Comparative Seasonal Assessment of Pollution and Health Risks Associated with Trace Metals in Water and Sediment of Buriganga and Turag River

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Abstract

This study assessed the intensity of six trace metals (TMs) (Cr, Zn, Fe, Cu, Pb, and Ni) throughout river water obtained from the Buriganga and Turag River. A Total of 20 water and sediment samples were investigated by flame atomic absorption spectroscopy (FAAS) and graphite furnace atomic absorption spectrometer (GFAAS). The mean concentration of TMs in water differs in the descending order of Fe > Cr > Zn > Ni > Cu > Pb and Fe > Cu > Cr > Pb for the river Buriganga and Turag correspondingly. The decreasing pattern of trace metals was found for Buriganga and Turag in sediments such as Fe > Cr > Ni > Cu > Zn > Pb and Fe > Zn > Cr > Ni > Cu > Pb, respectively. For probable human health hazard implications, contamination factor (CF), and pollution load index (PLI) were established. CF values indicate that the polluted sediment samples are low to moderate. The PLI < 1 shows the degradation of the consistency for sediments. Certain concentrations of selected TMs exceed the acceptable level. Thus, results predicted that the extensive risk for TMs throughout the river systems' aquatic environment and needs to be given greater consideration.

Keywords: Trace-metal, health-risk, seasonal variation, Buriganga and Turag River.

Introduction

Trace metal contamination is considered among the most prominent problems that endanger water quality [1–3]. Increased manufacturing activities [2], unsustainable farming practices [4], constant dumping of urban wastewater [5], and unnecessary traffic activities [6] lead to Trace metal contamination of ecosystems. The Trace metal pollution in the atmosphere has now become a global concern, attributed to the growing pollution of water, soil including food in so many places around the world.

The Rivers Buriganga and Turag are the main receivers of industrial wastewater, flowing around the Dhaka metropolitan, the capital of Bangladesh.

The study focused on the comparative evaluation of the concentration of Trace metals leached out into nearby Rivers from both textiles and leather industrial areas in Dhaka city. This also studied the seasonal variability of Trace metals in the aquatic environment that involves all Rivers' water and sediment to better determine the contamination and health threats correlated with polluted environmental assets.

Method

This research consists of two very important Bangladeshi Rivers, namely Buriganga and Turag, adjacent to Bangladesh's capital city, Dhaka. The sampling took place from January to February (winter season) in 2018 and from May to June (summer season) in 2019. a total of 20 water samples and sediments samples were collected from the selected sites for evaluating the comparative seasonal variation of metal concentration.

Results and Discussion

Table 1 Trace metal concentration (conc. mg/L) of water of two studied Rivers

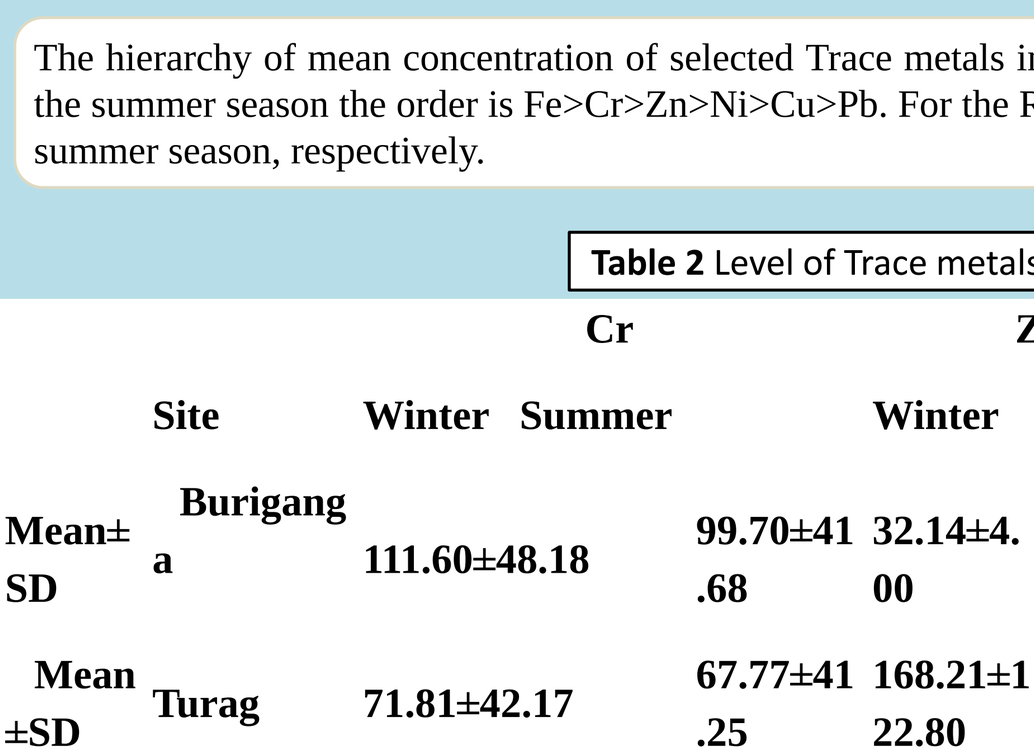
Site		Cr		Zn		Fe		Pb		Cu		Ni	
		Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Mean± SD	Buriganga	**2.85± 3.26**	**1.13± 1.13**	**1.25± 0.98**	**0.88± 0.54**	**14.01 ±3.74**	**10.61 ±1.69**	**0.30± 0.08**	**0.24± 0.15**	**0.80± 0.15**	**0.57± 0.14**	**1.36± 0.86**	**0.74± 0.43**
Mean± SD	Turag	**0.69± 0.59**	**0.53± 0.41**	**1.84± 1.0**	**1.36± 0.90**	**8.41± 2.12**	**5.58± 1.72**	**0.385 ±0.30**	**0.255 ±0.24**	**0.95± 0.70**	**0.55±. 46**	**0.89± 0.92**	**1.04± 0.65**

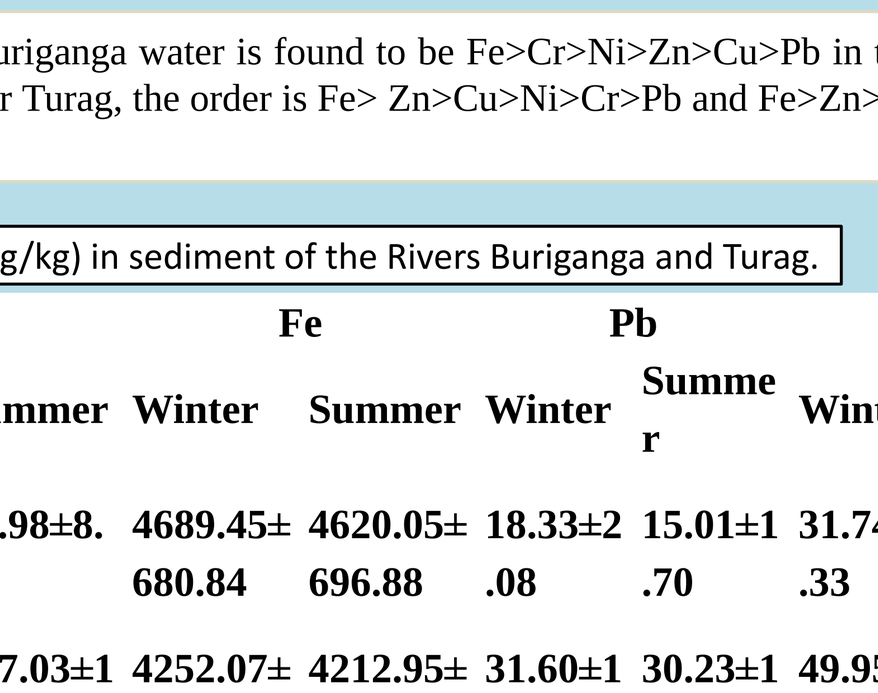
The hierarchy of mean concentration of selected Trace metals in Buriganga water is found to be Fe>Cr>Ni>Zn>Cu>Pb in the winter season whereas during the summer season the order is Fe>Cr>Zn>Ni>Cu>Pb. For the River Turag, the order is Fe> Zn>Cu>Ni>Cr>Pb and Fe>Zn>Ni>Cu>Cr>Pb during winter and summer season, respectively.

Table 2 Level of Trace metals (mg/kg) in sediment of the Rivers Buriganga and Turag.

	Site	Cr		Zn		Fe		Pb		Cu		Ni	
		Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Mean± SD	**Buriganga**	**111.60±48.18**		**99.70±41 .68**	**32.14±4. 00**	**25.98±8. 57**	**4689.45± 680.84**	**4620.05± 696.88**	**18.33±2 .08**	**15.01±1 .70**	**31.74±9 .33**	**29.25±9 .54**	**34.06±5 .88**	**31.18±3 .84**
Mean ±SD	**Turag**	**71.81±42.17**		**67.77±41 .25**	**168.21±1 22.80**	**157.03±1 13.44**	**4252.07± 224.34**	**4212.95± 158.44**	**31.60±1 2.59**	**30.23±1 1.23**	**49.95±1 5.40**	**45.95±1 4.09**	**57.71±3 3.15**	**54.14±2 9.36**

The decreasing trend of mean concentration in sediments is Fe>Cr>Ni>Cu>Zn>Pb for the Buriganga River and Fe>Zn>Cr>Ni>Cu>Pb for the Turag River. However, the two hierarchies for the sediment have a close match with the mean concentration hierarchy for most of the selected Trace metals in the water; revealed a close relationship for the metal concentration in water and sediment due to the surrounding environment including all biotic and abiotic factors.





Conclusions

The results show that the water and sediment of the Rivers contained six studied elements. The concentrations of Trace metals in water and sediment exceeded some well-recognized standards.