**Heavy metals contamination of river water and sediments in the mangrove forest ecosystems in Bangladesh: A consequence of oil spill incident**

**Table S1 (a)** Analytical results obtained on certified reference material NIST 1640 (water matrix)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Unit** | **Certificate Value** | **Observed Value** | **Precision, CV (%)** | **Recovery**  **(%)** |
| Pb | µg/l | 27.89 | 26.6 | 4.63 | 95.37 |
| Cd | µg/l | 22.79 | 21.19 | 7.02 | 92.98 |
| Cr | µg/l | 38.6 | 37.1 | 3.89 | 96.11 |
| Cu | µg/l | 85.2 | 84.1 | 1.29 | 98.71 |
| Co | µg/l | 20.28 | 19.21 | 5.28 | 94.72 |
| Mn | µg/l | 121.5 | 121.01 | 0.40 | 99.60 |
| Ni | µg/l | 27.4 | 25.98 | 5.18 | 94.82 |
| Fe | µg/l | 34.3 | 33.89 | 1.20 | 98.80 |
| Zn | µg/l | 53.2 | 51.99 | 2.27 | 97.73 |
| As | µg/l | 26.67 | 26.2 | 1.76 | 98.24 |

**Table S1 (b)** Analytical results obtained on certified reference material IAEA 433 (sediment matrix)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Unit** | **Certificate Value** | **Observed Value** | **Precision,**  **CV (%)** | **Recovery**  **(%)** |
| Mn | mg/kg | 316 | 294 | 6.96 | 93.04 |
| Zn | mg/kg | 101 | 92 | 8.91 | 91.09 |
| Cu | mg/kg | 30.8 | 29.8 | 3.25 | 96.75 |
| Ni | mg/kg | 39.4 | 36.01 | 8.60 | 91.40 |
| Pb | mg/kg | 26 | 25.8 | 0.77 | 99.23 |
| Co | mg/kg | 12.9 | 11.9 | 7.75 | 92.25 |
| Fe | mg/g | 40.8 | 37.01 | 9.29 | 90.71 |
| As | mg/kg | 18.19 | 17.2 | 5.44 | 94.56 |
| Cd | mg/kg | 0.153 | 0.145 | 5.23 | 94.77 |
| Hg | mg/kg | 0.195 | 0.178 | 8.72 | 91.28 |

**Table S2.** Water quality index for drinking purpose

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | Sample sites (Wi ×Qi) | | | | | | | | | | |
| W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 |
| pH | 8.386 | 9.018 | 6.892 | 6.318 | 5.916 | 2.584 | 4.135 | 5.973 | 5.916 | 5.744 |
| Temperature | 4.357 | 4.211 | 4.357 | 4.394 | 4.485 | 4.504 | 4.430 | 4.357 | 4.467 | 4.485 |
| DO | 7.781 | 14.342 | 15.257 | 14.342 | 15.257 | 11.900 | 13.121 | 10.527 | 14.952 | 15.410 |
| EC | 0.246 | 0.241 | 0.257 | 0.278 | 0.257 | 0.234 | 0.234 | 0.262 | 0.257 | 0.256 |
| TDS | 0.482 | 0.471 | 0.530 | 0.547 | 0.494 | 0.457 | 0.457 | 0.518 | 0.526 | 0.528 |
| Pb | 62.251 | 63.716 | 97.405 | 14.647 | 14.683 | 108.390 | 65.180 | 61.518 | 71.772 | 53.462 |
| Cd | 166.817 | 159.493 | 419.077 | 150.542 | 148.914 | 436.166 | 148.101 | 329.565 | 369.439 | 169.258 |
| Cr | 0.773 | 0.837 | 0.934 | 0.682 | 1.561 | 1.148 | 0.823 | 1.347 | 1.318 | 0.717 |
| Co | 120.611 | 109.397 | 212.730 | 149.792 | 120.268 | 187.211 | 117.979 | 363.437 | 336.889 | 116.950 |
| Cu | 0.0006 | 0.0003 | 0.0005 | 0.0003 | 0.0005 | 0.0004 | 0.0003 | 0.0004 | 0.0004 | 0.0002 |
| Ni | 1.445 | 1.345 | 2.724 | 1.191 | 2.470 | 3.255 | 1.657 | 3.180 | 3.192 | 1.668 |
| As | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 | 2.197 |
| Hg | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 | 0.610 |
| Fe | 0.013 | 0.026 | 0.090 | 0.067 | 0.086 | 0.080 | 0.053 | 0.073 | 0.092 | 0.012 |
| Mn | 0.763 | 0.138 | 0.360 | 0.267 | 0.188 | 0.320 | 0.117 | 0.244 | 0.120 | 0.040 |
| Zn | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0001 | 0.0002 | 0.0002 | 0.0001 |
| Ca | 1.165 | 1.190 | 2.234 | 1.272 | 2.512 | 2.214 | 1.049 | 2.195 | 2.445 | 1.109 |
| Mg | 9.053 | 8.225 | 16.864 | 7.929 | 19.527 | 16.598 | 6.450 | 21.125 | 20.533 | 7.485 |
| Na | 0.086 | 0.495 | 0.059 | 0.0985 | 0.597 | 0.071 | 0.052 | 0.649 | 0.060 | 0.645 |
| K | 46.139 | 15.837 | 110.033 | 54.719 | 113.491 | 96.433 | 42.294 | 100.954 | 98.946 | 43.453 |
| WQI | 433.184 | 391.796 | 892.619 | 409.898 | 453.523 | 874.381 | 408.948 | 908.742 | 933.739 | 424.037 |
| Average | 613.08 | | | | | | | | | | |

**Table S3.** Water quality index for irrigation purpose

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | Sample sites (Wi ×Qi) | | | | | | | | | |
| W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 |
| pH | 8.844 | 72.500 | 55.414 | 50.796 | 47.563 | 20.780 | 33.248 | 48.025 | 47.563 | 46.178 |
| EC | 0.0289 | 0.215 | 0.230 | 0.248 | 0.229 | 0.209 | 0.209 | 0.234 | 0.230 | 0.228 |
| TDS | 45.765 | 0.341 | 0.384 | 0.395 | 0.357 | 0.331 | 0.331 | 0.375 | 0.381 | 0.382 |
| Pb | 0.0002 | 0.002 | 0.003 | 0.0004 | 0.0004 | 0.003 | 0.002 | 0.001 | 0.002 | 0.001 |
| Cd | 15.834 | 115.400 | 303.219 | 108.923 | 107.746 | 315.584 | 107.157 | 238.454 | 267.304 | 122.465 |
| Cr | 0.203 | 1.683 | 1.878 | 1.371 | 3.138 | 2.308 | 1.654 | 2.708 | 2.649 | 1.442 |
| Co | 3.256 | 22.514 | 43.781 | 30.828 | 24.752 | 38.529 | 24.281 | 74.798 | 69.334 | 24.069 |
| Cu | 0.072 | 0.262 | 0.457 | 0.301 | 0.416 | 0.350 | 0.245 | 0.326 | 0.329 | 0.225 |
| Ni | 0.186 | 1.324 | 2.683 | 1.173 | 2.433 | 3.205 | 1.632 | 3.132 | 3.144 | 1.642 |
| As | 0.023 | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 |
| Hg | 5.793 | 44.158 | 44.158 | 44.158 | 44.158 | 44.158 | 44.158 | 44.158 | 44.158 | 44.158 |
| Fe | 5.252 | 0.0007 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.0003 |
| Mn | 0.201 | 0.277 | 0.723 | 0.537 | 0.377 | 0.644 | 0.235 | 0.491 | 0.242 | 0.081 |
| Zn | 0.0003 | 0.003 | 0.005 | 0.003 | 0.005 | 0.005 | 0.002 | 0.005 | 0.005 | 0.002 |
| Ca | 0.043 | 0.336 | 0.631 | 0.359 | 0.710 | 0.625 | 0.296 | 0.620 | 0.691 | 0.313 |
| Mg | 6.631 | 45.921 | 94.155 | 44.269 | 109.021 | 92.668 | 36.010 | 117.941 | 114.637 | 41.791 |
| Na | 0.004 | 0.188 | 0.022 | 0.037 | 0.227 | 0.027 | 0.020 | 0.246 | 0.022 | 0.245 |
| K | 1751.846 | 4583.622 | 31845.428 | 15836.605 | 32846.347 | 27909.460 | 12240.655 | 29218.015 | 28636.598 | 12576.257 |
| WQI | 1838.73 | 4888.92 | 32393.35 | 16120.19 | 33187.66 | 28429.07 | 12490.31 | 29749.71 | 29187.47 | 12859.66 |
| Average | 2798.59 | | | | | | | | | |

**Table S4.** Water quality index for aquatic purpose

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | Sample sites (Wi ×Qi) | | | | | | | | | |
| W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 |
| pH | 1.090 | 1.172 | 0.896 | 0.821 | 0.769 | 0.336 | 0.537 | 0.776 | 0.769 | 0.746 |
| Temperature | 0.800 | 0.773 | 0.800 | 0.806 | 0.823 | 0.826 | 0.813 | 0.800 | 0.820 | 0.823 |
| DO | 1.617 | 2.980 | 3.171 | 2.980 | 3.171 | 2.473 | 2.727 | 2.188 | 3.107 | 3.202 |
| EC | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.005 |
| TDS | 0.031 | 0.031 | 0.035 | 0.036 | 0.0326 | 0.030 | 0.030 | 0.034 | 0.034 | 0.034 |
| Pb | 15.818 | 16.190 | 24.750 | 3.721 | 3.731 | 27.542 | 16.562 | 15.632 | 18.237 | 13.584 |
| Cd | 2.756 | 2.635 | 6.924 | 2.487 | 2.460 | 7.206 | 2.447 | 5.445 | 6.104 | 2.796 |
| Cr | 0.141 | 0.153 | 0.171 | 0.125 | 0.286 | 0.210 | 0.151 | 0.247 | 0.242 | 0.131 |
| Co | 22.142 | 20.084 | 39.054 | 27.500 | 22.079 | 34.369 | 21.659 | 66.722 | 61.848 | 21.470 |
| Cu | 59.952 | 28.457 | 49.720 | 32.774 | 45.244 | 38.050 | 26.698 | 35.492 | 35.811 | 24.460 |
| Ni | 0.480 | 0.447 | 0.906 | 0.396 | 0.821 | 1.082 | 0.551 | 1.058 | 1.062 | 0.554 |
| As | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Hg | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 | 157.563 |
| Mn | 0.560 | 0.101 | 0.264 | 0.196 | 0.138 | 0.235 | 0.086 | 0.179 | 0.088 | 0.029 |
| Zn | 0.100 | 0.112 | 0.190 | 0.143 | 0.197 | 0.201 | 0.091 | 0.184 | 0.191 | 0.092 |
| WQI | 263.064 | 230.711 | 284.457 | 229.562 | 237.327 | 270.137 | 229.928 | 286.332 | 285.890 | 225.501 |
| Average | 254.29 | | | | | | | | | |

**Table S5.** Computed water quality index (WQI), metal quality index (MI), Alkalinity hazard (SAR) and Na % in Sela River water for the purpose of drinking, irrigation, and aquatic life water utilizations.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample**  **Sites** | **Alkalinity hazard (SAR)** | **Na %** | **Metal Quality Index (MI)** | | |
| **Drinking** | **Irrigation** | **Aquatic life** |
| **1** | 0.53 | 12.67 | 31.84 | 5.82 | 36.66 |
| **2** | 3.15 | 33.52 | 29.60 | 4.99 | 31.37 |
| **3** | 0.26 | 10.94 | 57.82 | 10.72 | 55.66 |
| **4** | 0.63 | 15.67 | 26.87 | 5.58 | 28.29 |
| **5** | 2.49 | 23.39 | 25.30 | 5.76 | 28.25 |
| **6** | 0.32 | 10.52 | 57.82 | 10.68 | 54.69 |
| **7** | 0.37 | 13.13 | 30.52 | 5.09 | 32.52 |
| **8** | 2.63 | 23.03 | 66.26 | 12.42 | 64.67 |
| **9** | 0.25 | 8.65 | 66.22 | 12.36 | 63.62 |
| **10** | 4.29 | 40.67 | 29.51 | 5.23 | 30.35 |
| **Mean** | 1.49 | 19.22 | 42.18 | 7.87 | 42.61 |

**Table S6.** Metal Pollution index (PI) of the studied metals measured in Sela river water for drinking, irrigation, and aquatic life water utilizations.

|  |  |  |  |
| --- | --- | --- | --- |
| **Studied metals** | **Metal Pollution Index (MPI)** | | |
| **Drinking** | **Irrigation** | **Aquatic life** |
| **Pb** | 12.02 | 0.02 | 14.14 |
| **Cd** | 14.56 | 4.37 | 4.37 |
| **Cr** | 0.90 | 0.45 | 0.90 |
| **Co** | 31.45 | 5.03 | 31.45 |
| **Cu** | 0.02 | 0.16 | 3.91 |
| **Ni** | 2.66 | 0.93 | 3.58 |
| **As** | 0.3 | 0.03 | 0.03 |
| **Hg** | 0.05 | 0.15 | 1.88 |
| **Fe** | 0.32 | 0.02 | 0.10 |
| **Mn** | 0.78 | 0.39 | 1.56 |
| **Zn** | 0.01 | 0.02 | 0.66 |

**Table S7.** Computed Cf, Cd, mCd and PLI values for all sediment sites of Sela River, Sundarbans, Bangladesh

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Sites** | **Cf1a**  **(Pb)** | **Cf2**  **(Cd)** | **Cf3**  **(Cr)** | **Cf4**  **(Mn)** | **Cf5**  **(Cu)** | **Cf6 (Fe)** | **Cf7 (Zn)** | **Cf8**  **(Ca)** | **Cf9**  **(Mg)** | **Cf10**  **(Na)** | **Cf11**  **(K)** | **Cf12**  **(As)** | **Cdb** | **mCdc** | **PLId** |
| **S1** | 1.47 | 10 | 1.26 | 0.95 | 2.43 | 0.97 | 1.42 | 0.07 | 1.06 | 0.07 | 0.16 | 1.64 | 21.50 | 1.79 | 3.42 |
| **S2** | 1.12 | 10.78 | 1.06 | 0.78 | 2.08 | 0.8 | 1.22 | 0.14 | 1.01 | 0.11 | 0.14 | 1.39 | 20.63 | 1.72 | 2.93 |
| **S3** | 1.27 | 10.29 | 1.15 | 0.94 | 2.33 | 0.88 | 1.34 | 0.12 | 0.93 | 0.1 | 0.15 | 1.12 | 20.61 | 1.72 | 3.13 |
| **S4** | 1.15 | 11.27 | 1.07 | 0.67 | 2.21 | 0.93 | 1.28 | 0.04 | 0.96 | 0.09 | 0.15 | 1.34 | 21.16 | 1.76 | 1.59 |
| **S5** | 1.18 | 10.29 | 1.15 | 0.86 | 2.47 | 0.66 | 1.36 | 0.05 | 0.88 | 0.06 | 0.14 | 1.5 | 20.60 | 1.72 | 1.46 |
| **S6** | 1.31 | 11.47 | 1.13 | 0.9 | 2.23 | 0.96 | 1.34 | 0.07 | 0.98 | 0.07 | 0.14 | 1.64 | 22.24 | 1.85 | 2.62 |
| **S7** | 1.78 | 22.35 | 1.27 | 0.96 | 2.51 | 0.96 | 1.37 | 0.09 | 0.95 | 0.06 | 0.16 | 1.72 | 34.17 | 2.85 | 5.44 |
| **S8** | 1.76 | 23.04 | 1.27 | 0.98 | 2.48 | 0.77 | 1.4 | 0.08 | 0.87 | 0.06 | 0.15 | 1.68 | 34.55 | 2.88 | 4.57 |
| **S9** | 1.56 | 20.69 | 0.98 | 0.59 | 2.03 | 1.02 | 1.28 | 0.03 | 0.86 | 0.06 | 0.15 | 1.22 | 30.47 | 2.54 | 1.34 |
| **S10** | 1.77 | 21.67 | 1.07 | 0.9 | 2.4 | 0.92 | 1.38 | 0.08 | 0.97 | 0.09 | 0.15 | 1.66 | 33.04 | 2.75 | 5.15 |
| **S11** | 1.86 | 22.65 | 0.92 | 0.7 | 2.24 | 0.92 | 1.45 | 0.01 | 1.97 | 2.94 | 0.19 | 1.72 | 37.55 | 3.13 | 15.43 |
| **S12** | 1.65 | 10.29 | 1.23 | 0.92 | 2.4 | 1.05 | 1.47 | 0.03 | 1.21 | 1.15 | 0.21 | 2.05 | 23.66 | 1.97 | 14.63 |
| **S13** | 1.83 | 13.73 | 1.41 | 1.08 | 2.58 | 1.31 | 1.62 | 0.03 | 1.16 | 0.49 | 0.23 | 1.97 | 27.44 | 2.29 | 16.57 |
| **S14** | 1.74 | 11.76 | 1.24 | 1.09 | 2.55 | 1.18 | 1.59 | 0.03 | 1.09 | 0.52 | 0.21 | 1.98 | 24.98 | 2.08 | 11.73 |
| **S15** | 1.77 | 13.73 | 1.18 | 1.02 | 2.37 | 1.03 | 1.55 | 0.03 | 1.07 | 0.39 | 0.19 | 1.81 | 26.14 | 2.18 | 8.45 |
| **S16** | 1.68 | 13.24 | 1.11 | 0.98 | 2.32 | 1 | 1.49 | 0.03 | 1.01 | 0.46 | 0.17 | 1.57 | 25.05 | 2.09 | 6.49 |
| **S17** | 1.56 | 7.84 | 1.14 | 0.97 | 2.29 | 0.97 | 1.51 | 0.02 | 1.04 | 0.3 | 0.21 | 1.67 | 19.52 | 1.63 | 4.04 |
| **S18** | 1.59 | 7.35 | 1.15 | 1.05 | 2.31 | 1.23 | 1.49 | 0.03 | 1.1 | 0.64 | 0.19 | 1.98 | 20.11 | 1.68 | 8.13 |
| **S19** | 1.6 | 7.65 | 1.03 | 0.74 | 2.42 | 1.03 | 1.5 | 0.02 | 1.09 | 0.8 | 0.19 | 1.45 | 19.51 | 1.63 | 4.47 |
| **S20** | 1.62 | 8.33 | 1.09 | 1.01 | 2.48 | 1.01 | 1.56 | 0.01 | 0.96 | 0.34 | 0.21 | 1.97 | 20.61 | 1.72 | 3.81 |
| **Mean** | **1.56** | **13.42** | **1.15** | **0.90** | **2.36** | **0.98** | **1.43** | **0.05** | **1.06** | **0.44** | **0.17** | **1.65** | **25.18** | **2.10** | **6.28** |

aCfn: Contamination factor for n metals, where n = number of metals analyzed; bCd: Degree of contamination; cmCd: modified degree of contamination; dPLI: Pollution load index;

**Table S8.** EF of metals concentrations at different sample sites in the sediment of Sela River, Sundarbans, Bangladesh

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample sites** | **Enrichment Factor (EF) of metals concentrations** | | | | | | | | | | | |
| **Pb** | **Cd** | **Cr** | **Mn** | **Cu** | **Fe** | **Zn** | **Ca** | **Mg** | **Na** | **K** | **As** |
| S1 | 1.52 | 10.32 | 1.30 | 0.98 | 2.51 | - | 1.46 | 0.07 | 1.10 | 0.07 | 0.16 | 1.69 |
| S2 | 1.40 | 13.46 | 1.33 | 0.97 | 2.59 | - | 1.52 | 0.18 | 1.26 | 0.13 | 0.17 | 1.74 |
| S3 | 1.43 | 11.64 | 1.30 | 1.06 | 2.63 | - | 1.51 | 0.14 | 1.05 | 0.11 | 0.17 | 1.26 |
| S4 | 1.23 | 12.10 | 1.14 | 0.71 | 2.37 | - | 1.37 | 0.04 | 1.03 | 0.10 | 0.16 | 1.43 |
| S5 | 1.80 | 15.71 | 1.76 | 1.31 | 3.76 | - | 2.08 | 0.08 | 1.35 | 0.09 | 0.21 | 2.29 |
| S6 | 1.36 | 11.91 | 1.17 | 0.94 | 2.31 | - | 1.39 | 0.08 | 1.02 | 0.07 | 0.15 | 1.70 |
| S7 | 1.86 | 23.31 | 1.32 | 1.00 | 2.61 | - | 1.43 | 0.09 | 0.99 | 0.06 | 0.17 | 1.79 |
| S8 | 2.30 | 29.98 | 1.65 | 1.27 | 3.23 | - | 1.83 | 0.10 | 1.14 | 0.08 | 0.20 | 2.19 |
| S9 | 1.54 | 20.35 | 0.96 | 0.58 | 2.00 | - | 1.26 | 0.03 | 0.85 | 0.06 | 0.15 | 1.20 |
| S10 | 1.93 | 23.60 | 1.17 | 0.98 | 2.61 | - | 1.50 | 0.09 | 1.06 | 0.09 | 0.16 | 1.80 |
| S11 | 2.02 | 24.65 | 1.00 | 0.76 | 2.43 | - | 1.58 | 0.01 | 2.14 | 3.20 | 0.20 | 1.87 |
| S12 | 1.57 | 9.81 | 1.17 | 0.88 | 2.29 | - | 1.40 | 0.03 | 1.15 | 1.09 | 0.20 | 1.95 |
| S13 | 1.39 | 10.47 | 1.08 | 0.82 | 1.97 | - | 1.23 | 0.03 | 0.89 | 0.38 | 0.18 | 1.50 |
| S14 | 1.47 | 9.98 | 1.05 | 0.92 | 2.16 | - | 1.35 | 0.03 | 0.92 | 0.44 | 0.17 | 1.68 |
| S15 | 1.71 | 13.31 | 1.14 | 0.99 | 2.30 | - | 1.51 | 0.03 | 1.04 | 0.38 | 0.19 | 1.76 |
| S16 | 1.68 | 13.25 | 1.11 | 0.98 | 2.32 |  | 1.49 | 0.03 | 1.01 | 0.46 | 0.17 | 1.57 |
| S17 | 1.62 | 8.13 | 1.18 | 1.00 | 2.38 | - | 1.56 | 0.02 | 1.08 | 0.31 | 0.21 | 1.73 |
| S18 | 1.30 | 5.99 | 0.93 | 0.86 | 1.88 | - | 1.21 | 0.02 | 0.90 | 0.52 | 0.16 | 1.61 |
| S19 | 1.55 | 7.42 | 1.00 | 0.71 | 2.35 | - | 1.46 | 0.02 | 1.06 | 0.77 | 0.18 | 1.40 |
| S20 | 1.60 | 8.22 | 1.08 | 1.00 | 2.45 | - | 1.54 | 0.01 | 0.95 | 0.34 | 0.21 | 1.94 |
| **Average** | **1.61** | **14.18** | **1.19** | **0.94** | **2.46** |  | **1.48** | **0.06** | **1.10** | **0.44** | **0.18** | **1.71** |
| **Range of EF values** | **1 ~ <3** | **10 ~ <25** | **1 ~ <3** | **<1** | **1 ~ <3** |  | **1 ~ <3** | **<1** | **1 ~ <3** | **<1** | **<1** | **1 ~ <3** |
| **Contamination status** | **Minor** | **Severe** | **Minor** | **No** | **Minor** |  | **Minor** | **No** | **Minor** | **No** | | **Minor** |

**Table S9.** Geoaccumulation index (Igeo) of metals measured in the sediments of Sela River, Sundarbans, Bangladesh

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample sites** | **Geoaccumulation index (Igeo) of metals concentrations** | | | | | | | | | | | |
| **Pb** | **Cd** | **Cr** | **Mn** | **Cu** | **Fe** | **Zn** | **Ca** | **Mg** | **Na** | **K** | **As** |
| S1 | -0.08 | 0.82 | -0.08 | -0.20 | 0.21 | -0.19 | -0.02 | -1.32 | -0.15 | -1.34 | -0.97 | 0.04 |
| S2 | -0.20 | 0.86 | -0.15 | -0.29 | 0.14 | -0.27 | -0.09 | -1.02 | -0.17 | -1.15 | -1.04 | -0.03 |
| S3 | -0.14 | 0.84 | -0.11 | -0.20 | 0.19 | -0.23 | -0.05 | -1.1 | -0.21 | -1.20 | -1.00 | -0.13 |
| S4 | -0.19 | 0.88 | -0.15 | -0.35 | 0.17 | -0.21 | -0.07 | -1.57 | -0.19 | -1.21 | -0.10 | -0.05 |
| S5 | -0.18 | 1.17 | -0.11 | -0.24 | 0.22 | -0.36 | -0.04 | -1.47 | -0.23 | -1.41 | -1.03 | 0 |
| S6 | -0.13 | 1.19 | -0.12 | -0.22 | 0.17 | -0.19 | -0.05 | -1.31 | -0.18 | -1.36 | -1.03 | 0.04 |
| S7 | 0.005 | 1.14 | -0.07 | -0.19 | 0.22 | -0.19 | -0.04 | -1.25 | -0.20 | -1.41 | -0.97 | 0.06 |
| S8 | 0 | 1.16 | -0.07 | -0.18 | 0.22 | -0.29 | -0.03 | -1.28 | -0.23 | -1.40 | -0.10 | 0.05 |
| S9 | -0.05 | 1.18 | -0.18 | -0.40 | 0.13 | -0.17 | -0.07 | -1.75 | -0.24 | -1.40 | -0.99 | -0.09 |
| S10 | 0.001 | 0.84 | -0.15 | -0.22 | 0.20 | -0.21 | -0.04 | -1.28 | -0.19 | -1.24 | -0.10 | 0.04 |
| S11 | 0.02 | 0.96 | -0.21 | -0.33 | 0.17 | -0.21 | -0.01 | -2.13 | 0.12 | 0.29 | -0.90 | 0.06 |
| S12 | -0.03 | 0.89 | -0.09 | -0.21 | 0.20 | -0.16 | -0.009 | -1.63 | -0.09 | -0.11 | -0.85 | 0.13 |
| S13 | 0.02 | 0.96 | -0.03 | -0.14 | 0.24 | -0.06 | 0.03 | -1.64 | -0.11 | -0.48 | -0.81 | 0.12 |
| S14 | -0.007 | 0.89 | -0.08 | -0.14 | 0.23 | -0.10 | 0.03 | -1.68 | -0.14 | -0.46 | -0.86 | 0.08 |
| S15 | 0.0003 | 0.96 | -0.10 | -0.17 | 0.20 | -0.16 | 0.02 | -1.69 | -0.15 | -0.59 | -0.89 | 0.02 |
| S16 | -0.02 | 0.95 | -0.13 | -0.19 | 0.19 | -0.18 | -0.003 | -1.73 | -0.17 | -0.51 | -0.94 | 0.04 |
| S17 | -0.05 | 0.72 | -0.12 | -0.19 | 0.18 | -0.19 | 0.003 | -1.81 | -0.16 | -0.69 | -0.86 | 0.12 |
| S18 | -0.05 | 0.69 | -0.12 | -0.15 | 0.19 | -0.09 | -0.003 | -1.72 | -0.13 | -0.37 | -0.89 | -0.02 |
| S19 | -0.04 | 0.71 | -0.16 | -0.30 | 0.21 | -0.16 | 0.001 | -1.95 | -0.14 | -0.27 | -0.89 | 0.12 |
| S20 | -0.04 | 0.74 | -0.14 | -0.17 | 0.22 | -0.17 | 0.02 | -2.07 | -0.19 | -0.64 | -0.86 | 0.73 |
| **Average** | **-0.06** | **0.92** | **-0.12** | **-0.23** | **0.20** | **-0.19** | **-0.02** | **-1.57** | **-0.16** | **-0.85** | **-0.94** | **0.04** |
| **Range of Igeo values** | **< 0** | **0–1** | **< 0** | **< 0** | **0–1** | **< 0** | **< 0** | **< 0** | **< 0** | **< 0** | **< 0** | **0–1** |
| **Contamination Status** | **PUa** | **UMC** | **PU** | | **UMC** | **PU** | | | | | | **UMC** |

**aPU: Practically uncontaminated; bUMC: Uncontaminated to moderately contaminated**

**Table S10.** The calculated Sediment quality guidelines and environment toxicity quotient values in this study.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Sites** | **S1** | **S2** | **S3** | **S4** | **S5** | **S6** | **S7** | **S8** | **S9** | **S10** | **S11** | **S12** | **S13** | **S14** | **S15** | **S16** | **S17** | **S18** | **S19** | **S20** | **Avg** |
| **ERMQ** | 0.12 | 0.10 | 0.11 | 0.10 | 0.11 | 0.11 | 0.14 | 0.14 | 0.12 | 0.14 | 0.14 | 0.12 | 0.14 | 0.13 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 |
| **PELQ** | 0.36 | 0.30 | 0.33 | 0.32 | 0.31 | 0.35 | 0.41 | 0.39 | 0.36 | 0.39 | 0.38 | 0.37 | 0.44 | 0.41 | 0.39 | 0.37 | 0.35 | 0.38 | 0.33 | 0.36 | 0.36 |
| **ETQ** | 250.73 | 213.23 | 234.16 | 228.50 | 222.31 | 222.83 | 252.40 | 244.92 | 229.03 | 238.33 | 279.27 | 317.82 | 352.46 | 315.57 | 296.01 | 265.62 | 310.97 | 298.13 | 284.21 | 317.15 | 268.68 |

|  |  |
| --- | --- |
|  |  |
| 1. Scree plot for water | 1. Scree plot for sediment |

**Fig. S1.** Principal component analysis by scree plot for both (a) water samples and (b) sediment samples in the study area.