Heavy Metals Accumulation In Water, Soil and Mangrove Plant On Tarut Bay In the Eastern Province Of Saudi Arabia

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Abstract: **Problem Statement**: Mangrove forests are one of the most important ecosystems which lie between the land and sea in the latitude of the tropical and subtropical areas but these plants are suffering from a lot of threats. Especially it's exposed to many environmental pressures. **Approach**: In this paper mangroves community on Tarut Bay in the Eastern Province of Saudi Arabia were studied because there is no such study in this area and to find from the results the importance of Mangrove as a phytoremediation plant. The study collected many samples from water, soil and plant as (*Avicennia marina*) at ten different locations in Tarut Bay in December 2010. Then eight heavy metals (B, Fe, Mn, Zn, Pb, Ni, Cd and Cu) were estimated. **Results**: the results in water samples showed that the B rule and Cd lack while soil samples showed the rule of B and lack of Cd and Cu, and the results of plant samples showed the rule of the Cu and lack of Cd. For the comparisons between heavy metals in water, soil and plant, the results showed that heavy metals in plants tissues were higher than soil and water as an evidence that Mangrove plant extract heavy metals, except Pb and B. the mean concentration of metals in plants gradually as: Cu $\longrightarrow$ Fe $\longrightarrow$ Mn $\longrightarrow$ Zn $\longrightarrow$ B $\longrightarrow$ Ni $\longrightarrow$ Pb $\longrightarrow$ Cd. **Conclusion/Recommendation**: The present results demonstrated that *Avicennia marina* is significant as vegetation filter by phytoextraction mechanism and the need to use it to clean the environment.

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1. Introduction

The Eastern Province is the largest geographical area in the Kingdom of Saudi Arabia which includes 86% from the industrial factories and since the discovery of oil this area did not stop progressing (Alayaf, 1993). The pollution of this area increased dramatically due to the industrial revolution, the main sources of this pollution are fossil fuel burning, oil industries, mining and smelting of metalliferous ores, municipal wastes, landfill leachates, fertilizers, pesticides and sewage (Al-Khateeb and Leilah, 2005). The pollution of the environment by our industrial, economic or social activities is one of the most important global problems nowadays (Kamal et *al*., 2004). Due to their toxic effects the contamination of Heavy Metals (HM) in the environment is consequently a major global concern which has provoked the emergence of phytoremediation technologies for cleaning soils (Baker *et al*., 1994; Salt *et al*., 1998; Terry and Banuelos, 2000) aqueous streams (Dushenkov *et al.,* 1995); mine wastes and sewage (Ait *et al*, 2004; Von and Max, 1984; Xingmao and Havelka, 2009) by the use of About 400 plant species which have been reported to accumulate toxic heavy metals.

Phytoremediation means deplete contaminated soils, water from contaminants with plants able to absorb, degrade or eliminate metals, pesticides, solvents, explosives, crude oil and its derivatives and various other contaminants from the media that contain them. It is clean, efficient, inexpensive and non-environmentally disruptive.

In the Gulf, oil and chemicals entering the marine environment from various sources such as the continued discharge and oil spills (Literathy *et al*, 2002). For example The Gulf War of 1991 brought serious environmental damage to the region. The world's largest oil spill, estimated at as much as 8 million barrels (Metz, 1993). Most of the polluted shores of the Eastern Province of Saudi Arabia in addition to the coasts to the borders of Kuwait saturated with crude oil during the Gulf War and many researches described the impact of oil spills in the Gulf War: (Gundlach *et al*, 1993; Tawfiq and Olsen, 1993; Jacob and Al-Muzaini, 1995; Hashim *et al*, 1995; GESAMP, 2007; Hashem, 2007; Bejarano and Michel, 2010; Danish, 2010).

In this paper mangrove communities on Tarut Bay in the Eastern Province of Saudi Arabia were studied. Tarut Bay is characterized by its heavy production, (Czudek, 2006) described it as the most important site on the Saudi Arabian Gulf Coast for wintering and migrating waders and other water birds, with a total of 58,000 water birds. But the ecosystem

of Tarut Bay is exposed to many environmental pressures and several factors threaten mangrove forests, human actions, including fishing ports and dams, invasion of sand dunes, camels grazing on mangrove leaves (Parvaresh, 2011), heavy metals (Agoramoorthy *et al*, 2008) and sewage (Tam and Wong, 1997). If the pollution and Urban utilization continues will lead to erosion of the Bay and near in the future will be burden on the environment and not the source of the wealth of fish and the most important site for the passage of winter birds in the Saudi sector on the coast of Arabian Gulf.

The magnificent rule of this tree to clean the environment been described by (Mac Farlane and Burchett, 2002; Mac Farine *et al*, 2003; Suresh and Ravishankar, 2004; Mac Farlane *et al,* 2007 and Isaiah *et al*, 2011). Also many reports referred to the use of some plants in phytoremediation e.g.: *Phragmites*, *Tamarix*, tobacco, sunflower, cordgrass, *Salix*, *Typha*, *Arabis gemmifera* and *Thlaspi caerulescens* (Kubota and Takenaka, 2003; Zhao *et al,* 2003; Adler, 2007; Manousaki *et al*, 2007 and Al-Taisan, 2009).

Mangrove tree *Avicennia marina* (Forssk) Vierh. Occurring in Arabian Gulf This species is tolerant of relatively high salinity together with low rainfall and temperature conditions (Loughland and Al-abdulkader, 2011), a family Avicennaceae plant-based wooden evergreen shrub or small, and often with a thick fluff flour, 3-1 meters high. Leaves stiff leathery, ovate to elliptic-oblong, dark–green glabrous on the upper side, Flowers orange-waxy, in short pedunculate, terminal and axillary, capitate cymes, with many of the salt crystals. Bract and bracteoles, a yellow corolla longer than the cup (Chaudhary and Al-Juwaid, 2001). The advantage of mangrove trees from other plants with distinguishing features such as aerial roots and seeds germinate on the tree.

The aim of study is to measure the pollution in Tarut Bay by examining the accumulation of heavy metals in water, soil and plant for mangroves community on Tarut Bay in the Eastern Province of Saudi Arabia because there is no such study in this area and to find from the results the importance of Mangrove tress as a phytoremediation plants specially caused the area is exposed to many environmental pressures.

2. Material and Methods

This study was carried on Tarut Bay in the Eastern Province of Saudi Arabia, were mangrove communities presence most concentrated. This Bay extends from the northern coast of the city of Dammam and ends at Ras Tanura area of 41 thousand hectares, the equivalent of 410 k^2 (Scott, 1995) Figure (1).

After many field trips in Tarut Bay in order to identify the area and to identify the whereabouts of mangrove accurately based on the map of the General Directorate of Military Survey (2001) Number (NG39-6), Figure (2) and using the latest mobile GPS, (Garmin nuvi 205W) I was able to locate the GPS points of the study locations Table (1).

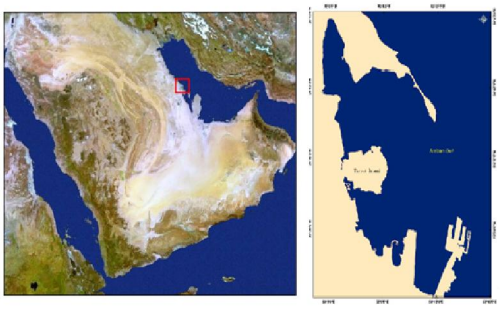


Figure 1 –left. Satellite image showing the Tarut Bay under the study (picture from King Abdul-Aziz City for Science and Technology).

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: Ras Tanurah	N 26°44.767' E049°59.615'

Figure 1 – Right. Detailed map to the location of the study (picture from King Abdul-Aziz City for Science and Technology Modified by the Researcher).

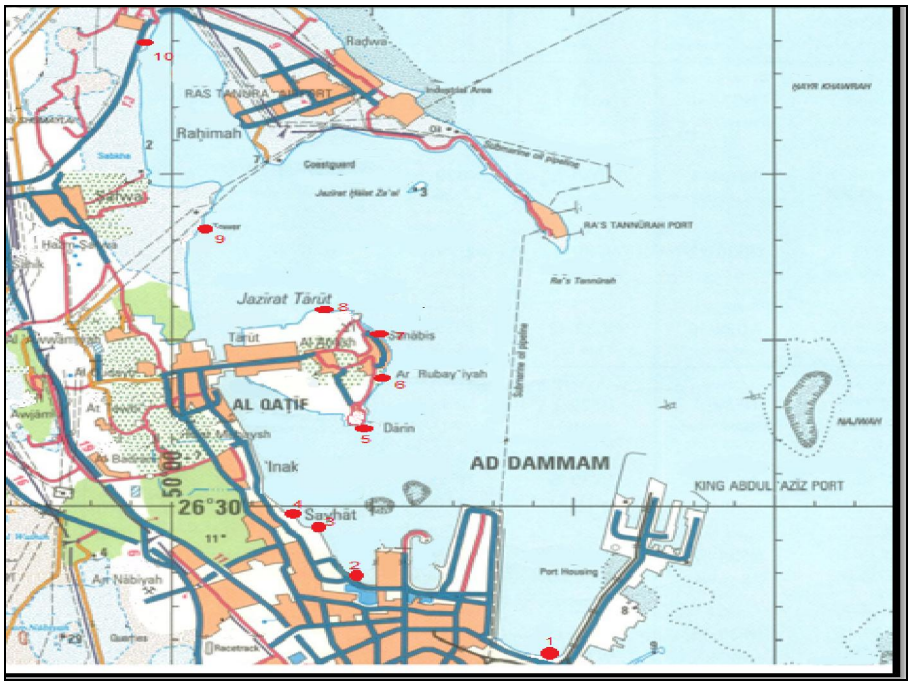


Figure 2 – Map of the General Directorate of Military Survey (Modified by the Researcher).

The ten located sites where Mangrove trees live as a community are (Dammam Port, Dammam, Syhat Road, Syhat, Darin, Rabiayah, Snabis, Zor Forest, Sfwa, Ras Tanurah). All of them contain the same type of mangrove species (Shoura, *Avicennia marina*). Samples were collected from water, soil and plant to evaluate the concentrations of eight heavy metals (B, Fe, Mn, Zn, Pb, Ni, Cd and Cu)**.**

The collection Journey started in the end of December 2010 (Winter season), Water samples collection been done in all location by (Reeve, 2002) method (three samples) each in 250ml polyethylene containers and acidify the sample to prevent adsorption of metals on the sides of the container, then heavy metals been analyzed in the same day with (inductively coupled plasma – optical emission spectroscopy) and determined in PPM by (Clesceri *et al*, 1998) soil samples collection been done in surface soil and 30 cm deep soil (three samples) in all locations then 1:5 soil to water extraction method used by (Kalra *et al,* 1991) later the heavy metals determined in PPM by the method of (Jones, 2001) in (Inductively Coupled Plasma – Mass Spectrometer).

Three samples of the investigated tree plant was collected randomly from all location in the same period of time then dried in electrical oven later Dry ashing been used cause it is simple, non-hazardous and less expensive, compared with wet digestion (Ryan *et al,* 2007), Then plant extraction for heavy metals determined in PPM by the Method of (A.O.A.C, 1998) In (Inductively Coupled Plasma – Mass Spectrometer).

Statistical analysis

All statistical analyses were performed using the software developed by the SPSS (ver. 15), (SPSS Inc., Chicago, IL) packages.

3. Results

Heavy metals results in **Water Samples** prove that boron prevails in all locations and Cd element ceased to exist as (<0.001), Table (2), Figure (3). Concentration of Pb and Mn in the water ranged from 0.101-0.033 and 0.027-0.013 ppm, respectively. Accordingly the elements are:

B → Pb → Fe → Mn → Zn → Cu → Ni → Cd.

The site of Ras Tanura registered the highest level in the total heavy metals (0.76 PPM) while the lowest levels were found in Syhat Road, Zor Forest and Dammam, which point out that the accumulation of heavy metals decreased into: Ras Tanurah → Rabiayah → Darin → Sfwa → Dam mam Port → Syhat → Snabis → Syhat Road → Zor Forest → Dammam.

Heavy metals results in **Soil samples** showed the rule of B element where a higher concentration has reached 2.250 ppm per surface layer of Zor Forest, while recorded lower concentration of 1.020 ppm on the deep layer of soil site Dammam and lack of Cd and Cu elements (<0.001) Table (3), Figure (4) and the eight elements gradually as the following:

B → Fe → Ni → Zn → Mn → Pb → Cd = Cu

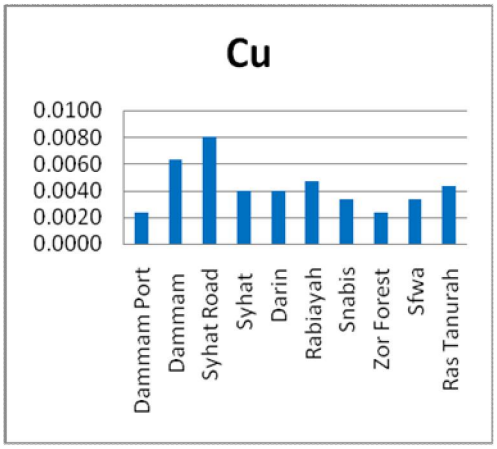
However, the mean of total concentrations in the accumulation of heavy metals in Surface Soil of all sites decreases as the following: Zor Forest → Dammam Port → Snabis → SyhatRoad → Rabiayah → Darin → Syhat → Dammam → Ras Tanurah.

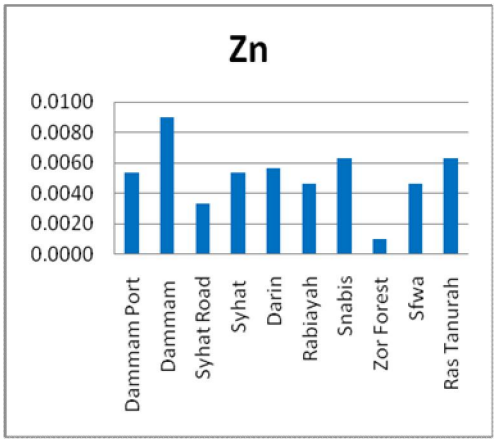
And the mean of total concentrations in the accumulation of heavy metals in Deep Soil of all sites decreases as the following: Zor Forest → Rabiayah → Ras Tanurah → Syhat Road → Syhat → Sfwa → Dammam Port → Snabis → Darin → Dammam.

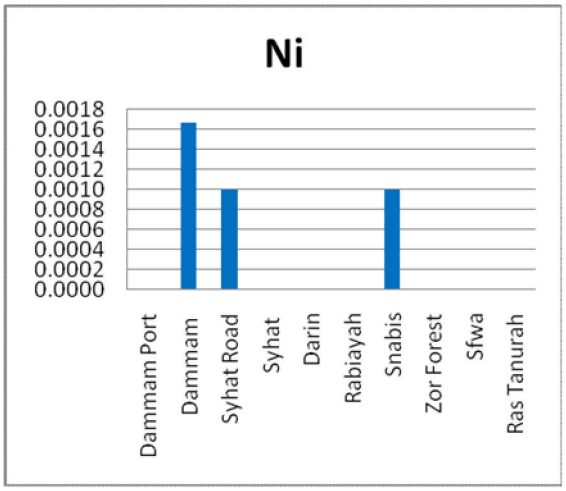
The results of the analysis of heavy metals **in Plant samples** showed the rule of the Cu element in Ras Tanurah sites where a higher concentration has reached 22.67 ppm, while Cd was the lowest element accumulated in Mangrove Plant samples 0.001 ppm (Table 4) Figure (5) and the eight elements gradually as the following: Cu → Fe → Mn → Zn → B → Ni → Pb → Cd, and Found out that Ras Tanurah site is the most polluted site with heavy metals and that the accumulation of heavy metals in Plant of all sites decreases as the following: Ras Tanurah → Syhat Road → Snabis → Darin → Sfwa → Dammam → Zor Forest → Syhat → Dammam Port → Rabiayah.

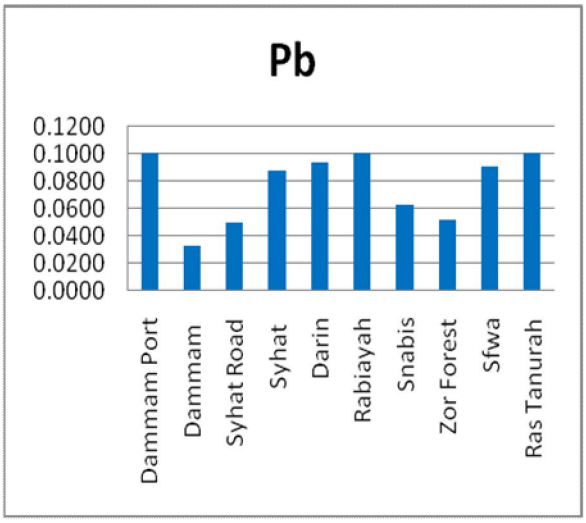
Table (2): Variations in heavy metal contents (PPM) in Water at ten Sites in the study area.

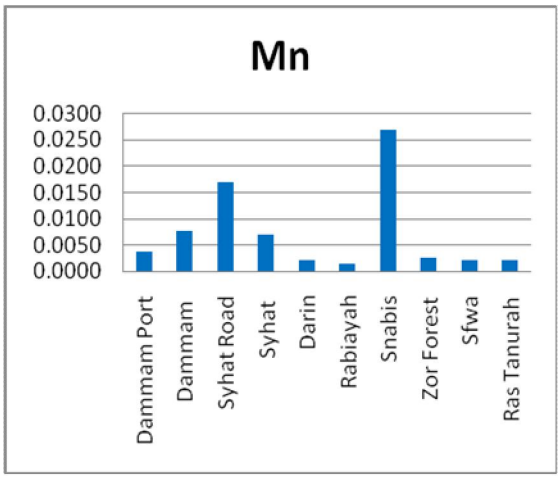
City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Total of Mean/City
Dammam Port	<0.001 ± 0.0000	0.0023 ± 0.0014	<0.001 ± 0.0000	0.1007 ± 0.0052	0.0053 ± 0.0063	0.0340 ± 0.0371	0.0037 ± 0.0052	0.7030 ± 0.1203	<0.849
Dammam	<0.001 ± 0.0000	0.0063 ± 0.0038	0.0017 ± 0.0014	0.0330 ± 0.0329	0.0090 ± 0.0174	0.0157 ± 0.0207	0.0077 ± 0.0076	0.1900 ± 0.0878	<0.263
Syhat Road	<0.001 ± 0.0000	0.0080 ± 0.0090	0.0010 ± 0.0000	0.0500 ± 0.0086	0.0033 ± 0.0057	0.0443 ± 0.0509	0.0170 ± 0.0086	0.3030 ± 0.1818	<0.427
Syhat	<0.001 ± 0.0000	0.0040 ± 0.0043	<0.001 ± 0.0000	0.0880 ± 0.0155	0.0053 ± 0.0029	0.0777 ± 0.1707	0.0070 ± 0.0194	0.6273 ± 0.0382	<0.809
Darin	<0.001 ± 0.0000	0.0040 ± 0.0025	<0.001 ± 0.0000	0.0940 ± 0.0197	0.0057 ± 0.0029	0.1017 ± 0.2584	0.0020 ± 0.0025	0.6723 ± 0.0488	<0.880
Rabiayah	<0.001 ± 0.0000	0.0047 ± 0.0029	<0.001 ± 0.0000	0.1007 ± 0.0080	0.0047 ± 0.0029	0.0867 ± 0.2080	0.0013 ± 0.0029	0.7233 ± 0.1174	<0.921
Snabis	<0.001 ± 0.0000	0.0033 ± 0.0029	0.0010 ± 0.0000	0.0633 ± 0.0396	0.0063 ± 0.0125	0.1163 ± 0.3618	0.0270 ± 0.0172	0.5763 ± 0.1329	<0.794
Zor Forest	<0.001 ± 0.0000	0.0023 ± 0.0014	<0.001 ± 0.0000	0.0523 ± 0.0150	0.0010 ± 0.0000	0.0567 ± 0.1837	0.0027 ± 0.0029	0.2997 ± 0.0160	<0.415
Sfwa	<0.001 ± 0.0000	0.0033 ± 0.0014	<0.001 ± 0.0000	0.0907 ± 0.0201	0.0047 ± 0.0029	0.0700 ± 0.0386	0.0020 ± 0.0000	0.6813 ± 0.0845	<0.852
RasTanurah	<0.001 ± 0.0000	0.0043 ± 0.0029	<0.001 ± 0.0000	0.1010 ± 0.0282	0.0063 ± 0.0029	0.1433 ± 0.0117	0.0020 ± 0.0000	0.7610 ± 0.1323	<1.018
Total of Mean/Ion	<0.001	0.0427	0.0037	0.7737	0.0517	0.7463	0.0723	5.5373	<7.224











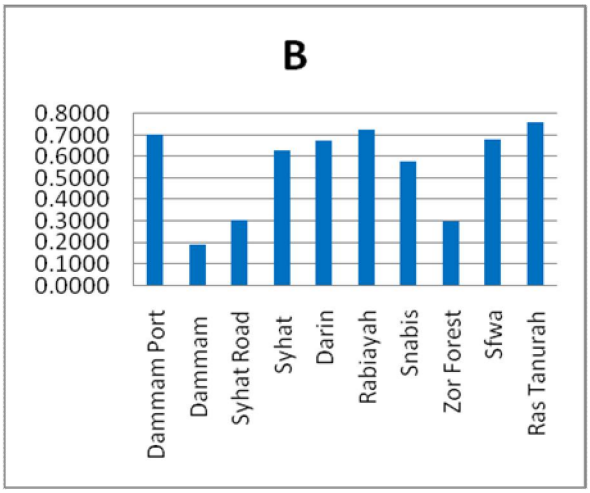


Figure (3): Heavy Metals In Water.

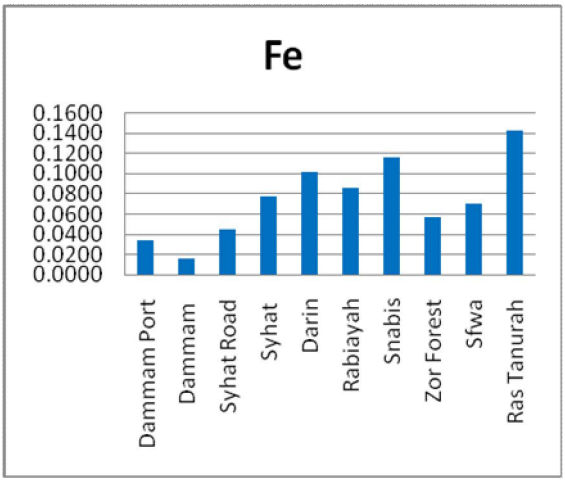
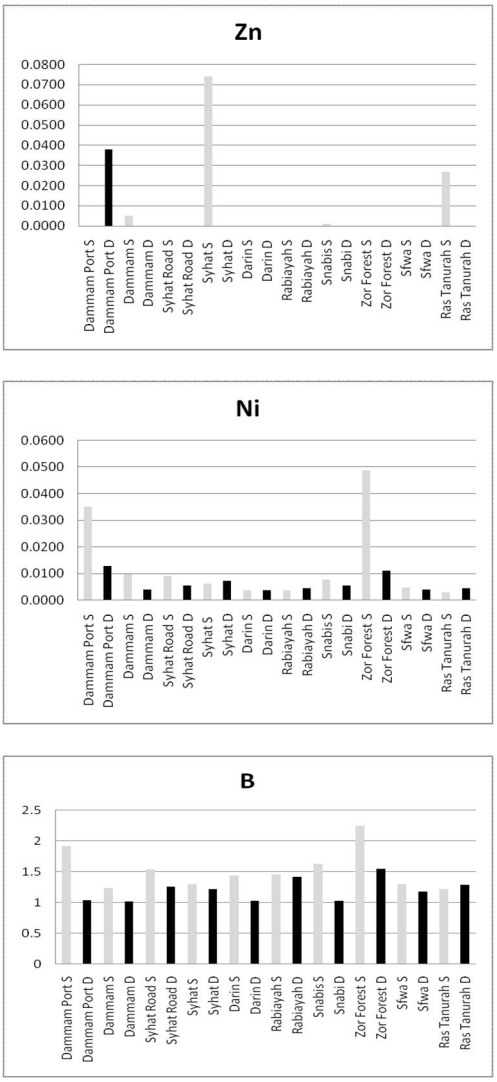
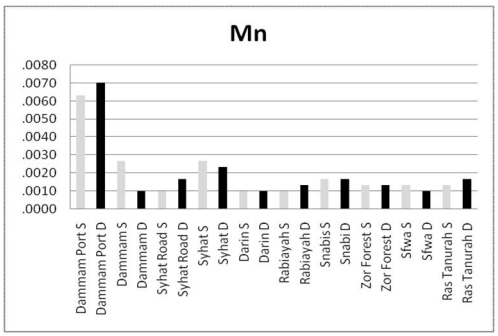


Table (3): Variations in heavy metal contents in PPM Soil Surface S: Depth, D.

City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Total of Mean/city
Dammam Port S	<0.001 ±0.0000	<0.001 ±0.0000	0.0350 ±0.0025	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0063 ±0.0087	1.9200 ±0.2687	<1.961
Dammam Port D	<0.001 ±0.0000	<0.001 ±0.0000	0.0127 ±0.0117	<0.001 ±0.0000	0.0380 ±0.0752	<1 ±0.0000	0.0070 ±0.0066	1.0417 ±0.0808	<1.099
Dammam S	<0.001 ±0.0000	<0.001 ±0.0000	0.0097 ±0.0038	<0.001 ±0.0000	0.0050 ±0.0000	<1 ±0.0000	0.0027 ±0.0029	1.2337 ±0.4829	<1.251
Dammam D	<0.001 ±0.0000	<0.001 ±0.0000	0.0040 ±0.0025	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.0203 ±0.0236	<1.025
Syhat Road S	<0.001 ±0.0000	<0.001 ±0.0000	0.0090 ±0.0043	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.5360 ±0.1615	<1.546
Syhat Road D	<0.001 ±0.0000	<0.001 ±0.0000	0.0053 ±0.0029	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0017 ±0.0029	1.2527 ±0.4711	<1.260
Syhat S	<0.001 ±0.0000	<0.001 ±0.0000	0.0063 ±0.0052	0.0030 ±0.0000	0.0740 ±0.0248	<1 ±0.0000	0.0027 ±0.0029	1.2917 ±0.3652	<1.378
Syhat D	<0.001 ±0.0000	<0.001 ±0.0000	0.0073 ±0.0143	0.0060 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0023 ±0.0038	1.2183 ±0.1686	<1.234
Darin S	<0.001 ±0.0000	<0.001 ±0.0000	0.0037 ±0.0014	<0.001 ±0.0000	0.0010 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.4363 ±0.5234	<1.442
Darin D	<0.001 ±0.0000	<0.001 ±0.0000	0.0037 ±0.0014	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.0223 ±0.1941	<1.027
Rabiayah S	<0.001 ±0.0000	<0.001 ±0.0000	0.0037 ±0.0014	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.4600 ±0.0248	<1.465
Rabiayah D	<0.001 ±0.0000	<0.001 ±0.0000	0.0043 ±0.0014	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0013 ±0.0014	1.4167 ±0.4701	<1.422
Snabis S	<0.001 ±0.0000	<0.001 ±0.0000	0.0077 ±0.0014	<0.001 ±0.0000	0.0010 ±0.0000	<1 ±0.0000	0.0017 ±0.0014	1.6267 ±0.1034	<1.637
Snabis D	<0.001 ±0.0000	<0.001 ±0.0000	0.0053 ±0.0029	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0017 ±0.0014	1.0230 ±0.3485	<1.030
Zor Forest S	<0.001 ±0.0000	<0.001 ±0.0000	0.0487 ±0.0029	<0.001 0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0013 ±0.0014	2.2500 ±0.0861	<2.300
Zor Forest D	<0.001 ±0.0000	<0.001 ±0.0000	0.0110 ±0.0086	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0013 ±0.0014	1.5523 ±0.0183	<1.565
Sfwa S	<0.001 ±0.0000	<0.001 ±0.0000	0.0047 ±0.0029	0.0020 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0013 ±0.0014	1.2973 ±0.4386	<1.305
Sfwa D	<0.001 ±0.0000	<0.001 ±0.0000	0.0040 ±0.0025	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0010 ±0.0000	1.1820 ±0.1612	<1.187
RasTanurah S	<0.001 ±0.0000	<0.001 ±0.0000	0.0030 ±0.0000	<0.001 ±0.0000	0.0267 ±0.0954	<1 ±0.0000	0.0013 ±0.0014	1.2193 ±0.3604	<1.250
RasTanurah D	<0.001 ±0.0000	<0.001 ±0.0000	0.0043 ±0.0014	<0.001 ±0.0000	<0.001 ±0.0000	<1 ±0.0000	0.0017 ±0.0029	1.2903 ±0.2486	<1.296
Total of Mean/Ion	<0.001	<0.001	0.193	<0.011	<0.145	<1	0.040	27.291	<27.681





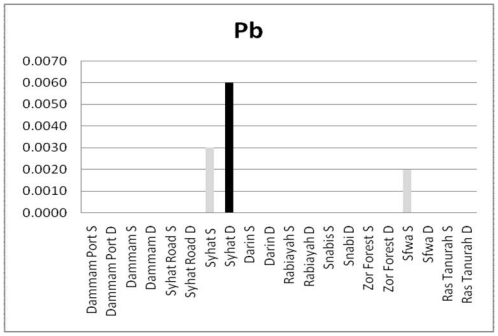
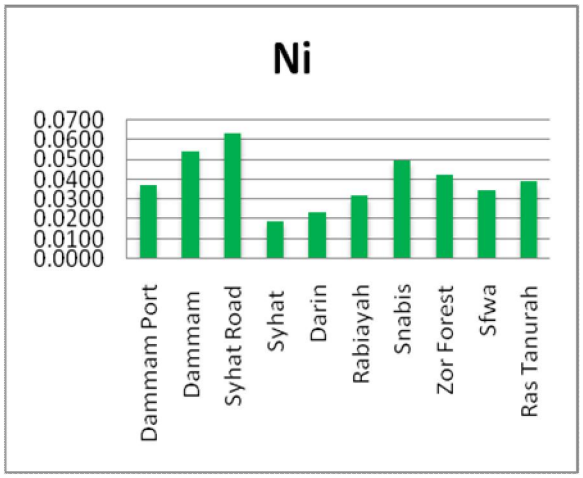
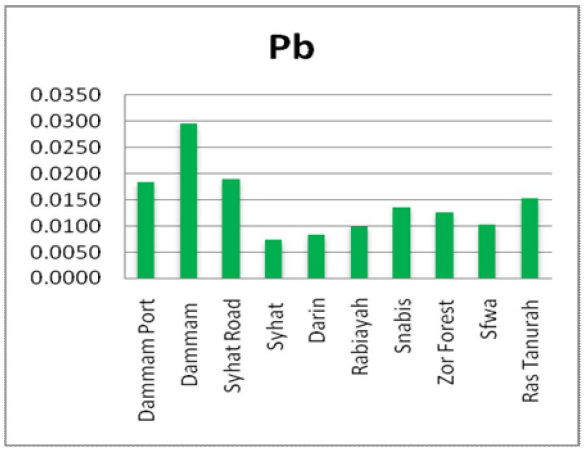


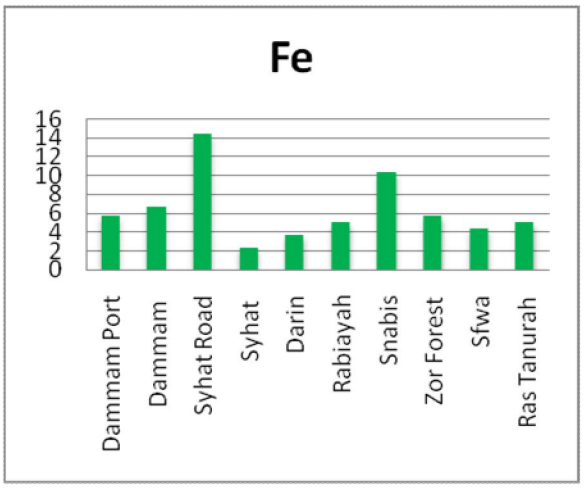
Figure (4): Heavy Metals In Soil.

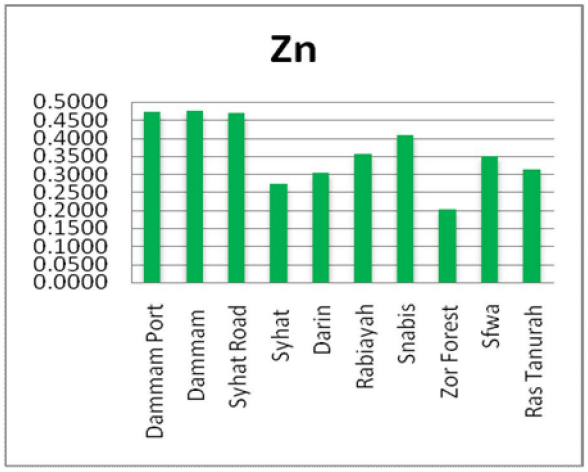
Table (4): Variations in heavy metal contents (PPM) in *Avicennia marina*.

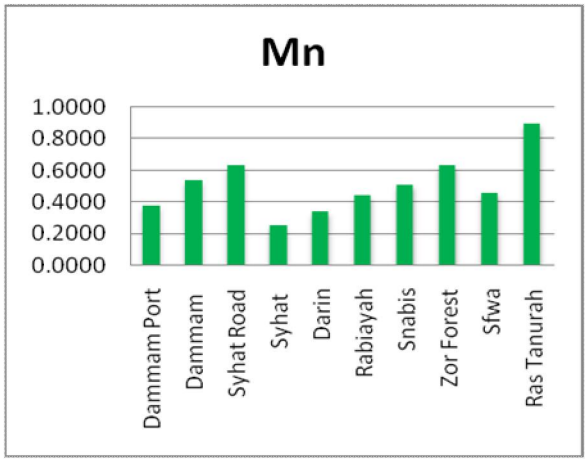
City	Cd	Cu	Ni	Pb	Zn	Fe	Mn	B	Total
Dammam Port	0.0010 ±0.0000	5.14 ±0.00	0.0370 ±0.0366	0.0183 ±0.0072	0.4723 ±0.2214	5.67 ±11.74	0.3770 ±0.1302	0.4143 ±0.1093	12.1267
Dammam	0.0013 ±0.0014	8.67 ±0.00	0.0540 ±0.0474	0.0297 ±0.0288	0.4750 ±0.2578	6.67 ±3.79	0.5373 ±0.1891	0.1957 ±0.0273	16.6297
Syhat Road	0.0020 ±0.0025	10.07 ±0.00	0.0637 ±0.0829	0.0190 ±0.0212	0.4680 ±0.3493	14.33 ±18.81	0.6310 ±0.3861	0.3753 ±0.4253	25.9623
Syhat	0.0013 ±0.0014	9.73 ±0.00	0.0190 ±0.0151	0.0073 ±0.0038	0.2723 ±0.1333	2.33 ±1.43	0.2510 ±0.0630	0.3567 ±0.2736	12.9710
Darin	0.0010 ±0.0000	15.80 ±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	20.4817
Rabiayah	0.0017 0.0029	5.27 ±0.00	0.0320 ±0.0197	0.0100 ±0.0000	0.3557 ±0.3881	5.00 ±4.97	0.4450 ±0.2644	0.3193 ±0.4038	11.4337
Snabis	0.0010 ±0.0000	11.00 ±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	22.6380
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	0.6350 ±0.1893	0.3873 ±0.2212	14.0170
Sfwa	0.0013 ±0.0014	11.80 ±0.00	0.0350 ±0.0215	0.0103 ±0.0057	0.3500 ±0.2226	4.33 ±2.87	0.4573 ±0.5278	0.3647 ±0.1271	17.3520
RasTanurah	0.0017 ±0.0014	22.67 ±0.00	0.0390 ±0.0263	0.0153 ±0.0143	0.3140 ±0.2685	5.00 ±2.48	0.8993 ±0.2906	0.3363 ±0.0983	29.2757
Total	0.0137	107.2200	0.3953	0.1447	3.6217	63.00	5.0827	3.4097	182.8877











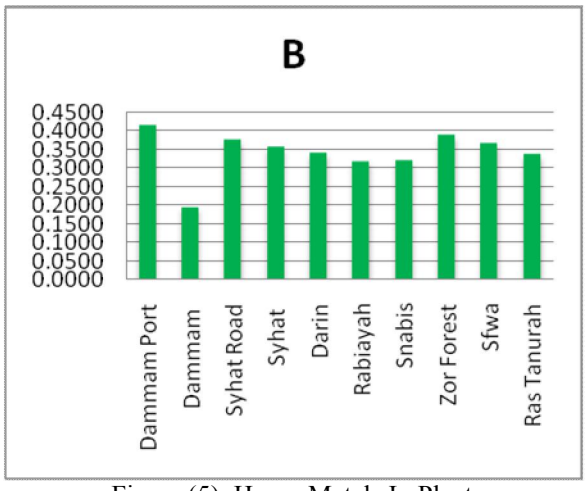


Figure (5): Heavy Metals In Plant.

4. Discussions

In this study, noticeable results of heavy metals in water samples showed that the B element rule in all locations and usually elevated levels of B in surface waters often occur within industrial and urban areas,

and Cd element lack also in all ten locations (<0.001) and our results is similar to what (Kar *et al*, 2008) found 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. Despite the findings of (Parvaresh *et al*., 2010) of higher concentrations of Pb in sediments than our findings, whereas Cd and Cu were detected only in 20 and 36 samples (0.001-0.003 and 0.003-0.032 mg/L), also in Turkey results have shown that B concentrations of the Seydi Stream water is higher than the Turkish Environmental Guidelines standard (Emiroglu *et al*, 2010).

Ras Tanura site consider as the highest site in the total of heavy metals and the lowest levels found in the sites: Syhat Road, Zor Forest and Dammam.

Heavy metals results in soil samples showed the rule of B element, and lack of Cd and Cu elements (<0.001) and the eight elements gradually as the following: B ⟶ Fe ⟶ Ni ⟶ Zn ⟶ Mn ⟶ Pb ⟶ Cd = Cu) thus heavy metals in surface soil decreases as: Zor Forest ⟶ Dammam Port ⟶ Snabis ⟶ Syhat Road ⟶ Rabiayah ⟶ Darin⟶ Syhat⟶ Sfwa⟶ Dammam⟶ R as Tanurah, while Heavy Metals in deep layer decreases as: Zor Forest ⟶ Rabiayah ⟶ Ras Tanurah ⟶ Syhat Road⟶ Syhat⟶ Sfwa⟶ DammamPort⟶ Sna bis⟶ Darin⟶ Dammam.

B content in soils of Dry and semi-dry areas much higher than the wet areas (Mengel and Kirkby, 1979), chemical studies in soil showed the lack of Cu can be expected in the basal and limestone soils and soils that are usually scattered in dry and semi-dry, as is the case in Saudi Arabia (Modaihsh *et al*, 2005) also the lack of Cu iron, manganese and Zn in alkaline soils described by (Noggle and Fritz, 1976).

And the results of the analysis of heavy metals in Plant samples showed the rule of the Cu element, while Cd was the lowest element accumulated in Mangrove. In a study of the submerged species *Potamogaton pectinatus* high translocation of Cd in both directions been reported by (Greger, 1999), while (Wolterbeek and Van, 2002) reported quite low, slowly acropetal translocation of Cd. Results found out that Ras Tanurah site is the most polluted site with heavy metals and that the accumulation of heavy metals in Plant of all other sites decreases. The accumulative partitioning of the heavy metals the grey mangrove, *Avicennia marina* were studied under field conditions, Cu and Pb were accumulated in root tissue to levels higher than surrounding sediment levels, For all the selected heavy metals the mean concentrations in plant *A. marina* were significantly higher than from water and soil. *A. marina* roots may be employed as a biological indicator of environmental. Exposure of Cu, Pb and Zn and leaves for Zn, with temporal monitoring (MacFarine *et al,* 2003) also (Nazli and Hashim,2010) found that the total concentrations of Cu and Pb in both the roots and leaves of *Sonneratia caseolar* is exceeded the general normal upper range in plants. This study has therefore shown the potential of *Sonneratia caseolaris* as a phytoremediation species for selected heavy metals in Malaysian mangrove ecosystem. For the comparisons between heavy metals in water, soil and plant, the Results showed that heavy metals increased in plants as evidence that Mangrove plant extract heavy metals, except Pb elements recorded his highest levels in water and B element recorded his highest levels in the soil. Studies showed that Mangrove stand components have been used widely as bioindicators for different types of environmental pollution including heavy metals, organic pollutants and hydrocarbons. Such as herbicides concentrate in leaves, pneumatophores (aerial roots) and bark of the stems and branches. (Sadooni and El-Kassas, 1999), The concentration and bioavailability of sediments and leaves of grey mangrove, *A. marina*, were studied in Iran, heavy metal concentrations in leaves were higher than the bioavailable fraction of metals in sediments (Parvaresh *et al*, 2011) measurements of trace metals in sea water of Kuwait indicate the presence of high levels of Pb in the northern sector (Fowler, 2002). Plants can take up heavy metals by their roots, or even via their stems and leaves, and accumulate them in their organs. Plants take up elements selectively, they subsequently move through the organic matter cycle and are transported by tidal current to the coastal waters (Ramos *et al.*, 2006). Accumulation and distribution of heavy metals in the plant depends on the plant species and element (Cheng, 2003) and **(**Singh *et al*., 2012**)**.

Conclusion:

Phytoremediation, which makes use of vegetation to remove, detoxify, or stabilize persistent pollutants, is a green and environmentally-friendly tool for cleaning polluted soil and water. That's why it is highly recommended to keep mangrove protected to remediate heavy metals from the environment.

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