

Assessment of trace metals in water, sediment and fish species of some urban rivers in Bangladesh

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Introduction: The present study observed at the situation of three urban rivers (Turag, Buriganga and Shitalakha) around Dhaka city, Bangladesh. The greater Dhaka city is one of the most densely populated area in the world with approximately 12 million people of which less than 25% are served by sewage treatment facilities. Trace metals from natural and anthropogenic sources pose serious threats to the environment. Hence, trace metals are vital indicators for monitoring the change of aquatic environment. The consumption of fish has increased notably in recent decades to satisfy high protein demand. However, trace metals in fish has become an important worldwide concern, not only threat to fish but also due to the human health risk.

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Objectives: To assess the contamination of trace metals in the aquatic environment

Results and Discussions

Sediment

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Study area and methods

Eighteen pairs of water and sediment and three species of fifty four fish samples were collected in March 2012



Fig. 1. Map of study area in Bangladesh

Analytical procedure:

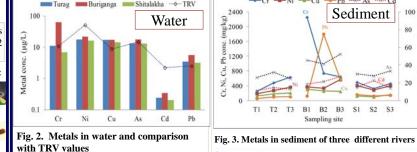
World Health Organization, Geneva.

0.2 g sediment / 0.3 g fish / 20 ml water sample 5 ml 69% HNO₃ (Kanto chemical Co, Japan) + 2 ml 30% H₂O₂ (Wako chemical Co, Japan)

Digestion by using microwave digestion system Filtration by DISMIC® -25HP PTTF (0.45 µm) syringe

Metal analysis by using ICP-MS (Agilent 7700 x) Reference: Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2004. Safety evaluation of certain food

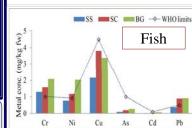
additives and contaminants. WHO Food Additives Series No.



Among three studied rivers, Buriganga River exhibited higher than other two

Some of the metals exceeded the Toxicity Reference Value (TRV) for safe fresh water.

rivers



defused Ni-Cd batteries and Cd plated items. >Stinging catfish (SC) and banded gourami

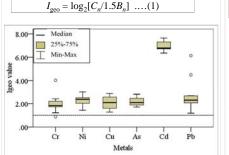
Sampling site

➤ Waste from tanneries was the most probably

activities, atmospheric emission, leachates from

these fish species. >Most of the studied metals were higher than the WHO recommended permissible limits in fish for human consumption.

Sediment quality assessment



Geo-accumulation index (Igeo) was used to >Higher Ni, Cd and Pb in sediment of assess metal accumulation in sediment and Buriganga River might be due to industrial measure the degree of metal pollution.

(BG) are bottom living and therefore, sediments

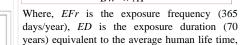
responsible for the highest Cr concentration in Fig. 5. Igeo values of metals in sediment

The frequency of Igeo value of metals; Cd > Pb > Cr > Ni > Cu > As.

The highest Igeo values for Cd (6.4 - 7.7) indicated extreme contamination. For other metals, moderately to extremely polluted. could be the major sources of high metals in

 $EFr \times ED \times FIR \times C \times CSFo$

Calculation of target carcinogenic risk:



FIR is the fish ingestion rate (87.16 g/person/day), C is the metal concentration in fish (mg/kg, fresh weight), BW is the body weight (60 kg for adult), AT is the averaging time for non-carcinogens and CSFo is the oral carcinogenic slope factor.

Table 1. Carcinogenic risk due to fish consumption

Target Carcinogenic Risk (TR) species Pb 2.6×10^{-3} 4.1×10^{-4} 7.8×10^{-6} 3.7×10^{-3} 5.8×10^{-4} 1.3×10^{-5}

 5.5×10^{-3} 6.5×10^{-4} 1.7×10^{-5} Carcinogenic risk of Ni, As and Cd were

higher than the threshold risk level (10-6) set by

USEPA ►Ni and As have a residual cancer risk as exceeding USEPA recommended value of 10-4.

Conclusion: This study has shown that the water and sediment of the rivers was heavily polluted with metals. As some of the selected metals exceeded the safe levels, therefore, it suggested that the water from contaminated sites should not be used without treatment. Target carcinogenic risk values

were larger than the threshold risk level set by USEPA (10-6), indicating carcinogenic risks for all adult people of the study area. islam-md.saiful-nj@ynu.ac.jp

Fig. 4. Metals content in fish species and comparison with WHO permissible limits

€ \$2000

Buriganga River.