Study of the rate of organic oil pollutants (PAHS) and heavy metals (V, Ni, Hg) in the four regions, Siri, Lavan, Khark and Bahregan in the Persian Gulf

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ABSTRACT: Pollution of marine waters is one of the important issues that has a irreparable effects. Also, in the organic oil pollutants, due to inappropriate effects on the environment and humans health and ability to create cancer, hydro carbons of polycyclic (PAHS) and heavy metals (Ni,Hg,V) have a particular importance. According to the importance of study of the environ mental contaminants in the four operational regions Siri , Lavan ,Khark and heavy metals (Ni,V,Hg) in the water and sediments was performed in two stage that was for sampling from receptive environment pollution. The sampling was accomplished with VAN VEEN GRAB device. Results are showed that concentration of the oil pollutants and heavy metals generally are dropped in the water and increased in the sediments.

Keywords: *Marine water; Pollution; PAHS; Heavy Metals; Sediments*

INTRODUCTION

Study and investigation about (PAHs) late aromatic hydro carbons is an important part of the investigations about environmental quality in the aqueous environments that can determine the pollution status and effects of these com pounds on the ecosystem. (Maskaoui *et al.,* 2002; Fernandes *et al.,* 1997). In the organic pollutants that enter to the coastal waters, they allocated the greats concern due to owning (PAHs) late aromatic hydro carbons, carcinogenic and mutagenic properties and sustainability of marine ecosystem to themselves. (PAHs) late hydrocarbons, carcinogenic and mutagenic properties and sustainability of marine ecosystem to themselves (Sari, 1377). latehydrocarbons are lipophilic organic compounds that are formed from two or more benzene rings fused together ,they mainly enter in the environment through the humans activities(Mcgroddy and Farrington, 1995). PAHs are the specific group of chemical compounds,dissolve in the water a little, they are very lipophilic and have an extreme desire to attract and bind to colloidal particles suspended in the water column, deposit in the marine sediments(Tam *et al.,* 2001). (PAHs) late ploy aromatic compounds identified by the agency protection Ezra have 16

PAHscompounds (Tolosa *et al.,* 2005), are introduced as a pioneer pollutant. Various factors, including discharge of industrial waste water and municipal, pour of oil, burning of fossil fuels, forest first volcanic eruption, automobile exhaust, non-point sources such as urban runoff and atmospheric deposition are entered into the aquatic environments (Simoneit *et al.,* 2002; Neff, 1979; Peterson *et al.,* 1997). In some PAHs, some other compounds are used as indicators that are named PAHs molecular ratio and they are employed as a determinant for importer sources of PAHs compounds (Magi *et al.,* 2002). If the ratio of Phenanthren to Anthracen (Phe/Ant) is greater than 15,it will show the origin of petro genic (be petroleum) and if it is less than 10, it will represent the pyrolitic source (fuel source) (Baumard *et al.,* 1998 a,b) and if the ratio of f lorantn and payrn (Flu/Pyr) is greater than 1,will be pyrolitic source and less than 1, will represent petrogenic source , if the ratio of aromatic hydro carbons with low molecular weight to aromatic hydro carbons with high molecular weight is less than 1, (Baumard *et al.,* 1998a,b) it will be pyrologic source and if it is greater than 1 (LMW/HMW), will represent petrogenic source(Tam *et al.,* 2001). Persian gulf is one of the rarest marine ecosystems by its unique geographical features and ecological values. Persian gulf act as a major economic resource and one of the most

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valuable oil and gas reserves in the world and About two-thirds of the world's oil reserves are in the gulf, Around 25,000 oil and non-oil tankers annually imports, and it removed through the strait of Hormuz, therefore it is one of the most crowded world's water ways for oil and non-oil tankers. Persian gulf waters are exposed to the pollution due to oil spill, washing of oil tankers, discharging ballast water of ships, oil rigs of operation of wells and accidents such as oil tankers crash and destructing and getting
fire the oil rigs.

MATERIALS AND METHODS
The first stay of the sampling process in order to collect the water and sediment samples from the four regions Siri ,Lavan , Khark and Bahregan has been done during the 12 days in 2007/07 . Daring this operation, 910 samples are provided from above regions and relevant oil rigs and have been transferred to the laboratory. This operation has been covered about 1400 km and almost has taken across the Persian gulf. Operational regions are shown in Fig. 1.
For determining of poly cyclic aromatic hydro carbons PAHs, 500 g was poured into the specific container after putting in a aluminum cover and were frozen at a temperature below – 20◦c as an index sample of the station .For determining of heavy metals. 100 g was poured into the specific container (zip-lock plastic bag) and were frozen at a

temperature below -20◦c as an index sample of the station.

Sampling to measure PAHs
Sampling to determine the PAHs compositions 2/5 liters of sampled water was required for extracting PAHs.First approximately 75 ml of sample was poured into a beaker that was pre-cleaned and put aside. Then instead, 50 ml of 360 1 mixture of hexane and dichloromethane as solvent was added to the sample bottle and was screwed tightly in the bottle that covered with aluminum foil bottles were shaken strictly for a few minutes and they were put in place without moving, After the required time, the door of the bottle was semi-opened and exiting the acquired gas from the solvent was allowed .This process was repeated several times, in total, for 5 minutes. Then, bottles were put without moving for a few minutes and allowing solvent and liquid phases were separated. In this stage, aggregated solvent at the top of the bottle (usually in the guttural part) was collected carefully by pipette and was poured in a clean container that was pre-provided. The above operation was repeated by adding 50 ml of the solvent mixture in the sample bottle and finally the separated solvent from the upper part of the bottle was added to the first 50 ml after collecting. If water was in the solvent, it would exit carefully by pipette and 1 teaspoon of sodium sulfate is added to the bottle to make sure there is no water in the sample.

Fig. 1: The area of sampling and its different stations

Sampling to measure heavy metals

The water sample was provided from depth of one meter above sea level by glass amber color 2/5 liter bottles. The bottle was placed in the special clamp that a shaker was embedded on the bottom of it and by the graded rope was sent into the sea at the station, samples of water were taken. Sampling was done 3 times at the each station and finally composite samples were prepared, were transferred into the polypropylene containers with volume 1/5 ml. About 2/5 ml of concentrated nitric acid was added to the prepared composite samples until sample PH became less than 2. Then, the sample was transferred to the laboratory without light at 4°c.

Sampling was done with VAN VEEN GRAB device.

RESULTS AND DISCUSSION

Concentration of PAHs in sediments

With regards that sedimentation was very minor in the Persian gulf and also very minor changes in pollutant concentrations in sediment may take place within one year, So only at the first stage of experiments, determining the concentration of PAHs was done in sediments at four operational regions and

as a result of changes in concentration, this parameter was done locally in this report.

Siri region

The total amounts, the average, the maximum and minimum of the concentration of PAHs in the water of the Siri region in two stages were presented in Table 1.

Based on this comparisons, the average concentration of PAHs in the water was increased during the second stage than the first stage. The total concentrations in the water of the various station in two stage at Siri region were compared in Fig. 2.

Lavan region

The total amounts, the average, the maximum and minimum of the concentrations of PAHS in the water of the Lavan region in two stages were presented in Table 1. Based on this comparison, the average concentration of PAHs in the water was increased during the second stage than the first stage. The total concentration in the water of the various station in two stage at Lavan region were compared in Fig. 2.

Table1: Concentration of PAHs in the water Samples

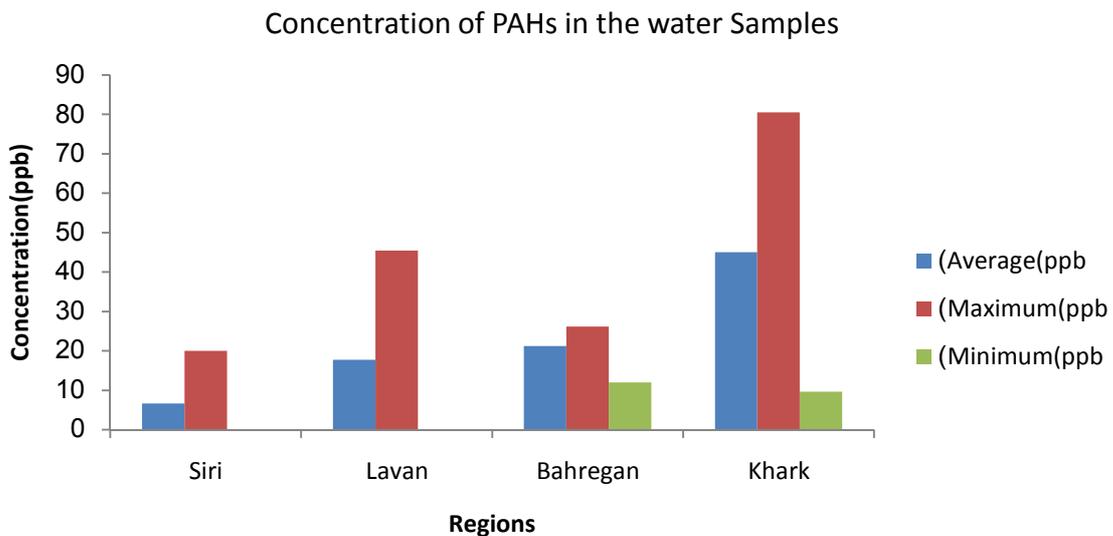| Concentration	Average(ppb)	Maximum (ppb)	Minimum (ppb)
Siri	6.61	20.04	N.D
Lavan	17.73	45.48	N.D
Bahregan	21.2	26.2	12
Khark	45.02	80.56	9.64

Fig. 2: Concentration of PAHs in the water Samples

Khark region
The total amounts, the average, the maximum and minimum of the concentrations of PAHs in the water of the Khark region in two stages were presented in Table 1. Based on this comparisons, the average concentration of PAHs, in the water was increased during the second stage than the first stage. The total concentration in the water of the various station in two stages at Khark region were compared in Fig. 2.

Bahregan region
The total amounts, the average, the maximum and minimum of the concentrations of PAHs in the water of the Bahregan region in two stages were presented in Table 1. Based on this comparisons, the average concentration of PAHs in the water was increased during the second stage than the first stage. The total concentration in the water of the various station in two stages at Bahregan region were compared in Fig. 2.

Concentrationof Heavy metals (V, Ni, Hg)
Study of the changes in the concentration of heavy metals , the data presented in Table 2 , distribution of heavy metals (V, Ni, Hg) concentrations can interpret in four operational regions based on the examined environment (sediment and water) and different regions.

Concentrations of heavy metals in sediments
With regards that sedimentation was very minor in the Persian gulf and also very minor changes in pollutant concentration in sediment may take place within one years, So only at the first stage of experiments, determining the concentrations of heavy metals was done in sediments at operational four regions and as a result of changes in concentration, this parameter was not done in this report .

Table 2: Concentration of Heavy metals in water Sample

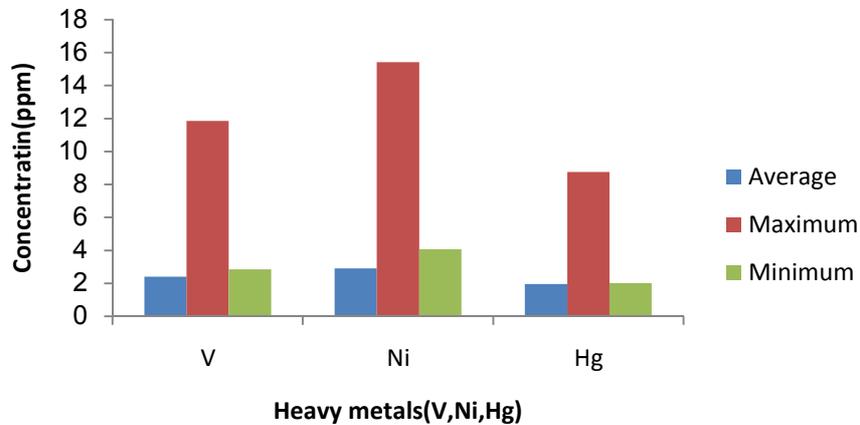| **Area**	Measurment	**V(ppm)**	**Ni(ppm)**	**Hg (ppm)**
iri	Average	2.41	11.86	2.84
	Maximum	2.91	15.42	4.07
	Minimum	1.96	8.75	2.01
Lavan	Average	2.66	13.63	7.56
	Maximum	3.03	16.24	12.05
	Minimum	2.23	10.65	2.07
Bahregan	Average	2.41	11.9	5.26
	Maximum	3.04	16.31	8.58
	Maximum	2.2	10.42	2.59
Khark	Average	2.67	13.92	5.1
	Maximum	3.59	20.15	8.73
	Maximum	1.31	5.64	2.52

Fig. 3: concentration of heavy metals in siri

Concentrations of heavy metals in the water
Siri region

The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Siri region at the same stations in two stages of measuring were presented in Table 2. Based on this comparisons, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been remained unchanged and average of mercury has been increased, the concentration of heavy metals in the water of siri region at the same station in two stages of comparison was presented in Fig. 3.

lavan region

The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Lavan region at the same station in two stages of measuring were presented in Table 2. Based on this comparison, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been increased and the average of mercury has been decreased .The concentration of heavy metals in the water of Lavan region at the same station in two stages of comparison was presented in Fig. 4.
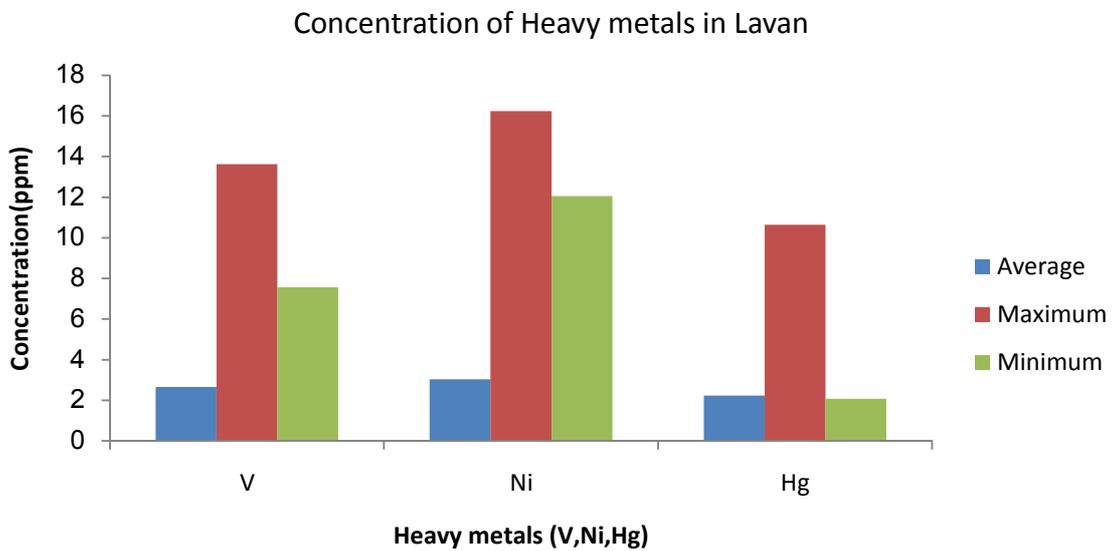

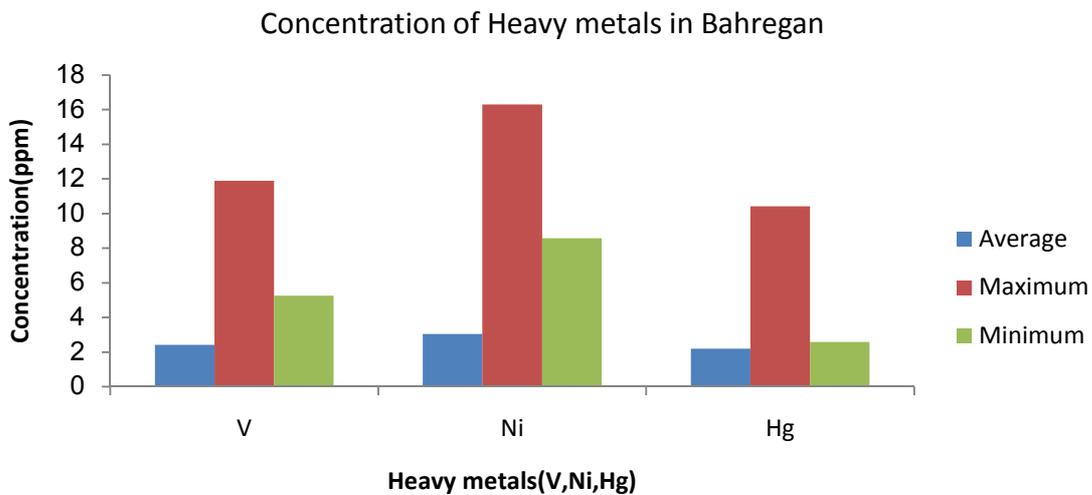Fig. 4: concentration of heavy metals in Lavan

Fig. 5: Concentration of Heavy metals in Bahregan

Khark region
The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Khark region at the same station in two stages of measuring were presented in Table 2. Based on this comparison, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been increased and the average of mercury has been decreased.

The concentration of heavy metals in the water of Khark region at the same station in two stages of comparison was presented in Fig. 5.

Bahregan region
The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Bahregan region at the same station in two stages of measuring were presented in Table 2. Based on this comparison, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been decreased and the average of mercury has been increased .The concentration of heavy metals in the water of Bahregan region at the same station in two stages of comparison was presented in Fig. 6.

CONCLUSION
Concentration of PAHs in the water and sediment
With regards that sedimentation was very minor in the Persian gulf and also very minor changes in pollutant concentrations in sediment may take place within one year, So only at the first stage of experiments, determining the concentration of PAHs was done in sediments at four operational regions and as a result of changes in concentration, this parameter

was not done in this article.
The total amounts, the average, the maximum and minimum of the concentration of PAHs in water of the Siri region in two stages were presented in Table 1.
Based on this comparison, the average concentration of PAHs in the water was increased during the second stage than the first stage.
The total amounts, the average, the maximum and minimum of the concentration of PAHs in water of the Lavan region in two stages were presented in Table 1.Based on this comparison, the average concentration of PAHs in the water was increased during the second stage than the first stage.
The total amounts, the average, the maximum and minimum of the concentration of PAHs in water of the Khark region in two stages were presented in Table 1. Based on this comparison, the average concentration of PAHs in the water was increased during the second stage than the first stage.
The total amounts, the average, the maximum and minimum of the concentration of PAHs in water of the Bahregan region in two stages were presented in Table 1. Based on this comparison, the average concentration of PAHs in the water was increased during the second stage than the first stage.
Concentrations of heavy metals in sediments the water and sediments
With regards that sedimentation was very minor in the Persian gulf and also very minor changes in pollutant concentration in sediment may take place within one years, So only at the first stage of experiments, determining the concentrations of heavy metals was done in sediments at four operational regions and as a result of changes in concentration, this parameter was not done in this article.
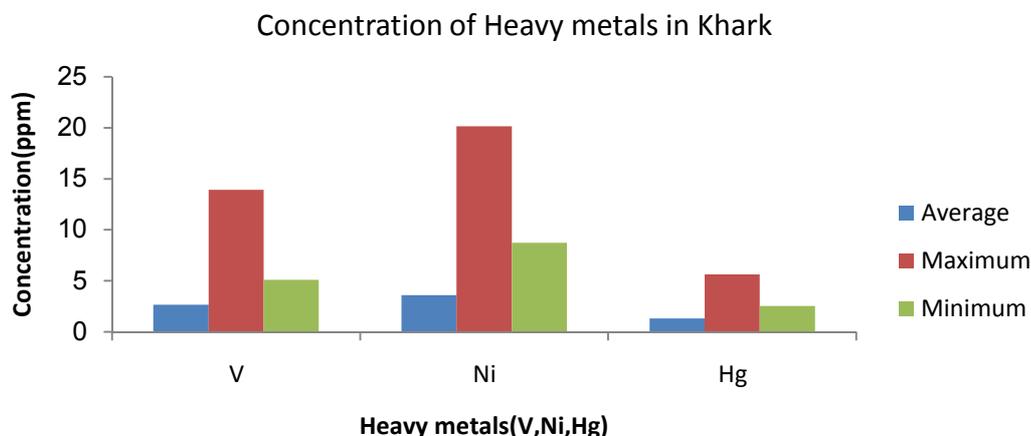

Fig. 6: Concentration of Heavy metals in Khark

The total amounts, the average, the maximum and minimum of the concentration of heavy metals (V, Ni, Hg) in water of the Siri region at the same stations in two stage of measuring were presented in Table 2. Based this comparison, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been remained unchanged and the average of mercury has been increased.

The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Lavan region at the same station in two stages of measuring were presented in Table 2. Based on this comparison, the average concentration of vanadium has been decreased in the second stage than the first stage, the average of nickel has been increased and the average of mercury has been decreased. The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Khark region at the same station in two stages of measuring were presented in Table 2.

Based on this comparison, the average concentration of vanadium has been decrease, the average of mercury has been increased.

The total amounts, the average, the maximum and minimum of the concentration of heavy metals in water of the Bahregan region at the same station in two stages of measuring were presented in Table 2. Based on this comparison, the average concentration of vanadium has been increased in the second stage than the first stage, the average of nickel has been decreased and the average of mercury has been increased.

Result was showed that with regard to the sampling time, the concentration of PAHs in water was increased during the second stage than the first stage in four operational regions.

But concentration of heavy metals has been changed, including. Nickel has been remained unchanged in Siriregion, has been increased in Lavan region and has been increased too In Khark and Bahregan regions.Vanadium has been decreased in Siri, Lavan and Khark regions and has been increased in Bahregan region. Mercury has been increased in Siri, Khark and Bahregan regions and has been decreased in Lavan region. These results were indicated that with regard to various input sources of pollutants in sea water, these changes were created and given the importance of marine water pollution, these cases should be further pay attention and was presented useful solutions. This study was showed the potential of water pollution in Persian gulf and importance for presenting so reduce marine pollution, especially petroleum contaminant and heavy metals.

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