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BIOACCUMULATION OF HEAVY METALS IN SOME SHELL FISHES AND SOIL FROM POLLUTED IN CHAKTAI KHAL OF KARNAFULLY RIVER, CHITTAGONG

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Environmental pollution has become a major concern of developing countries in the last few decades. There is a growing sense of global urgency regarding the pollution of our environment by an array of chemicals used in various activities (Tariq *et al.* 2008). Chaktai Khal is located in 22°21'31"N 91°50'36"S which is one of the busiest commercial center of the country. Chaktai Khal was most suitable for handling of essential commodities.

Benthic gastropod sand Crustaceans have an especially close relationship with the sediments that comprises their habitat and feeding site which in turn are used as food source by birds and fish and make them accessible for human consumption through food chain and eventually pose great health risk (Altndag and Yigit 2005). Heavy metals accumulated in soil can affect concentration of heavy metals in the organisms that dwells in that area (Kim and Kim 2006).

The snails accumulate metals to high concentrations than any other group of invertebrate and demonstrated the ability as potential bio-indicator (Zhou *et al.* 2008). Bioaccumulation of metals, by aquatic life is his risk to human and other animals since these metals could be transported directly upon consumption to in ecosystem. Through biological magnification some aquatic organisms may build up concentration of metals present in low concentration in environment to levels which are harmful to life and exceed public health standard (Philips, 1976).

Fig. 1. The map of Karnaphuli River and the position of ChaktaiKhal.

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The present work was aimed at studying to determine the concentrations of heavy metals Zn, Cu, Cd and lead in soil sediments, mud crab and snail's species and Bivalve -Asiatic hard calm inhabiting at the Chaktai khal Zone and to find out suitable snail species as sentinel animal used for metal monitoring program in fresh water ecosystem.

Mollusks as Asiatic hard calm (Meretrix meretrix) and cherry snail (Neritina smithi) and crustacean as Mud crab (Scylla olivacea) and soil of this zone are used as sample for finding the bio-accumulating rate to analyze and compare the metallic component of that site and also relationship with the specimens . These are caught by netting device and collected from April to May in First time and in second time from October to November of the year. Upon collection, the samples were washed with tap water and rinsed thoroughly with distilled water and transported in plastic specimen vial with 4% formalin to the laboratory. Muscle tissues were removed from the animal and cut into small pieces and dried at constant temperature of 800 for 48 hour in the oven. Dried samples of individual tissues were grinded into fine powder by agate motor for biological tissue and aluminum carbide motor for sand and soil. Tablets were made from this powder by using 10 mm dia and hydraulic pressure. The pellets were 10 mm in diameter and about 1-mm thick containing 100 mg portions of the samples and they were prepared with a graduated hydraulic press by applying 3 tons of pressure. All standards and unknowns were prepared under identical conditions. The readymade pellets from each sample standard where then put into clean dry small plastic Petri dishes and preserved in a vacuum desiccators until analysis. Radioisotope Induced X Ray Fluorescence method was used to estimate heavy metal from the tablet. For the analysis of soil samples, a single multi-element standard, IAEA-Soil-7 was used for the calibration of concentration in this study. Every specimen has been analyzed for seven times.

The Mean concentration of Heavy metals in selected crustacean and Mollusks; soil samples, is presented in Table 1. The results were expressed in mg/kg dry weight of tissues and the average value have also compared with the standard value of FAO and their maximum and minimum for concentrations (MAC. BD) of heavy metals in the tissues of these samples are shown in the (Table 1) for the sites of CUFL.

Sarma *et al.* 2007 observed bioaccumulation of heavy metals in some commercial fishes and crabs of the Gulf of Cambay where the rate of (Cu: 43, Zn: 55, Fe: 423 and Pb: 2.43 mg/kg) in mud crab and order of toxicity was Fe>Zn>Mn>Cu>Ni>Cd>Pb>Rb. In this study, Mud crab collected from Chaktai Khal was Fe: 333.6, Mn: 123.95, Zn: 100. 14, Cu: 58.12, Br: 33.50, Ni: 13.19, Cd: 6.06, Pb: 3.79 and Rb: 3.74 (mg/kg) and order of toxicity was Fe>Mn>Zn> Cu> Br>Ni>Cd>Pb>Rb which is near about similar with Sarma. In Mud crab, Sr and Fe are highly accumulated but As, Pb, Zn and Ni exceeded the standard level (Fig. 2.). The Cu level recorded in tissue of Mud crab samples showed elevated concentration than Mollusks. This level is presumably influenced by the Cu contained Haemocyanin in the Haemolymph of crustaceans.

Again, Kamaruzzaman *et al.* (2012) found that all the heavy metal Pb, Cu and Zn accumulations in Scylla sp. were higher than the international standard Maximum Permissible Level (MPL).

In Mollusks, Asiatic hard calm and Cherry snail the order was Fe>Mn>Zn>Co>Ni>Rb>Pb>As>Br and Fe>Sr>Mn>Zn>Co>Cu>Br>Rb respectively. Among, Mollusks the value of Co: 18.35, Ni: 13.19 and As: 2.64 mg/kg was 3 to 15 times higher than the standard value of FAO (Co: 6, Ni: <1 and As: 1 mg/kg). Levels of heavy metals mg/Kg dry tissues of Asiatic hard calm and Cherry snail as showed in Table 1. indicated that Asiatic Hard Calm accumulated higher concentrations of Co, As, Pb and Ni that were higher than the standard level allowed. But Mn, Cu and Zn were still below the standard level (Fig. 3).

Again Karm et al. 2013 observed that the freshwater snail has a tendency to accumulate higher concentrations of Zn, Cu, Pb and Cd. In Cherry snail Zn, Co, Cu and Mn were higher than Asiatic Hard Calm but Cu was higher than standard level (Fig. 3 and Fig. 4).

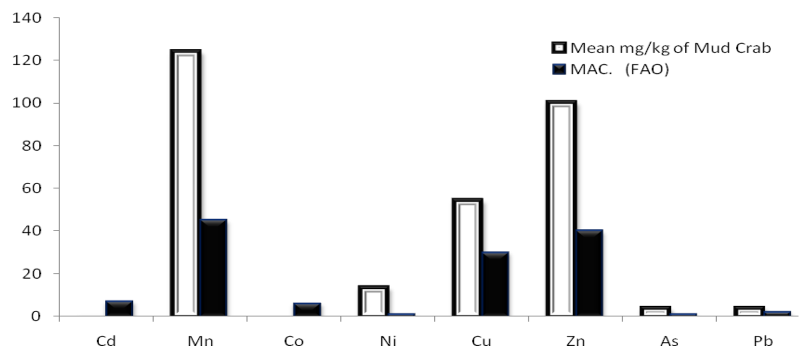

Fig. 2. Comparison of bioaccumulation of heavy metals of mud crab (Scylla olivacea) and Standard value of FAO

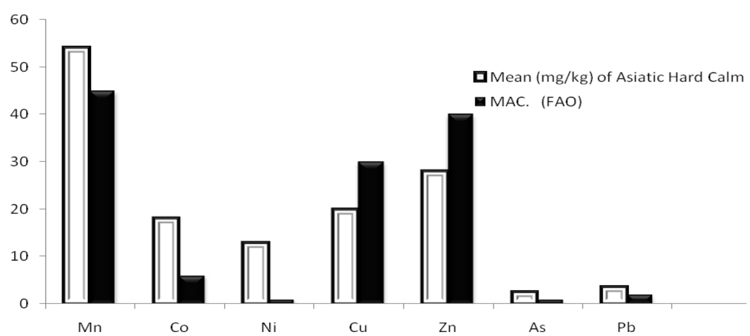

Fig. 3. Comparison of bioaccumulation of heavy metals of Asiatic hard calm (Meritrix meritrix) and Standard value of FAO

Table 1.The Mean (±SD) concentration of heavy metals (mg/kg), Minimum and Maximum of selected specimens and soil with standard value of FAO and Maximum allowable concentration (Maximum Allowable Concentration. Bangladesh) of some heavy metals.

Heavy Metal	Stan-dard value of FAO	Mud crab			Asiatic hard calm			Cherry snail			MAC. BD	Soil		
		Mean ± SD (mg/kg)	Mini.	Maxi.	Mean ± SD (mg/kg)	Mini.	Maxi.	Mean ± SD (mg/kg)	Mini.	Maxi.		Mean ±SD (mg/kg)	Mini.	Maxi .
K		BDL			BDL	BDL		3106	3075	3125				
Ca		55.46	53.7	58.7	317.49	315.6	318.6	32.3	31.8	32.9	BDL			
Cd	7	0.06	4.90	6.90	BDL	BDL		BDL	BDL					
Mn	45	123.95	56.50	130.98	54.11	52.7	55.8	97.4	96.7	98.1	684	984.43	983	987
Fe		333.67	122	576	1924.14	1893	1945	3383	3279	3400	4333	6471.43	6469	6475
Co	6	BDL			18.27	17.98	18.41	30.9	29.8	31.1	284	284.86	281	287
Ni	<1	13.19	11.90	19.21	12.97	12.75	13.19	BDL				BDL		
Cu	30	58.12	42.20	58.12	1819.96	19.7	20.2	23.2	22.8	23.3	39.3	71.19	70.9	71.6
Zn	40	100.14	81.10	100.10	28.16	26.8	29.1	51.39	51.7	52.3	79.6	156.86	155	159
As	1	<3.59			2.64	2.09	3.15	BDL	BDL		0.6	6.77	5.15	9.5
Br		33.50	33.50	116	2.33	2.26	2.36	16.6	15.9	16.8				
Rb	2	3.7	3.21	5.75	8.11	7.94	8.35	12.1	11.7	12.2		202.14	199	205
Sr		557	534	562.67	109.14	101	113	174	169	176		121.71	116	130
Pb		3.79	0.89	3.79	3.70	3.19	4.01	BDL	BDL		75.4	40.84	30	53
Cr	0.1										30.4	444.57	441	447
Y												32.21	31.9	32.5
Zr											123	251	249	254
Mb											5	19.67	19.4	19.9
Ti	4627	6087.43	6084	6091										

MAC.BD= Maximum Allowable Concentrations of Bangladesh
FAO =Food and Agriculture Organization
BDL= Below Detection Limit

According to Bangladesh price water house coopers (BPWC), 2006, the order of the toxicity of heavy metals in Soil is, Mb> Co> Cu> Zn>Zr> Ti> As> Fe>Mn. But in this Study the order of the toxicity of heavy metals in Soil is Fe>Ti>Cr>Mn>Co>Zr>Rb>Zn>Sr>Cu>Pb>Y>Mb>As (Fig. 5). In Soil, based on standard of Bangladesh Cr, Mb, Cu, As and Ti were many times exceeded the standard Level but Pb was still below (Fig. 5).

But Siddique and Akter (2012) found the mean concentration of Fe, Cd and Pb are above the recommended value in the soil of Karnafully River which may indicate a fresh and continuous contamination of salt marsh pore water due to anthropogenic activities.

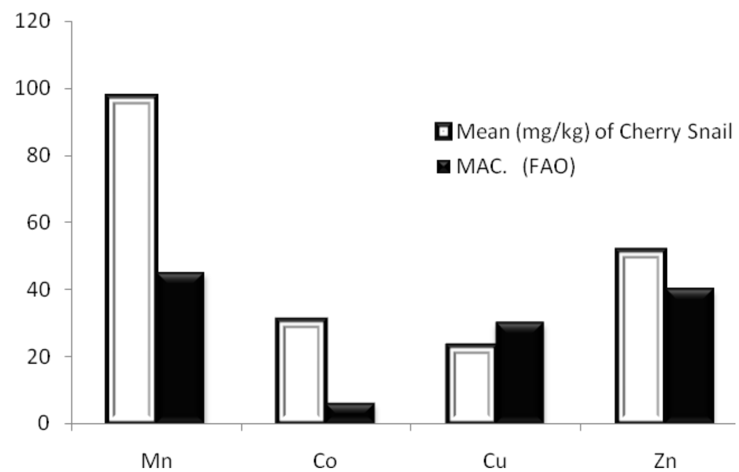

Fig. 4. Comparison of bioaccumulation of heavy metals of Cherry snail (Neritinasmithi)and Standard value of FAO.

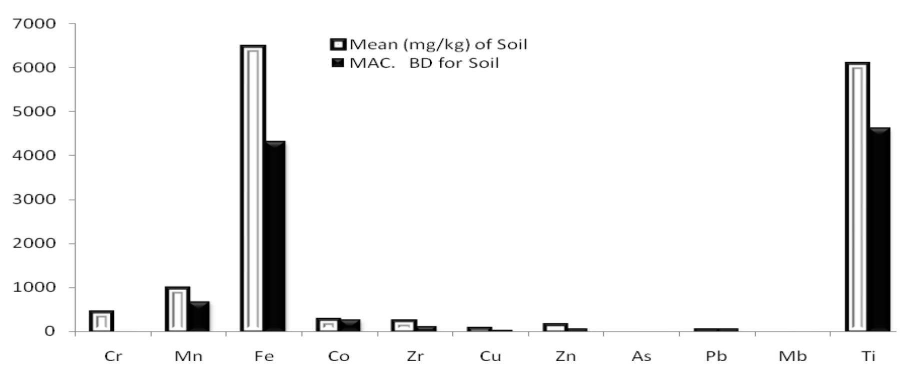

Fig. 5. Comparison of bioaccumulation of heavy metals of Soil and Maximum allowable concentration (MAC. BD).

During the present study, it was observed that the magnitude of heavy metal accumulation in snails and crab tissues depend upon type of heavy metal and species of the invertebrate. The observed differences in tissues metal concentrations between Crustaceans and Mollusks species might be due to variation in reproductive condition, genotype of the animal, difference in metabolic rate, body weight, trophic position, presence or absence of enzyme system that can degrade the pollutants (Valavanidis and Vlachogianni 2010). Element concentrations in mollusks differ between different species due to species-specific ability or capacity to regulate or accumulate trace metals (Abdullah *et al.* 2007) and might be related to the species-specific digestive physiology and absorption rate of a metal across gut epithelium (Lee and Lee, 2005). Therefore, three species that live in a same place can differ in the types and concentrations of metals they accumulate. Intraspecific and interspecific variation has been observed across many taxa with respect to resistance to natural environmental stressors (Arad *et al.* 1993).

Form the present study, it can be concluded that the heavy metal concentration in the different tissue of animals and Soil are higher than the prescribed level. Therefore the selected species and soil for this study are very risky for human consumption in this region. This study will convey a strong message for the government body, policy maker to establish rules and regulation in order to save our environment and will be helpful for public awareness.

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