

Supplementary Materials

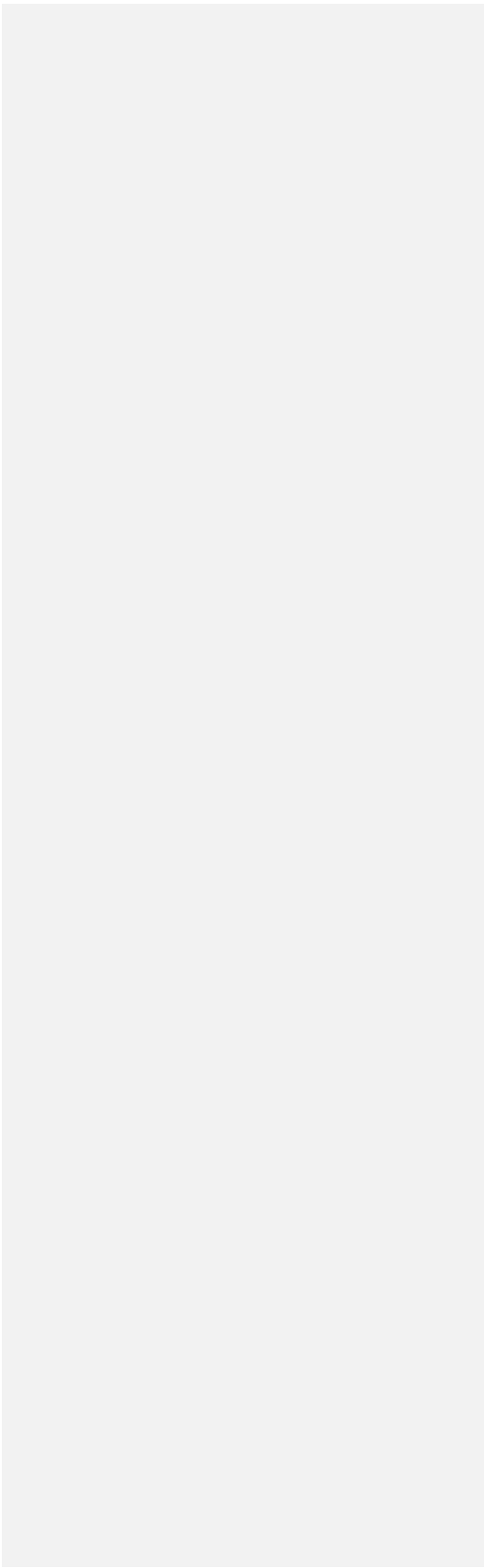


Table S1: The formulae and descriptions of sediment contamination and risk indices

Index	Formula	Classification	Description	References
Geoaccumulation Index (I_{geo})	$I_{geo} = \log_2 \frac{C_n}{1.5 \times B_n}$ C_n is the concentration of elements measured in sediment samples and B_n is the geochemical background concentration of the element (n). Factor 1.5 is the background matrix correction factor due to lithospheric effects .	≤ 0 (Class 0)	Unpolluted	Müller (1969)
		0–1 (Class 1)	Unpolluted to moderately polluted	
		1–2 (Class 2)	Moderately polluted	
		2–3 (Class 3)	Moderately polluted to strongly polluted	
		3–4 (Class 4)	Strongly polluted	
		4–5 (Class 5)	Strongly to extremely polluted	
		>5 (Class 6)	Extremely polluted	
Enrichment Factor (EF)	$EF = \frac{\left(\frac{Element}{Fe}\right)_{sample}}{\left(\frac{Element}{Fe}\right)_{background}}$	<1.5	Crustal origin of TEs	Herut and Sandler (2006)
		>1.5	Non-crustal or anthropogenic sources of TEs	
Hazard Quotient (HQ)	$HQ = \frac{SCC}{SQG}$ SCC is the concentration of elements in sediments in $\mu\text{g g}^{-1}$, and SQG is the sediment quality guidelines in $\mu\text{g g}^{-1}$. SQG values were determined at ER-L levels according to Long et al (1995)	<0.1	No adverse effects	Feng et al. (2011)
		0.1–1	Potential hazards	
		1–10	Moderate hazards	
		>10	High hazards	
Modified Hazard Quotient (mHQ)	$mHQ = \left[c_i \left(\frac{1}{TEL_i} + \frac{1}{PEL_i} + \frac{1}{SEL_i} \right) \right]^{\frac{1}{2}}$ C_i is the measured concentration of TE in the sediment samples, TEL_i, PEL_i and SEL_i are acronyms for the threshold effect level, probable effect level and severe effect level for ith element, respectively.	mHQ < 0.5	Nil to very low severity of contamination	Benson et al. (2018)
		0.5 < mHQ < 1.0	Very low severity of contamination	
		1 < mHQ < 1.5	Low severity of contamination	
		1.5 < mHQ < 2.0	Moderate severity of contamination	
		2.0 < mHQ < 2.5	Considerable severity of contamination	
		2.5 < mHQ < 3.0	High severity of contamination	
		3.0 < mHQ < 3.5	Very high severity of contamination	
		mHQ > 3.5	Extreme severity of contamination	

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Toxic Risk Index (TRI)	$TRI_i = \sqrt{((C_i/TEL_i)^2 + (C_i/PEL_i)^2)/2}$ $TRI = \sum_{i=1}^n TRI_i$ TRI _i is the toxic risk index of individual TE _i , C _i is the concentrations of TEs, TRI is the cumulative toxic risk index	TRI < 5	no toxic risk	Zhang et al. (2016)
		5 < TRI < 10	low toxic risk	
		10 < TRI < 15	moderate toxic risk	
		15 < TRI < 20	considerable toxic risk	
		TRI > 20	very high toxic risk	

Table S2: Exposure factors used in chronic daily intake (CDI) estimation for non-carcinogenic risk

Parameter	Value
IngR	100 mg/day (adult), 200 mg/day (children)
EF	350 days
ED	24 years (adult), 6 years (children)
BW	70 kg (adult), 15 kg (children)
AT	365 × ED adult/children
CF	1×10 ⁻⁶ kg/mg
inhR	20 mg/cm ²
PEF	1.36×10 ⁹ m ³ /kg
SA	5700 cm ² event ⁻¹
AFsoil	0.07 mg/cm ²
ABS	0.001

Adapted from US Environmental Protection Agency (USEPA) (2002).

Table S3: The reference dose (RfD) values of trace elements

Trace Elements	RfD (mg/kg/day)
Cd	0.0010
Cr	0.0030
Cu	0.0371
Ni	0.0200
Pb	0.0035
Fe	0.7000
Mn	0.1400
Co	0.0200
Zn	0.3000
Be	0.0020
V	0.0090
As	0.0003
B	0.2000
Ba	0.2000

Source: US Environmental Protection Agency [1]

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Table S4: Carcinogenic risk (Lifetime Cancer Risks) for different exposure pathways for (a) adults and (b) children.

a. Adults				
Trace elements	CR ing	CR inh	CR dermal	LCR [2]
Cd	2.722E-06	2.002E-09	1.086E-08	2.735E-06
Cr	4.193E-05	3.083E-08	1.673E-07	4.213E-05
Pb	3.556E-07	2.615E-10	1.419E-09	3.573E-07
As	1.474E-05	1.084E-08	5.881E-08	1.481E-05
b. Children				
Trace elements	CR ing	CR inh	CR dermal	LCR [2]
Cd	2.541E-05	1.868E-08	5.069E-08	2.548E-05
Cr	3.914E-04	2.878E-07	7.808E-07	3.924E-04
Pb	3.319E-06	2.440E-09	6.621E-09	3.328E-06
As	1.376E-04	1.011E-07	2.744E-07	1.379E-04

Figure S1 (a-i). Normalized X-ray diffraction patterns of sediment samples from S1 (a), S2 (b), S3 (c), S4 (d), S5 (e), S6 (f), S7 (g), and S8 (h) sites over seasons (pre monsoon, monsoon and post monsoon) along with the control site (i) during the monsoon season; quartz (Q), illite (I), chlorite (Ch), oligoclase (O) and rutile (R).

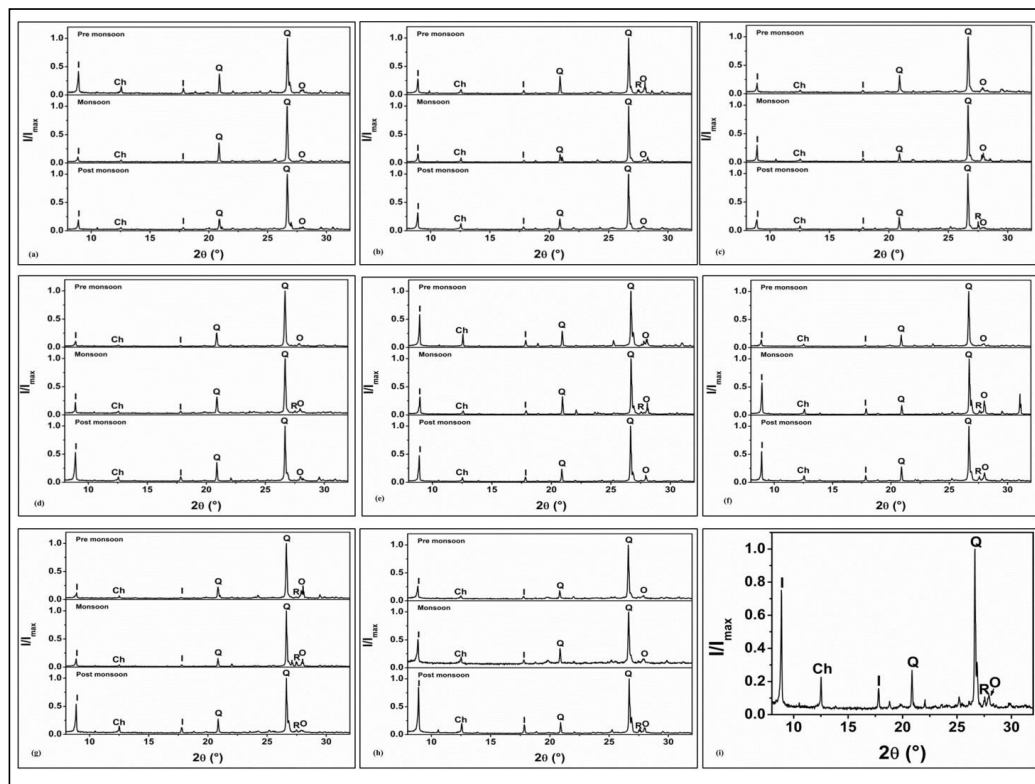
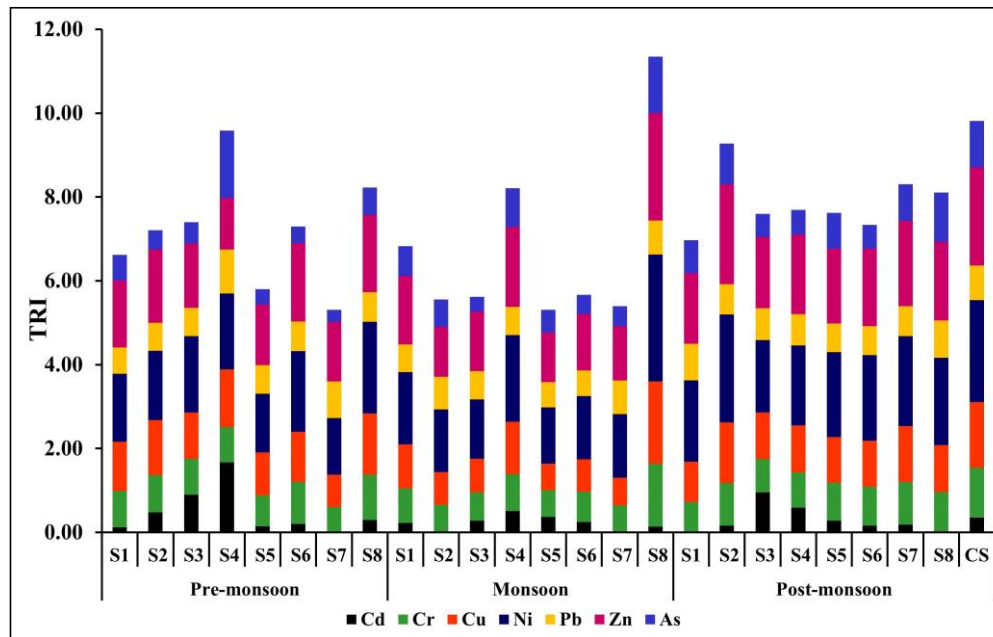


Figure S2. Toxic Risk Index (TRI) values based on the total concentration of trace elements at different sampling sites



References

- 1 USEPA (United States Environmental Protection Agency). Exposure Factors Handbook 2011 Edition (Final); United States Environmental Protection Agency: Washington, DC, USA, 2011. Available online: <http://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252> (accessed on 18 September 2020).
- 2 Hunter, P.R., Acceptable risk Paul R. Hunter and Lorna Fewtrell. Water Quality: Guidelines, Standards & Health, 2001: p. 207.