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Metals Accumulation in Grey Mangrove (*Avicennia marina* (Forsk.) Vierh.) Inhabiting Tarut Bay, Eastern Saudi Arabia

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Abstract

Mangrove forests are of special interest because of their metal accumulation potenials as they occur in environments characterized by an excess of toxic ions. In this current study, we investigated the accumulation capacity of (*Avicennia marina*), a dominant mangrove plant inhabiting Tarut Bay in Eastern Saudi Arabia. Samples comprising mangroves, water and soil from 10 locations of Tarut Bay were analyzed for 8 heavy metals including Boron, Iron, Manganese, Zink, Lead, Nickel, Cadimum and Cupper. In water samples, B (5.5 PPM) was the highest while Cd was absent, also soil samples contained higher B (27.2 PPM), while Cd was lacking in these samples too. Overall, the concentrations of heavy metals were higher in plant shoot as compared to water and soil samples. In plant shoot Cu level was highest (107.22 PPM), while Cd was the lowest in. Our results demonstrate that grey mangrove absorb and accumulate higher quantities of heavy metals and thus play a vital role via cleansing the coastal environment from such harmful heavy metals. Our findings asserted that grey mangrove is a promising candidate for the purpose of Phytostabilization of industrially polluted coastal shores.

Keywords: heavy metals, grey mangrove, accumulation, tarut bay, vegetation filters

1. Introduction

The Eastern Province is the largest geographical area in the Kingdom of Saudi Arabia, covering about 86% of the country's industrial zone. Since the discovery of oil, this area has undergone immense progress (Alayaf, 1993). The pollution of this area increased dramatically due to the industrial revolution. The main sources of this pollution are the burning of fossil fuel, petroleum industries, mining and smelting of metalliferous ores, municipal wastes, landfill leachates, fertilizers, pesticides and sewage (Al-Khateeb & Leilah, 2005). The pollution of the environment by industrial, economic and social activities is one of the most important global problems, now adays (Kamal et al., 2004).

Due to their toxic effects, the contamination of heavy metals (HM) in the environment is a major global concern, which has provoked the emergence of phytoremediation technologies for cleaning soils (Baker et al., 1994; Salt et al., 1998; Terry & Banuelos, 2000), streams (Dushenkov et al., 1995), mine wastes and sewage (Ait et al., 2004; Von & Max, 1984; Xingmao & Havelka, 2009) by the use of approximately 400 plant species, capable of accumulating toxic heavy metals. Phytoremediation means to remove contaminants from polluted soils and water bodies using plants, capable of absorbing, degrading or eliminating them (Salt et al., 1998). It is a clean, efficient, inexpensive and environmental friendly mechanism.

In the Gulf region, oil and chemicals enter the marine environment from different sources such as continued discharge of industrial waste and oil spills from ships (Literathy et al., 2002). The Gulf War of 1991 brought serious environmental damage to the region. The world's largest oil spill was estimated at about as much as 8 million barrels (Metz, 1993). Most of the shores of the Eastern Province of Saudi Arabia and, the coasts bordering Kuwait got saturated with crude oil during the Gulf War, and many researches had described the impact of oil spills during the Gulf War (Gundlach et al., 1993; Tawfiq & Olsen, 1993; Jacob & Al-Muzaini, 1995; Hashim et al., 1995; GESAMP, 2007; Hashem, 2007; Bejarano & Michel, 2010; Danish, 2010).

Grey mangrove (Avicennia *marina* (Forssk.) Vierh) inhabit the Arabian Gulf and it is tolerant to relatively high salinity, together with low rainfall and high temperatures (Loughland & Al-abdulkader, 2011). The phytoremediating role of grey mangroves, especially in cleaning the environment has been described by earlier reserchers (Mac Farlane & Burchett, 2002; Mac Farine et al., 2003; Suresh & Ravishankar, 2004; Mac Farlane et al., 2007; Isaiah et al., 2011). Many scientists have suggested the use of some other plants in phytoremediation including *Phragmites*, *Tamarix*, tobacco, sunflower, cordgrass, *Salix*, *Typha*, *Arabis gemmifera* and *Thlaspi caerulescens* (Kubota & Takenaka, 2003; Zhao et al., 2003; Adler, 2007; Manousaki et al., 2007; Al-Taisan, 2009).

Tarut Bay is considered as one of the most important coastal zones in the Gulf region and water birds flock here during winter in huge numbers i.e. Approximately 58,000 water birds (Czudek, 2006). The ecosystem of Tarut Bay is exposed to many environmental constraints and several factors threatens the mangroves vegetation. Some of these threats includ anthropogenic activities such as building fishing ports and dams, invasion of sand dunes, and camel grazing on mangrove leaves (Parvaresh, 2011), heavy metals (Agoramoorthy et al., 2008) and sewage from industrial and residential areas (Tam & Wong, 1997).

This current study aims at investigating the extent of heavy metals accumulation in mangrove plants, soils and water in the Tarut Bay. To the best of our knowledge this is the first about metal accumulation in mangrove plants, soils and water in the selected study. (Farraj et al., 2011) published a paper that analysed the accumulation of heavy metals in Cuttlefish in the Arabian Gulf. Al-Sulami et al. (2002) also analysed the distribution of toxic heavy metals in fishes, sediments and water along the eastern coast of Saudi Arabia. While it can be agreed that some of the objectives of the latter study tally with those of this present study, the difference is that this current study sampled different sites and goes further to verify the accumulation of these toxic substances in mangrove plants. Also, Sadiq & Zaidi (1994) analysed the accumulation of metals in sediments and mangrove leaves from samples collected from Tarut Bay and Gurmah Island. This current study is similar to the above because it measures accumulation of heavy metals in soils (sediments) and mangrove plants in the Tarut Bay. However, this current study does not focus on Gurmah Island and it was conducted in 1994 which is relatively a long time ago, this reason necessitates this current analysis of metal accumulation in mangroves and sediments in Tarut Bay. Also, (Zyadah & Taweel, 2013) verified the accumulation of heavy metals in fish and prawns at the Dammam Coast of the Arabian Gulf. Their analysis is different from this current study because it is based on fish and prawns while this current study looks at bioaccumulation mostly in mangroves, sediments and water.

2. Material and Methods

This study was carried out on grey mangroves communities inhabiting Tarut Bay located in the eastern Province of Saudi Arabia. Tarut Bay extends from the northern coast of the city of Dammam and ends at Ras Tanura, covering an area of 41 thousand hectares (410 k^2) as shown in Figure 1 (Scott, 1995). Ten sites were selected and samples been between December 2010 and January 2011. It was worth mentioning help was taken from maps of the General Directorate of Military Survey (2001), and by using the latest mobile GPS (Garmin nuvi 205W) as shown in (Figure 2 & Table 1).

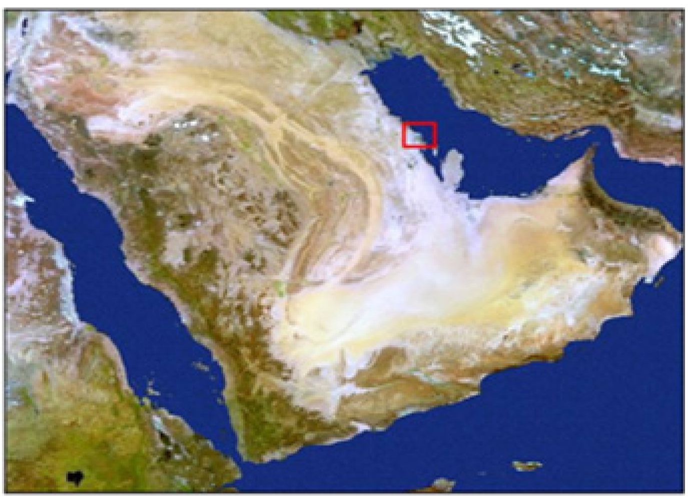

Figure 1. Satellite image showing the Tarut Bay under the study (picture from King Abdul-Aziz City for Science and Technology)

Figure 2. Map of the General Directorate of Military Survey (Modified by the Researcher)

Table 1. GPS points of the study locations

Sites	GPS	
Site1: Dammam Port	N 26°25.400'	E 050°09.196'
Site2: Dammam	N 26°27.957'	E050°04.376'
Site3: Syhat Road	N 26°29.932'	E050°02.467'
Site4: Syhat	N 26°30.335'	E050°02.519'
Site5: Darin	N 26°33.025'	E050°04.685'
Site6: Rabiayah	N 26°33.025'	E050°04.685'
Site7: Snabis	N 26°34.088'	E050°05.307'
Site8: Zor Forest	N 26°35.855'	E050°03.832'
Site9: Sfwa	N 26°37.705'	E050°00.387'
Site10: RasTanurah	N 26°44.767'	E049°59.615'

Samples collected from water, soil and plants were used to determine the concentrations of eight heavy metals: Boron, Iron, Manganese, Zink, Lead, Nickel, Cadimum and Cupper. The water samples were collected following (Reeve, 2002), three samples were collected from each of the 10 sites in 250 ml polyethylene container, and acidified (by adding 2 ml Hcl in 1 litter water) to prevent absorption of heavy metals on the sides of the container. The samples were then transported to the laboratory at (4°C) and heavy metals were analyzed on the same day, using the inductively coupled plasma–optical emission spectroscopy (Clesceri et al., 1998).

Three Soil samples were semantically collected from surface soil (0-10 cm) and (10-30 cm) deep soil, at all locations and processed following 1:5 soil to water extraction method (Kalra et al., 1991). The heavy metals were determined by Inductively Coupled Plasma – Mass Spectrometer, following (Jones, 2001).

Three Mangrove (Shoot) samples were collected randomly from all locations during the same period, and dried in electrical oven. The dry ashing protocol was used as it is simple, non-hazardous and less expensive as compared with wet digestion (Ryan et al., 2007). The heavy metals contents were determined through Inductively Coupled Plasma – Mass Spectrometer, by following (AOAC, 1998) protocol. The heavy metals were quantified in ppm, while three samples were analyzed for each parameter.

The data obtained was subjected to statistical tests (T-test) using the software SPSS version 15 (SPSS Inc., Chicago, USA).

3. Results

Grey mangrove vegetation inhabiting 10 sites at Tarut Bay i.e. Dammam Port, Dammam, Syhat Road, Syhat, Darin, Rabiayah, Snabis, Zor Forest, Sfwa and Ras Tanurah were studied for heavy metal accumulation. Of these 10 sites, Ras Tanura registered the highest levels of the total heavy metals (0.76 ppm), while the lowest levels of heavy metals were recorded for Syhat Road, Zor Forest and Dammam. The presence of heavy metals from highest to lowest was as follows: Ras Tanurah→Rabiayah→Darin→Sfwa→Dammam Port→Syhat→Snabis→Syhat Road→Zor Forest→Dammam.

Water samples analyzed for heavy metal accumulation showed that B and Pb were present in all samples, while Cd element was absent <0.001, as shown in Table 2 and Figure 3. It was observed that Pb and Mn contents in the water ranged from 0.101-0.033 ppm and 0.027-0.013 ppm respectively. The heavy metals were found present in the following sequence, as B was the most abundant element followed by Pb, Fe, Mn, Zn, Cu, Ni and Cd respectively.

Table 2. Variations in heavy metal contents (PPM) in Water at ten Sites in the study area

City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Geometric
Dammam Port	<0.001	0.0023	<0.001	0.1007	0.0053	0.034	0.0037	0.703	1.04
	±0.0000	±0.0014	±0.0000	±0.0052	±0.0063	±0.0371	±0.0052	±0.1203	
Dammam	<0.001	0.0063	0.0017	0.033	0.009	0.0157	0.0077	0.19	2.7
	±0.0000	±0.0038	±0.0014	±0.0329	±0.0174	±0.0207	±0.0076	±0.0878	
Syhat Road	<0.001	0.008	0.001	0.05	0.0033	0.0443	0.017	0.303	5.48
	±0.0000	±0.0090	±0.0000	±0.0086	±0.0057	±0.0509	±0.0086	±0.1818	
Syhat	<0.001	0.004	<0.001	0.088	0.0053	0.0777	0.007	0.6273	2.52
	±0.0000	±0.0043	±0.0000	±0.0155	±0.0029	±0.1707	±0.0194	±0.0382	
Darin	<0.001	0.004	<0.001	0.094	0.0057	0.1017	0.002	0.6723	1.71
	±0.0000	±0.0025	±0.0000	±0.0197	±0.0029	±0.2584	±0.0025	±0.0488	
Rabiayah	<0.001	0.0047	<0.001	0.1007	0.0047	0.0867	0.0013	0.7233	1.34
	±0.0000	±0.0029	±0.0000	±0.0080	±0.0029	±0.2080	±0.0029	±0.1174	
Snabis	<0.001	0.0033	0.001	0.0633	0.0063	0.1163	0.027	0.5763	1.54
	±0.0000	±0.0029	±0.0000	±0.0396	±0.0125	±0.3618	±0.0172	±0.1329	
Zor Forest	<0.001	0.0023	<0.001	0.0523	0.001	0.0567	0.0027	0.2997	2.34
	±0.0000	±0.0014	±0.0000	±0.0150	±0.0000	±0.1837	±0.0029	±0.0160	
Sfwa	<0.001	0.0033	<0.001	0.0907	0.0047	0.07	0.002	0.6813	1.15
	±0.0000	±0.0014	±0.0000	±0.0201	±0.0029	±0.0386	±0.0000	±0.0845	
RasTanurah	<0.001	0.0043	<0.001	0.101	0.0063	0.1433	0.002	0.761	2.44
	±0.0000	±0.0029	±0.0000	±0.0282	±0.0029	±0.0117	±0.0000	±0.1323	
Total of Mean/Ion	<0.001	0.0427	0.0037	0.7737	0.0517	0.7463	0.0723	5.5373	

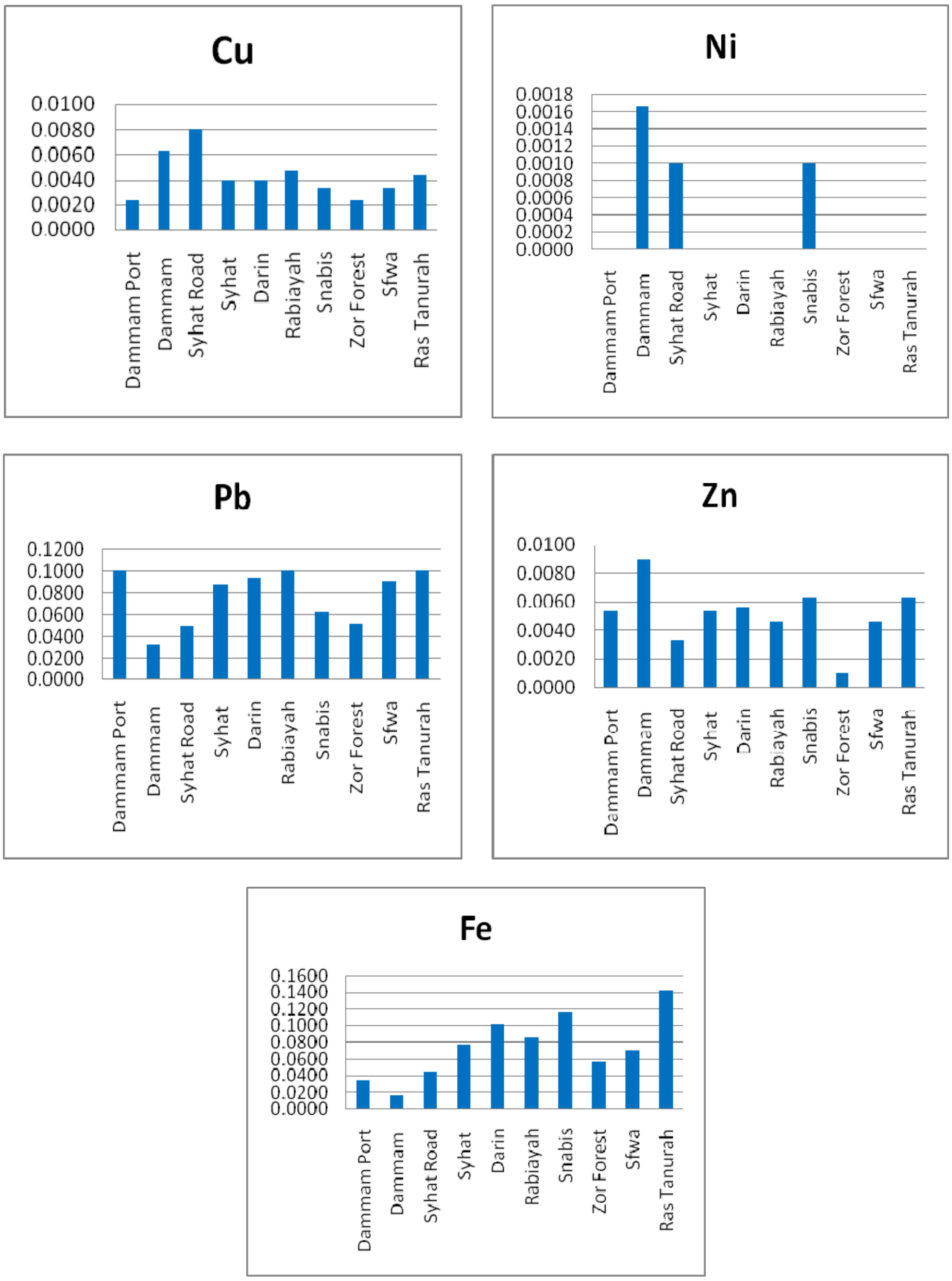

Figure 3. Heavy Metals In Water (PPM)

In soil samples, B and Fe elements were present in higher contents as their concentration reached to 2.250 ppm in soil surface layer at Zor Forest, while lowest contents (1.02 ppm) of B and Fe were recorded for deep layer of soil at Dammam. The elements Cd and Cu were present in negligible quantities in all soil samples (<0.001), as shown in Table 3 and Figure 4. The overall contents from highest to lowest al all sites were as follows: B→Ni→Zn→Mn→Pb→Fe→Cd =Cu. It was also observed that the contents of heavy metals greatly varied in surface and deep soil. We recorded that the mean concentrations of heavy metals in surface soil of 10 sites from highest to lowest were as follows: Zor Forest→Dammam Port→Snabis→SyhatRoad→Rabiayah→Darin→Syhat→Dammam→Ras Tanurah. On the other hand, the mean concentrations of heavy metals in deep soil of all these sites decreased as follows: Zor Forest→Rabiayah→Ras Tanurah→Syhat Road→Syhat→Sfwa→Dammam Port→Snabis→Darin →Dammam (Table 3 & Figure 4).

Table 3. Variations in heavy metal contents in PPM Soil Surface S: Depth, D.

City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Geometric
Dammam Port S	<0.001	<0.001	0.035	<0.001	<0.001	<1	0.0063	1.92	0.0206
	±0.0000	±0.0000	±0.0025	±0.0000	±0.0000	±0.0000	±0.0087	±0.2687	
Dammam Port D	<0.001	<0.001	0.0127	<0.001	0.038	<1	0.007	1.0417	0.0019
	±0.0000	±0.0000	±0.0117	±0.0000	±0.0752	±0.0000	±0.0066	±0.0808	
Dammam S	<0.001	<0.001	0.0097	<0.001	0.005	<1	0.0027	1.2337	0.0004
	±0.0000	±0.0000	±0.0038	±0.0000	±0.0000	±0.0000	±0.0029	±0.4829	
Dammam D	<0.001	<0.001	0.004	<0.001	<0.001	<1	0.001	1.0203	0.0020
	±0.0000	±0.0000	±0.0025	±0.0000	±0.0000	±0.0000	±0.0000	±0.0236	
Syhat Road S	<0.001	<0.001	0.009	<0.001	<0.001	<1	0.001	1.536	0.0037
	±0.0000	±0.0000	±0.0043	±0.0000	±0.0000	±0.0000	±0.0000	±0.1615	
Syhat Road D	<0.001	<0.001	0.0053	<0.001	<0.001	<1	0.0017	1.2527	0.0034
	±0.0000	±0.0000	±0.0029	±0.0000	±0.0000	±0.0000	±0.0029	±0.4711	
Syhat S	<0.001	<0.001	0.0063	0.003	0.074	<1	0.0027	1.2917	0.0001
	±0.0000	±0.0000	±0.0052	±0.0000	±0.0248	±0.0000	±0.0029	±0.3652	
Syhat D	<0.001	<0.001	0.0073	0.006	<0.001	<1	0.0023	1.2183	0.0004
	±0.0000	±0.0000	±0.0143	±0.0000	±0.0000	±0.0000	±0.0038	±0.1686	
Darin S	<0.001	<0.001	0.0037	<0.001	0.001	<1	0.001	1.4363	0.0001
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0000	±0.5234	
Darin D	<0.001	<0.001	0.0037	<0.001	<0.001	<1	0.001	1.0223	0.0019
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0000	±0.1941	
Rabiayah S	<0.001	<0.001	0.0037	<0.001	<0.001	<1	0.001	1.46	0.0023
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0000	±0.0248	
Rabiayah D	<0.001	<0.001	0.0043	<0.001	<0.001	<1	0.0013	1.4167	0.0028
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0014	±0.4701	
Snabis S	<0.001	<0.001	0.0077	<0.001	0.001	<1	0.0017	1.6267	0.0001
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0014	±0.1034	
Snabis D	<0.001	<0.001	0.0053	<0.001	<0.001	<1	0.0017	1.023	0.0030
	±0.0000	±0.0000	±0.0029	±0.0000	±0.0000	±0.0000	±0.0014	±0.3485	
Zor Forest S	<0.001	<0.001	0.0487	<0.001	<0.001	<1	0.0013	2.25	0.0119
	±0.0000	±0.0000	±0.0029	0	±0.0000	±0.0000	±0.0014	±0.0861	
Zor Forest D	<0.001	<0.001	0.011	<0.001	<0.001	<1	0.0013	1.5523	0.0047
	±0.0000	±0.0000	±0.0086	±0.0000	±0.0000	±0.0000	±0.0014	±0.0183	
Sfwa S	<0.001	<0.001	0.0047	0.002	<0.001	<1	0.0013	1.2973	0.0001
	±0.0000	±0.0000	±0.0029	±0.0000	±0.0000	±0.0000	±0.0014	±0.4386	
Sfwa D	<0.001	<0.001	0.004	<0.001	<0.001	<1	0.001	1.182	0.0022
	±0.0000	±0.0000	±0.0025	±0.0000	±0.0000	±0.0000	±0.0000	±0.1612	
RasTanurah S	<0.001	<0.001	0.003	<0.001	0.0267	<1	0.0013	1.2193	0.0004
	±0.0000	±0.0000	±0.0000	±0.0000	±0.0954	±0.0000	±0.0014	±0.3604	
RasTanurah D	<0.001	<0.001	0.0043	<0.001	<0.001	<1	0.0017	1.2903	0.0031
	±0.0000	±0.0000	±0.0014	±0.0000	±0.0000	±0.0000	±0.0029	±0.2486	
Total of Mean/Ion	<0.001	<0.001	0.193	<0.011	<0.145	<1	0.04	27.291	

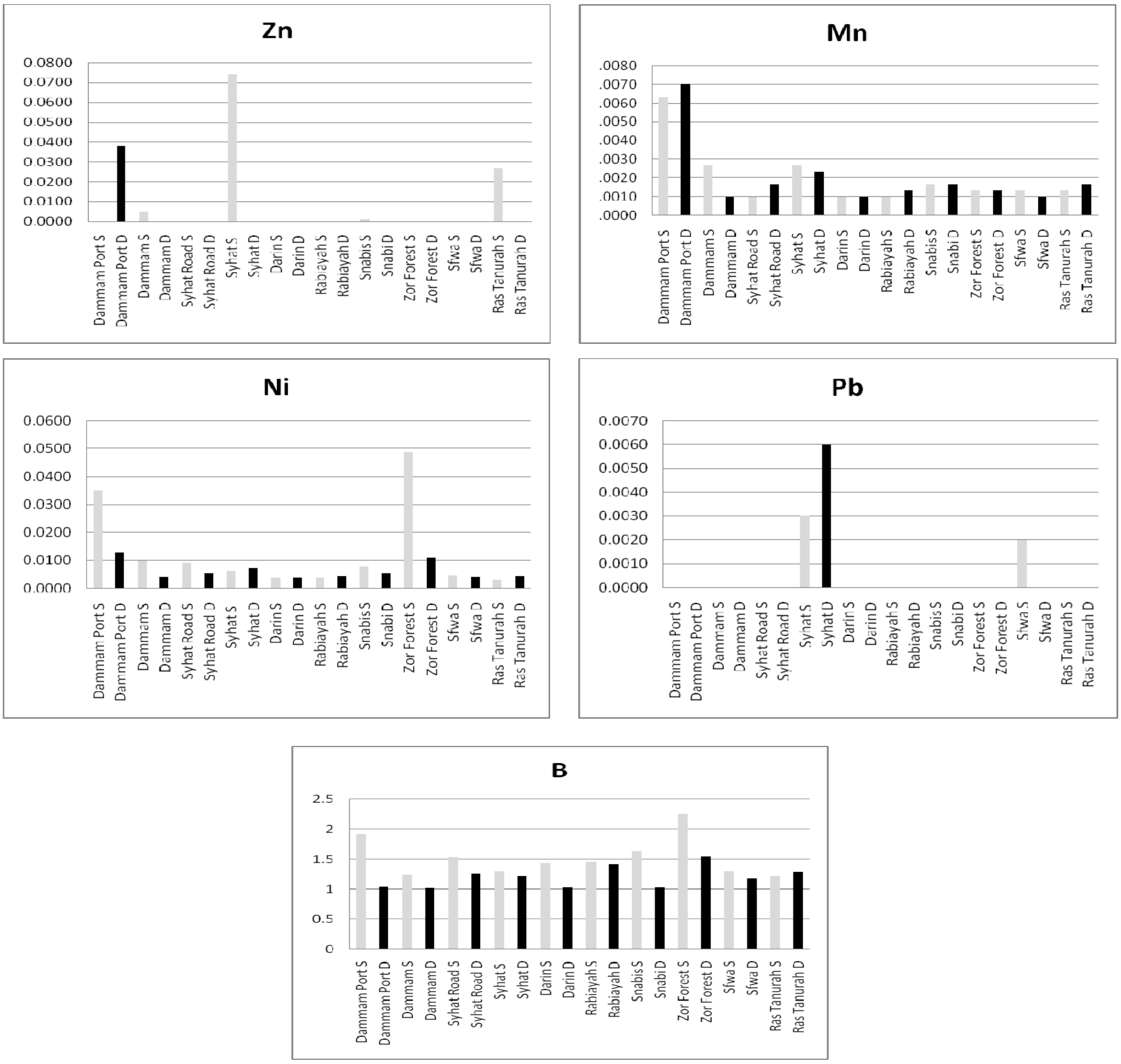

Figure 4. Heavy Metals In Soil (PPM)

The analysis of grey mangrove samples for heavy metals accumulation showed that Cu and Fe elements were present in highest concentrations in Ras Tanurah site, where a heavy metal concentration have reached to 22.67 ppm, while Cd was the least accumulated element in grey mangroves. An overall concentration of various elements from most abundant to least in plant samples were as follows: Cu→Fe→Mn→Zn→B→Ni→Pb→Cd. It was observed that Ras Tanurah was the most polluted site with maximum heavy metals presence, and the accumulation of heavy metals in plant samples of various sites decreased as follows: Ras Tanurah→Syhat Road →Snabis→Darin→Sfwa→Dammam→Zor Forest→Syhat→Dammam Port→Rabiayah (Table 4 & Figure 5).

Table 4. Variations in heavy metal contents (PPM) in *Avicennia marina*

City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Geometric
Dammam Port	0.001 ±0.0000	5.14 ±0.00	0.037 ±0.0366	0.0183 ±0.0072	0.4723 ±0.2214	5.67 ±11.74	0.377 ±0.1302	0.4143 ±0.1093	0.0012
Dammam	0.0013 ±0.0014	8.67 ±0.00	0.054 ±0.0474	0.0297 ±0.0288	0.475 ±0.2578	6.67 ±3.79	0.5373 ±0.1891	0.1957 ±0.0273	0.0025
Syhat Road	0.002 ±0.0025	10.07 ±0.00	0.0637 ±0.0829	0.019 ±0.0212	0.468 ±0.3493	14.33 ±18.81	0.631 ±0.3861	0.3753 ±0.4253	0.0062
Syhat	0.0013 ±0.0014	9.73 ±0.00	0.019 ±0.0151	0.0073 ±0.0038	0.2723 ±0.1333	2.33 ±1.43	0.251 ±0.0630	0.3567 ±0.2736	0.0003
Darin	0.001 ±0.0000	15.8 ±0.00	0.0233 ±0.0176	0.0083 ±0.0052	0.3037 ±0.1653	3.67 ±5.17	0.3393 ±0.3066	0.3393 ±0.2123	0.0006
Rabiayah	0.0017 0.0029	5.27 ±0.00	0.032 ±0.0197	0.01 ±0.0000	0.3557 ±0.3881	5 ±4.97	0.445 ±0.2644	0.3193 ±0.4038	0.0009
Snabis	0.001 ±0.0000	11 ±0.00	0.0497 ±0.0426	0.0137 ±0.0072	0.4093 ±0.3642	10.33 ±8.72	0.5103 ±0.3857	0.3207 ±0.1389	0.0023
Zor Forest	0.0013 ±0.0014	7.07 ±0.00	0.0427 ±0.0462	0.0127 ±0.0268	0.2013 ±0.2531	5.67 ±6.25	0.635 ±0.1893	0.3873 ±0.2212	0.0012
Sfwa	0.0013 ±0.0014	11.8 ±0.00	0.035 ±0.0215	0.0103 ±0.0057	0.35 ±0.2226	4.33 ±2.87	0.4573 ±0.5278	0.3647 ±0.1271	0.0012
RasTanurah	0.0017 ±0.0014	22.67 ±0.00	0.039 ±0.0263	0.0153 ±0.0143	0.314 ±0.2685	5 ±2.48	0.8993 ±0.2906	0.3363 ±0.0983	0.0033
Total	0.0137	107.22	0.3953	0.1447	3.6217	63	5.0827	3.4097	

Figure 5. Heavy Metals In Plant (PPM)

4. Discussion

Heavy metal pollution of the biosphere has hugely accelerated since the beginning of the industrial revolution (Nriagu, 1979). All over the world, industrialization and urbanization has accelerated the problem of heavy metal contamination. Heavy metals are metals with specific gravity greater than 5 g/cm^3 (Nies, 1999). Lead, mercury, arsenic, and cadmium ranked as first, second, third, and sixth hazards on the list from US Agency for Toxic Substances and Disease Registry (ATSDR) that lists all hazards present in toxic waste sites according to their prevalence and the severity of their toxicity. These days, the problem of heavy metal contamination is a matter of serious concern on a local, regional, and global scale (Rai, 2008). Plants absorb heavy metals through their roots, or even via their stems and leaves, and accumulate them in their tissues plus Plants take up elements selectively, which subsequently move through the biogeochemical cycle and are transported to the coastal waters (Ramos et al., 2006).

In this study, noticeable results of heavy metals accumulation in water samples showed that B element was abundant at all locations and usually elevated levels of B in surface waters often occur within the industrial and urban areas, while Cd element was rare in all ten locations (<0.001). Our current findings confirm the previous report of (Kar et al., 2008), which stated that a total of 96 surface water samples collected from Ganga river in West Bengal during 2004-05: Fe, Mn, Zn, Ni, Cr and Pb were detected in more than 92% of the samples. Another study observed that B concentration of the Seydi Stream in Turkey was much higher than the Turkish Environmental standard (Emiroglu et al., 2010).

In soil samples, higher contents of B were found, while Cd and Cu elements were present in negligible quantities (<0.001). Similarly, earlier studies showed that B content was much higher in soils of dry and semi-dry areas as compared to wet lands (Mengel & Kirkby, 1979). Chemical analysis of soil samples showed that lack of Cu can be expected in the basic and limestone soils and the soils usually scattered in dry and semi-dry regions, like those of Saudi Arabia (Modaihsh et al., 2005). On the other hand, lack of Cu, Fe, Mn and Zn in alkaline soils has been previously reported (Noggle & Fritz, 1976).

In plant samples, Cu element was abundant while Cd was the least accumulated element. Low contents of Cd may be due to its quite low and slow acropetal translocation in plants as reported by (Wolterbeek & Van, 2002). In grey mangrove, the accumulative partitioning of heavy metals demonstrated that under field conditions, the higher Cu and Pb elements were accumulated in root tissues as compared to the surrounding sediment levels. We observed that the mean heavy metal concentration in plant samples were significantly higher than water and soil samples. It clearly demonstrated the capacity of grey mangrove as a vital heavy metal accumulating plant. (Usman et al., 2013) also found out that A.marina of Farasan Island west Saudia Arabia can be a potential accumulator of Cu in aboveground parts (Usman et al., 2013). Also a Higher accumulation of Cu and Pb in roots and leaves of *Sonneratia caseolar* showed that this plant can be used as potential phytoremediation species for selected heavy metals in Malaysian mangrove ecosystem (MacFarine et al., 2003; Nazli & Hashim, 2010). Previous studies showed that mangrove stands have been widely used as bio-indicators for different types of environmental pollutants including heavy metals, organic pollutants and hydrocarbons It was reported that heavy metal concentrations in leaves of grey mangrove was higher than the bioavailable fraction of metals present in sediments (Sadooni & El-Kassas, 1999).

5. Conclusion

Current study showed that grey mangroves absorbed higher quantities of heavy metals from their surroundings, which demonstrate the importance of these plants in cleaning the coastal environments from pollutants. It is thus recommended that grey mangroves vegetation must be prevented from further decay by checking various factors which has caused deforestation of these valuable assets. Also to do more experiments by adding some fertilizers to it and check the possibility of increasing the populations because if deterioration of grey mangroves continues, it will result in the destruction of local ecosystem, erosion of the Tarut Bay, and the coast may become an environmental mess.

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