

Determination of heavy metals concentrations in sea water intake of Al khums desalination plant

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Abstract

This study was carried out to determine the heavy metals concentrations such as Fe, Cu, Mn and Zn to know their effects on the desalination units and other components. The samples were collected from feed water intake of Alkhums desalination plant. The plant was chosen because of its importance in supplying fresh water for potable water and industrial uses. These results differences lead to the corrosion by precipitation on the components of desalination units. Moreover heavy metals concentrations were very high compared to the standard rates of the seawater. The mean concentrations of Cu, Fe, Zn, and Mn at site 2 were (2.36,0.042,0.066 and 0.056 ppm) respectively, and site 4 were (2.75,0.048,0.071 and 0.06 ppm) respectively.

Key words: Heavy metals, Sea water, desalination plant, precipitation.

Introduction:

Marine pollution is a global environmental problem , human activities in the coastal area and marine sea water contribute to the discharge of various kinds of pollutants such as heavy metals into the seawater ecosystems [1][2]. The desalination of salt water from seawater is main important substituted which suggest in world wild to save of water demand and necessary purposes the desalination technologies are development during world war II with by cause the increasing requirements on potable water due to rise of population ratio.

The desalination plants projects is considered as one of the important projects as it is the other choice for many Arab countries including Gulf and north Africa countries specially Libya which use techniques of desalination plants for using for drinking water industrial and agriculture purposes [3].

Provision of potable water by seawater desalination is generally considered a benefit despite high concentration and operating costs of plants. Potable water production means emitting a concentrate into the sea ground or evaporation ponds [4]. Concentrate contains not only the contents the seawater taken in but also additives necessary for the desalting process and corrosion by products [5]. The response of the impacted marine ecosystem depends on factors such as transport direction , distance and and dilution. One half of the worlds seawater desalination capacity is located in the Arabian Gulf and overall impacts on this enclosed sea may be considered in addition to local effects on certain biotopes [6]. Libya is water dependency consists of 90% ground water and 10% for the other sources. The desalination plants and co-generation power plants in Libya were established between (1979-2008) the Alkhums desalination plant has started the production of water in 1982. The plant consists of four units it has been operating with MSF process. Capacity of each unit 10.500 m³/day total production 42.000 m³/day [3].

The present study was conducted to investigate the heavy metal contents such as (Fe, Cu, Mn, and Zn) in seawater and their affects on desalination components.

Location of the study area

Area of study is located in Alkhums city 135 km east of Tripoli city north of the coastal high way the town lies between Latitude of N 32 38 59 and Longitude of E 14 15 52.

Materials and Methods

The samples were collected from four intakes channels S1, S2, S3 and S4 around that area. The pH, conductivity and temperature were measured immediately. The samples were filtered through 11µm pore size whatman No 1 membrane filter paper, samples was added 2ml nitric acid concentration as according to the standard methods. Preservation for determination of metal [7]. The samples were kept in polyethylene bottles samples were transported to the laboratory in a cool container [8]. Elements was analyzed (Cu, Mn, Fe and Zn) by using of the photometric measurements (Ultra-Violet Dr 2010-spectro-photometer). Analysis of variance (ANOVA) and pearson correlation were performed on the data using SPSS (10.0). Results were presented as the mean ±Standard error.

Results and Discussion

The copper (Cu) concentrations in samples was higher (0.75 ppm) in site S4 while in site S2 (2.36 ppm) was lower than S4 comparing with to the standard copper concentration in the clean seawater is about 0.023 ppm. This pollution maybe due to the pretreatment of the plant and the industrial sources located near the plant location "Fig. 1".

"Fig. 1,"

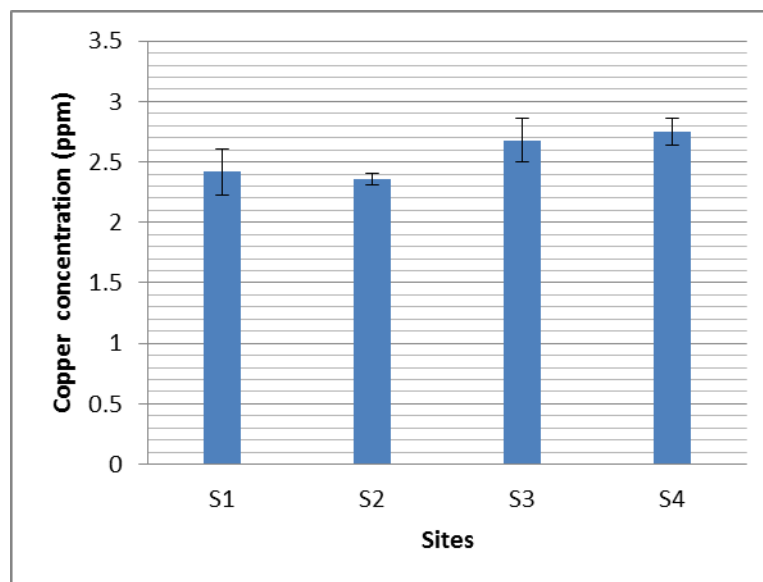


Figure 1. Concentration of (Cu) in different sites.

In "Fig.2", shown the mean concentration of Iron (Fe), the standard concentration average of (Fe) in seawater about 0.004ppm while the mean maximum concentration of (Fe) in sites S2 and S4 were recorded low value in S2 (0.044 ppm) while high in S4 (0.048 ppm) may be the Iron is dissolved in seawater and precipitate into the bottom and forming the red ferrous hydroxide. It means may be come with chemical waste water which is rejected to the sea side without treatment.

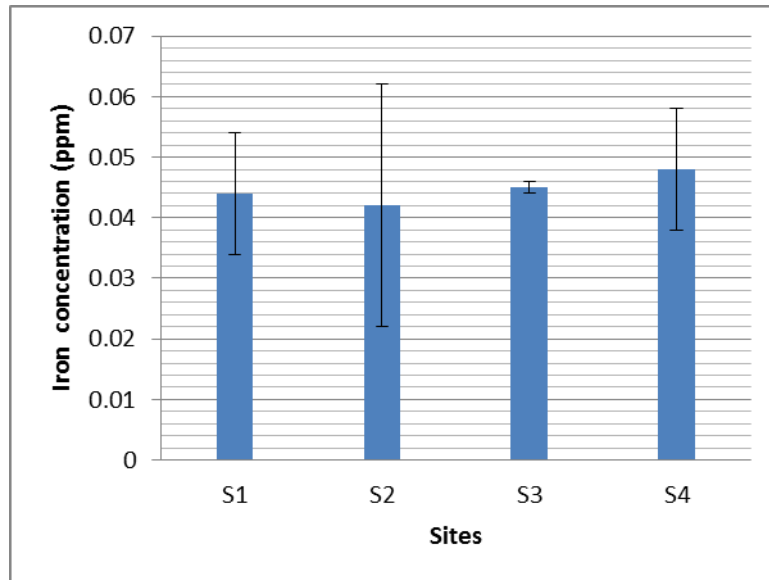


Figure 2. Concentration of (Fe) in different sites.

The results presented in "Fig. 3", show the Zinc concentration at both sites ranged from 0.066 ppm to 0.071 ppm in S2 and S4 respectively, the maximum mean value of Zinc concentration in S4 while minimum in S2. The corrosion of the pipes due to high salinity led to high concentration of the Zinc.

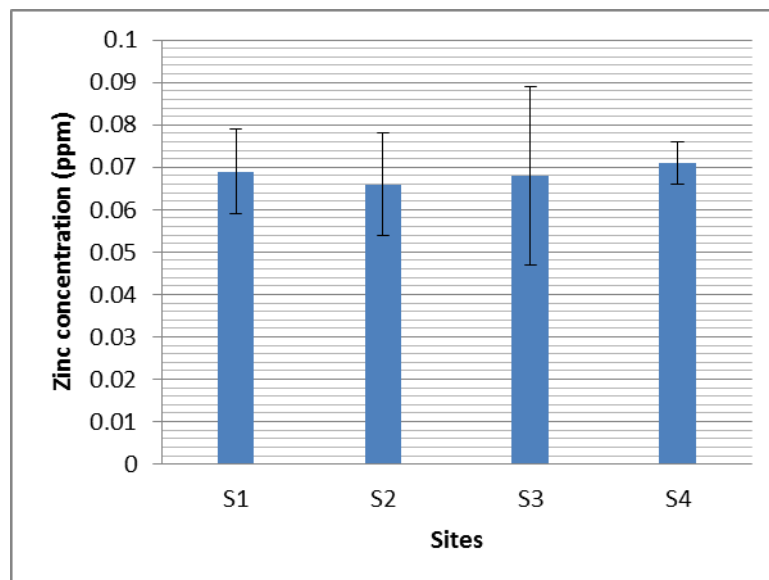


Figure 3. Concentration of (Zn) in different sites.

The minimum concentration of manganese (Mn) was recorded in S2 (0.056 ppm) while it was high in S4 (0.060 ppm) "Fig. 4", all the Mn concentrations were higher than of the standard concentration of the seawater. May be occurs due to the high salinity of brine solution after desalted and reject of all the waste water disposal from power plant station. Otherwise some of industrial pollutant which nearby the study area may found its way to seawater.

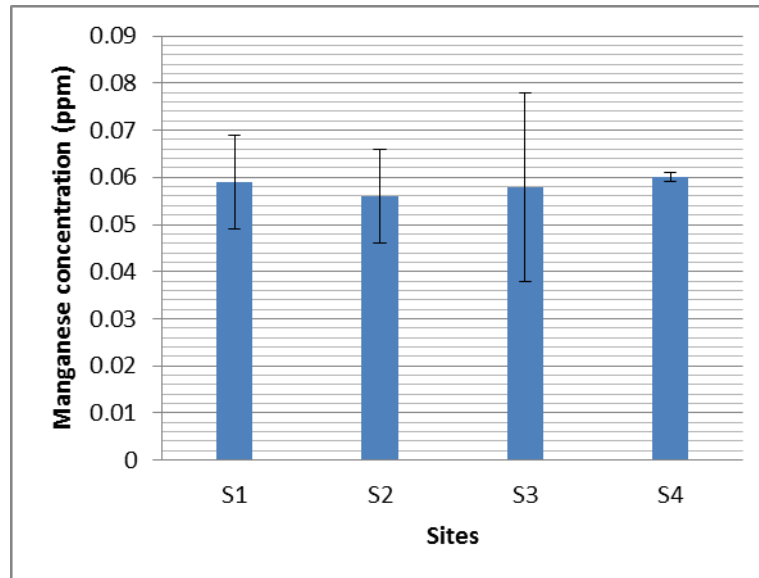


Figure 4. Concentration of (Mn) in different sites.

Conclusion and Recommendation

Generally, desalination plants produce waste brine with heavy metals in comparatively low concentrations [9]. Distillation techniques associated with heavy metals increased whilst high temperature aids corrosion of metals constructed with heavy metals [10] [11]. Thus the results showed the heavy metals concentrations were very high compared to the standard of the seawater. On the other hand differences of results lead to corrosion by precipitation on the components of the desalination unites. Moreover the reason of these pollution could be because of the geographic environmental location and predominant concentration such as motion of water current which aid to transport the pollutants into the seaside from all the different pollutant sources such as high salinity of brine solution after desalted which are rejected to the sea side without treatment . Then the important points have to consider when planning to establish new desalination plants. Environmental effects assessment process to prevent operating problems and protection marine and coastline ecology. As well as optimum use of chemical additional with according to specification to guaranty and to save the efficiency of the plant.

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تحديد التراكيز العناصر الثقيلة بمأخذ مياه البحر لمحطة تحلية الخمس

اجريت هذه الدراسة لتحديد تراكيز العناصر الثقيلة مثل الحديد والنحاس و المنجنيز و الزنك لمعرفة اثارها علي وحدات تحلية المياه والمكونات الاخرى فقد تم جمع العينات من مياه التغذية لمحطة تحلية الخمس وقد تم اختيار هذه المحطة نظرا لأهميتها في توفير المياه العذبة الصالحة للشرب والاستخدامات الصناعية واختلاف النتائج تؤدي الي التآكل والترسيب علي مكونات محطة تحلية المياه وتراكيز العناصر الثقيلة عالية مقارنة مع معدلات القياسية لمياه البحر فمتوسط تركيزات النحاس و الحديد والزنك و المنجنيز في الموقع 2 كانت (2.36، 0.066، 0.042، 0.056 ppm) علي التوالي وفي الموقع 4 كانت (0.071، 0.048، 2.75، 0.06 ppm) علي التوالي.

الما : العناصر الثقيلة ، مياه البحر ، محطة التحلية، الترسيب.