. Root and bark samples were collected (six replicates per station from six different trees) using a knife. Small roots near the sediment surface were targeted for the sampling. The specimens of mangrove gastropod - *Cassidula aurisfelis* were collected manually under the trees selected for plant tissues sampling (St 1 to 6). The edible and economically important mangrove cockles - *Tegillarca granosa* were collected from a cockle culture area in Sangga Besar river. All samples were placed in labeled polythene zip-lock covers and kept in an icebox before transferring to the laboratory for further preservation and analyses.

At the Institute of the Institute of Oceanography and Environment (INOS) laboratory (Universiti Malaysia Terengganu-UMT), sediment samples were put into 15 ml test tubes with a spatula. Samples other than sediments were carefully washed with tap water and then with distilled Milli-Q water (Millipore Corporation, USA) to remove the debris. After washing, 2–6 leaves were pooled together and wrapped in sterile aluminium foil (that was put in furnace at 260 °C for 1 hour to avoid any Hg contamination). Roots were cut with a steel knife and three different tissues were separated per each root sample: epidermis, cortex and xylem. Samples were cut into small pieces and put in 15 ml test tubes.

For gastropods and cockles, the muscle tissue was gently extracted from the shell with aid of tweezers and separated from the visceral tissue. Three gastropods were pooled together in order to get enough material to perform the Hg analysis (for a total of six replicates per station). In the case of cockles two individuals were pooled to make one sample and ten replicates were made. Afterwards the samples were put in 15 ml tubes. For the handling of gastropods and cockles, ethical approval was obtained by the Ethical Biosecurity Committee of the INOS, UMT.

For the drying process all samples were kept in a deep freezer at −80 °C for 48 hours and subsequently put in a freeze dryer (LABCONCO Freeze Dry System/Freezezone 4.5) with pressure lower than 0.133 mBar and temperature of −40 °C for 48–72h. Sediments samples were grinded to fine powder with mortar and pestle, then sieved with 60 μm mesh size, to get homogeneous samples and to separate the sediment particles from other materials (e.g. plant debris). Leaf, root and mollusc samples were grinded with mortar and pestle till a fine powder was obtained. For the
Table 1
Station-wise raw data of mercury concentrations in Matang Mangrove Forest Reserve. All values reported are in \( \mu g Kg^{-1} \). SED IN: sediments from inside the forest (10–15 m from fringe), SED RB: sediments from the river bank, YL: young leaves, ML: mature leaves, SL: senescent leaves, DL: decomposing leaves, B: bark, RE: root epidermis, RC: root cortex, RX: root xylem, G: gastropods. Plant tissue data from St 4 and 6 are from *Rhizophora mucronata*, while others from *R. apiculata*.

| Station | SED IN | SED RB | Y L  | M L  | S L  | D L  | B    | R E  | R C  | R X  | G    |
|---------|--------|--------|------|------|------|------|------|------|------|------|------|
| **Station 1** | | | | | | | | | | | |
| 42.628  | 44.822 | 4.467  | 18.323 | 36.898 | 29.871 | 0.591 | 1.196 | 0.1489 | 0.803 | 71.749 |
| 40.525  | 44.444 | 10.525 | 8.391  | 26.436 | 38.146 | 0.34  | 3.29  | 0.94  | 1.06  | 78.019 |
| 45.035  | 11.137 | 15.827 | 38.939 | 35.288 | 0.739 | 3.41  | 1.459 | 1.915 | 79.558 |
| **Station 2** | | | | | | | | | | | |
| 40.903  | 89.505 | 1.068  | 13.333 | 32.687 | 40.641 | 0.033 | 0.986 | 0.779 | 0.382 | 29.234 |
| 43.821  | 87.88  | 1.922  | 11.366 | 38.435 | 47.107 | 0.022 | 1.185 | 0.449 | 0.793 | 29.956 |
| 42.693  | 86.406 | 1.672  | 15.73  | 33.484 | 24.155 | 4.389 | 2.389 | 0.379 | 0.145 | 32.056 |
| **Station 3** | | | | | | | | | | | |
| 47.861  | 56.465 | 4.824  | 31.949 | 30.808 | 31.302 | 2.665 | 2.128 | 0.19  | 0.33  | 92.709 |
| 44.646  | 42.661 | 20.407 | 21.17  | 33.554 | 29.869 | 4.091 | 8.16  | 1.453 | 0.136 | 111.68 |
| 42.673  | 46.981 | 12.049 | 28.872 | 30.213 | 43.88  | 2.18  | 7.473 | 0.15  | 0.169 | 167.736 |
| 40.099  | 74.142 | 14.459 | 16.126 | 29.656 | 33.004 | 0.11  | 5.657 | 1.05  | 0.108 | 152.453 |
| **Station 4** | | | | | | | | | | | |
| 40.563  | 32.564 | 1.295  | 26.058 | 34.645 | 28.626 | 3.307 | 2.599 | 0.323 | 0.099 | 132.42 |
| 44.942  | 37.352 | 1.518  | 29.842 | 21.698 | 41.636 | 1.128 | 3.82  | 2.039 | 0.055 | 135.116 |
| 34.338  | 35.603 | 0.045  | 11.864 | 29.708 | 36.499 | 2.276 | 2.568 | 1.801 | 0.291 | 130.605 |
| 42.017  | 33.556 | 1.614  | 29.737 | 29.524 | 28.858 | 1.353 | 3.2   | 0.183 | 0.1   | 123.409 |
| 37.464  | 30.801 | 1.26   | 28.915 | 32.59  | 37.018 | 2.145 | 2.85  | 0.151 | 0.159 | 117.218 |

G. Wolswijk et al. / Data in brief 29 (2020) 105134
### Station 5

| SED IN | SED RB | Y L | M L | S L | D L | B | R E | R C | R X | G |
|--------|--------|-----|-----|-----|-----|---|-----|-----|-----|----|
| 38.532 | 40.057 | 2.918 | 26.581 | 29.12 | 26.996 | 0.42 | 1.331 | 0.022 | -0.345 | 134.8 |
| 39.762 | 39.259 | 13.927 | 37.686 | 29.806 | 28.616 | 1.684 | 4.114 | 0.228 | -0.508 | 125.205 |
| 44.659 | 35.447 | 0.252 | 24.685 | 32.569 | 30.867 | 0.793 | 2.898 | 1.056 | -0.317 | 121.025 |
| 37.219 | 36.221 | 7.863 | 25.426 | 33.308 | 30.264 | 0.462 | 1.943 | -0.056 | -0.127 | 137.778 |
| 33.571 | 42.223 | 2.785 | 28.124 | 32.243 | 33.849 | 5.009 | 3.529 | 0.622 | -0.075 | 118.955 |

### Station 6

| SED IN | SED RB | Y L | M L | S L | D L | B | R E | R C | R X | G |
|--------|--------|-----|-----|-----|-----|---|-----|-----|-----|----|
| 37.585 | 35.168 | 5.207 | 18.363 | 31.914 | 35.05 | 4.759 | 2.574 | -0.383 | -0.432 | 113.123 |
| 40.816 | 36.771 | 4.275 | 31.057 | 33.038 | 37.245 | 1.286 | 2.597 | 0.397 | -0.289 | 116.73 |
| 42.573 | 36.991 | 3.998 | 18.671 | 34.218 | 37.139 | 0.602 | 1.388 | 0.514 | -0.278 | 140.402 |
| 34.687 | 34.889 | 4.105 | 15.987 | 30.529 | 35.451 | 4.647 | 1.371 | 2.119 | -0.322 | 107.305 |
| 34.936 | 36.834 | 2.706 | 12.754 | 28.549 | 35.459 | 2.869 | 2.289 | 0.782 | 0.421 | 113.863 |

### Station 7

| SED IN | SED RB | Y L | M L | S L | D L | B | R E | R C | R X | G |
|--------|--------|-----|-----|-----|-----|---|-----|-----|-----|----|
| 56.374 | 63.69 | 0.235 | 5.166 | 32.202 | 26.633 | -0.199 | 1.027 | -0.264 | -0.248 |
| 58.7 | 47.589 | 0.136 | 12.446 | 51.04 | 47.988 | 1.23 | 1.163 | -0.582 | -0.269 |
| 56.373 | 77.462 | -0.145 | 20.864 | 44.751 | 19.213 | 0.404 | 2.996 | -0.483 | -0.448 |
| 53.822 | 50.504 | 0.097 | 23.369 | 39.552 | 41.734 | 0.048 | 3.079 | -0.186 | -0.573 |
| 54.824 | 48.632 | -0.068 | 12.36 | 45.446 | 31.898 | 0.37 | 2.581 | -0.534 | -0.415 |
| 0.123 | 23.54 | 53.526 | 34.898 | -0.061 | 2.24 | -0.292 | -0.523 |
| 0.056 | 16.185 | 36.433 | 37.452 | -0.138 |
| -0.247 | 9.109 | 38.989 | 39.819 | -0.398 |
| -0.291 | 7.699 | 49.666 | 42.398 | -0.526 |
| 0.367 | 13.563 | 34.337 | 30.71 | -0.513 |
| -0.307 | -0.573 |

### Station 8

| SED IN | SED RB | Y L | M L | S L | D L | B | R E | R C | R X | G |
|--------|--------|-----|-----|-----|-----|---|-----|-----|-----|----|
| 50.126 | 48.238 | 2.259 | 11.07 | 34.963 | 37.181 | 0.866 | 3.903 | -0.136 | -0.473 |
| 43.415 | 41.013 | 0.84 | 16.161 | 34.704 | 37.638 | 1.97 | 3.92 | 0.171 | -0.723 |
| 50.673 | 41.702 | 0.796 | 17.94 | 31.44 | 28.07 | 0.604 | 5.876 | 0.507 | -0.19 |
| 48.037 | 44.078 | 0.772 | 14.317 | 30.833 | 23.539 | 1.444 | 5.291 | 1.488 | 0.169 |
| 48.101 | 48.775 | 1.548 | 14.847 | 37.002 | 37.134 | 1.535 | 8.708 | 0.429 | 0.11 |
| 4.049 | 5.771 | 29.501 | 45.792 | 1.507 | 1.933 | -0.224 | -0.043 |
| 0.632 | 14.763 | 23.503 | 36.811 | 0.227 |
| 0.391 | 13.634 | 37.898 | 35.386 | 0.356 |
| 0.743 | 7.351 | 23.349 | 42.164 | 0.123 |
| 0.655 | 12.796 | 34.852 | 33.908 | -0.061 |
| 0.265 | -0.242 |
xylem samples, it was not possible to get a homogeneous result, so two Hg measurements per sample were taken to validate the data (Table 1). Total Hg concentration was measured with a direct mercury analyser (MA-3000, Nippon Instruments Corporation) with detection limit of 0.02 ng of total Hg. Measurements were done at wavelength of 253.7 nm. Prior to analysis, a calibration curve was made with seven Hg standards (STD) with Hg content from 0 to 100 ng (namely 0, 5, 10, 15, 20, 50 and 100 ng). Linear regression was done with the function ‘lm’ in R software, multiple R² was equal to 0.9961 and the p-value was 3.145 x 10⁻⁷.

For the accuracy assessment of the measurements, a STD solution of 0.1 ppb covered with additive B (Nippon Instrument Corporation) and certified reference materials (CRM) were run before and after the samples. For plant tissues and mollusks, the CRM NIST-SRM2976 (freeze-dried mussel tissue) with a concentration of 61.0 (±3.6) µg Kg⁻¹ was chosen, whereas for sediments the CRM NIST-SRM2702 (marine sediments) with a concentration of 447.4 (±6.9) µg Kg⁻¹ was used.

### Table 2
Mercury concentration in mangrove cockles - *Tegillarca granosa* L. collected from Matang Mangrove Forest Reserve (raw data from 10 replicates) (S = sample).

| S1   | S2   | S3   | S4   | S5   | S6   | S7   | S8   | S9   | S10  |
|------|------|------|------|------|------|------|------|------|------|
| 33.636 | 29.333 | 25.37 | 32.282 | 21.971 | 25.249 | 31.333 | 29.046 | 26.267 | 21.477 |

For the accuracy assessment of the measurements, a STD solution of 0.1 ppb covered with additive B (Nippon Instrument Corporation) and certified reference materials (CRM) were run before and after the samples. For plant tissues and mollusks, the CRM NIST-SRM2976 (freeze-dried mussel tissue) with a concentration of 61.0 (±3.6) µg Kg⁻¹ was chosen, whereas for sediments the CRM NIST-SRM2702 (marine sediments) with a concentration of 447.4 (±6.9) µg Kg⁻¹ was used.
Table 3
Data accuracy assessment. Recovery percentage of the CRM NIST-SRM 2976 (freeze-dried mussel tissue) and CRM NIST-SRM2702 (marine sediments).

| date          | measured value | certified value | recovery % |
|---------------|----------------|-----------------|------------|
| SRM 2976      |                |                 |            |
| August 02, 2018 | 59.576         | 61              | 97.7       |
| August 05, 2018 | 58.615         | 61              | 96.1       |
| August 06, 2018 | 57.989         | 61              | 95.1       |
| August 07, 2018 | 62.595         | 61              | 102.6      |
| August 08, 2018 | 63.942         | 61              | 104.8      |
| August 09, 2018 | 59.884         | 61              | 98.2       |
| August 12, 2018 | 57.097         | 61              | 93.6       |
| August 13, 2018 | 60.917         | 61              | 99.9       |
| August 14, 2018 | 52.913         | 61              | 86.7       |
| August 15, 2018 | 55.391         | 61              | 90.8       |
| August 16, 2018 | 57.130         | 61              | 93.7       |
| August 17, 2018 | 57.891         | 61              | 94.9       |
| August 19, 2018 | 58.092         | 61              | 95.2       |
| August 20, 2018 | 49.939         | 61              | 81.9       |
| August 20, 2018 | 53.099         | 61              | 86.9       |
| SRM2702       |                |                 |            |
| July 03, 2018  | 337.381        | 447.4           | 75.4       |
| July 03, 2018  | 455.431        | 447.4           | 101.8      |
| July 04, 2018  | 421.724        | 447.4           | 94.3       |
| July 05, 2018  | 382.092        | 447.4           | 85.4       |
| August 17, 2018| 568.737        | 447.4           | 127.1      |
| August 17, 2018| 425.107        | 447.4           | 95.0       |

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Competing Interests

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

Reference

[1] Giovanna Wolswijk, Behara Satyanarayana, Le Quang Dung, Fui Siau Yin, Ahmad Nazila Bin Ali, Ibrahim Sunkanmi Saliu, Muhammad Amir Bin Fisol, Cristina Gonnelli, Farid Dahdouh-Guebas, Distribution of mercury in sediments, plant and animal tissues in Matang mangrove forest Reserve, Malaysia, J. Hazard Mater. (2019), https://doi.org/10.1016/j.jhazmat.2019.121665.