Enrichment Factor (EF)

EF is measured to identify the anthropogenic level of impact in sediments, the contribution of each element to the enrichment of sediment of an individual site and can be calculated by Eq. (X)., shown in Table X. The EF values of HMs in the Balu, Buriganga, Dhaleshwari, Shitalakshya and Turag river sediments for both winter and rainy seasons are depicted in Table 2. EF values of Shitalakshya in rainy season were very high enrichment and lay in 20 ≤ EF < 40 which exceed in winter season having extremely high enrichment, EF ≥ 40. At every point, EF values were of Cd in the winter and rainy seasons were significantly higher than other metals and lay in the 5≤ EF ≤ 20 groups, indicating significant enrichment. The EF values of Pb indicate significant enrichment in Buriganga, Shitalakshya and Turag in winter and Buriganga in rainy season. In Shitalakshya EF values of Cd ranged from 28.03 to 48.96 in winter while 28.66 to 38.63 in rainy season and in Pb it was 4.47 to 12.20 in winter while 3.84 to 5.87 in rainy season. The EF values of Cd in the winter season in Buriganga ranged from 18.23 to 21.01; which was 13.42 to 17.44 in rainy season and the EF values of Pb in winter season ranged from 9.98 to 10.30 while 5.63 to 5.86 in rainy season. In Turag EF values of Pb in the winter season ranged from 7.10 to 8.78; which was 3.322 to 5.50 in rainy season. The other rivers, Dhaleshwari and Balu have the range of EF values of Cd were 3.60 to 15.52; 4.96 to 7.81 in winter and 2.18 to 10.26; 4.50 to 6.17 in rainy season respectively which indicate moderate enrichment to significant enrichment. The range EF values of Pb in Dhaleswari and Balu were 1.61 to 5.56; 2.91 to 3.25 in winter and 1.19 to 2.94; 1.70 to 1.85 in rainy season respectively indicating deficiency to minimal enrichment to moderate enrichment. The EF values of Cu in winter season in Buriganga, Dhaleswari, and Shitalakshya ranged from 3.04 to 4.01; 1.60 to 3.70; 2.16 to 4.35 respectively indicating moderate enrichment while in rainy season it was Buriganga and Shitalakshya which showed moderate enrichment having the range from 2.17 to 2.28; 1.60 to 2.49 respectively. All the other ranges of Cr, Ni, As lied in EF<2 indicating deficiency to minimal enrichment in all five rivers. The EF>1.5 indicate sources of metal enrichment are thoroughly from anthropogenic activities, whereas EF<1.5 report that sources are more likely to be natural origins (Zhang and Liu 2002). Hossain et al. (2021b) reported moderate to severe enrichment by Mn, Zn, Cu, Pb, Ni, and Cr in the sediment cores of different ship-breaking areas of Shitakundo, Bangladesh. In another study, Tamim er al. (2016) showed minimal enrichment of Cr, Zn, K, Ti, Cu, Rb, Sr, Cs, Hf, and Hg in the sediment sample of Buriganga river near Hazaribagh area, Dhaka, Bangladesh. Most significant rivers can be oredered based on the enrichment value as Shitalakshya > Buriganga > Turag > Dhaleshwari> Balu.

Table 2: Enrichment Factors (EF) of HMs for sediments of Balu, Buriganga, Dhaleshwari, Shitalakshya and Turag River, Bangladesh

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Season | River | Cr | Ni | Cu | As | Cd | Pb | Fe |
| Winter | Balu | 0.17 | 0.48 | 1.71 | 0.61 | 6.38 | 3.08 | 1.00 |
| Buriganga | 0.85 | 0.81 | 3.53 | 0.63 | 19.62 | 10.14 | 1.00 |
| Dhaleshwari | 1.02 | 0.56 | 2.14 | 1.50 | 8.85 | 3.95 | 1.00 |
| Shitalakshya | 0.73 | 0.84 | 2.94 | 1.60 | 40.69 | 8.43 | 1.00 |
| Turag | 0.12 | 0.76 | 1.54 | 0.81 | 8.98 | 8.01 | 1.00 |
| Rainy | Balu | 0.12 | 0.40 | 1.29 | 0.55 | 5.34 | 1.77 | 1.00 |
| Buriganga | 0.62 | 0.54 | 2.22 | 0.48 | 15.43 | 5.74 | 1.00 |
| Dhaleshwari | 0.79 | 0.35 | 1.42 | 1.13 | 6.35 | 2.09 | 1.00 |
| Shitalakshya | 0.52 | 0.58 | 1.90 | 1.21 | 32.13 | 4.63 | 1.00 |
| Turag | 0.10 | 0.40 | 1.15 | 0.67 | 6.11 | 4.05 | 1.00 |
| Maximum  (*Mmax*) |  | 1.02 | 0.84 | 3.53 | 1.60 | 40.69 | 10.14 | 1.00 |
| Minimum  (*Mmin*) |  | 0.10 | 0.35 | 1.15 | 0.48 | 5.34 | 1.77 | 1.00 |
| Mean (N=10) |  | 0.50 | 0.59 | 1.99 | 0.94 | 14.99 | 5.19 | 1.00 |