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Pollution Assessment of Surface and Drainage Water by Heavy Elements in Al Ahrar District, Wasit Governorate, Iraq

Ayser Al-Shamma, Reyam A. Hassan*

Department of Geology, College of Science, Baghdad University, Baghdad, Iraq.

Abstract

The study area lies in Wasit governorate south west Kut city, where Al Ahdeb oil field is located to the south of Al Ahrar district. The present study deals with assessment of heavy metals pollution in water by collecting eleven water samples (five samples from drainage and six samples from surface water) in 5th of December 2016. The water samples analysis of heavy elements in the study area shown that water is polluted with high concentration of (Pb, Cd) elements, while the concentration of (Cu, Fe, Zn) in water samples are within the permissible limits of both World Health Organization, and Iraqi standards and there are no hazard effects from these elements. The study detected some diseases that injured the people living in the vicinity of the oil field complex such as scabies, vitiligo, eczema and contact dermatitis, as a result of increasing of (Pb) ion in water samples.

Keywords: water pollution, surface and drainage water, heavy elements, diseases.

تقييم تلوث المياه السطحية ومياه المبالز بالعناصر الثقيلة في منطقة الاحرار، محافظة واسط، العراق

أيسر محمد الشماع ، ريام عبد الكريم حسن*

قسم علم الارض، كلية العلوم، جامعة بغداد، بغداد، العراق

الخلاصة

تقع منطقة الدراسة في محافظة واسط جنوب غرب مدينة الكوت، حيث يقع حقل الاحدب النفطي الى الجنوب من ناحية الاحرار، هذه الدراسة تتعامل مع تقييم تلوث المياه السطحية بالعناصر الثقيلة في منطقة الدراسة حيث تم جمع أحد عشر نموذج من المياه (من مياه المبالز وقنوات الري) في الخامس من ديسمبر ٢٠١٦. حيث اظهرت نتائج التحاليل الكيميائية للمياه انها ملوثة بتراكيز عالية من ايونات العناصر الثقيلة (الكاديوم والرصاص)، بينما تراكيز العناصر الثقيلة (الزنك والحديد والنحاس) هي ضمن الحدود المسموح بها. كشفت الدراسة عن بعض الأمراض التي أصابت الناس الذين يعيشون في المنطقة المجاورة لمجمع حقل النفط مثل: الحرب والبهاق والأكزيما والتهاب الجلد التماسي، وذلك نتيجة لزيادة أيون الرصاص في عينات المياه.

Introduction

Freshwater in the world's rivers and lakes represents a small percentage of the total amount of water on the planet. Only a small fraction of the freshwater supply is available for living needs, however, most of which is used for agriculture. Agricultural chemicals such as fertilizers and pesticides are carried by the drain water, which empties into streams and rivers and then finally flows to the ocean, and if concentrations are high enough, the chemicals can kill fish and other marine life, [1].

*Email: reyam.kareem93@gmail.com

The study area suffers from a pollution problem because of the emissions of: toxic gases, solid and liquid waste from Al Ahdeb oil field, which is a structural field laying in Al Ahrar district, Wasit governorate. The work was started in this field in 2009, (personal community, 2016), which is an oil production only and isn't a refinery, for the reason that an increasing work in Al Ahdeb oil field which led to pollution in the study area. The study attempted to evaluate water pollution in the study area by collecting water samples and analyzes them in laboratories to detect the concentration of heavy metals which is responsible of the water pollution in the area. In addition, the increasing of heavy elements may have many effects on human health. The study revealed some diseases that affected people living in the vicinity of the oil field complex such as scabies, vitiligo, eczema, and conjunctivitis, as shown in (Figure-1).

The study area lies in Wasit governorate south-west of Kut city, as shown in Figure-2. The study area covered (649.8) km² and lays between:

Longitude 45° 30` & 45° 46` E

Latitude 32° 23` & 32° 35` N

The altitude of the study area varies from few meters to 47 meters above sea level and the main cities within the area are: Al Ahrar and Kut in addition to scattered villages. The study area is located in the Mesopotamian plain which is a part of the stable shelf [2]. Also it is covered by different type of Quaternary sediments, which are represented by the flood plain sediments, crevasse splay, shallow depression sediments, marsh sediments, sand sheet and the anthropogenic sediments, [3] as shown in Figure-3.



Figure 1- Some diseases that injured people in the study area

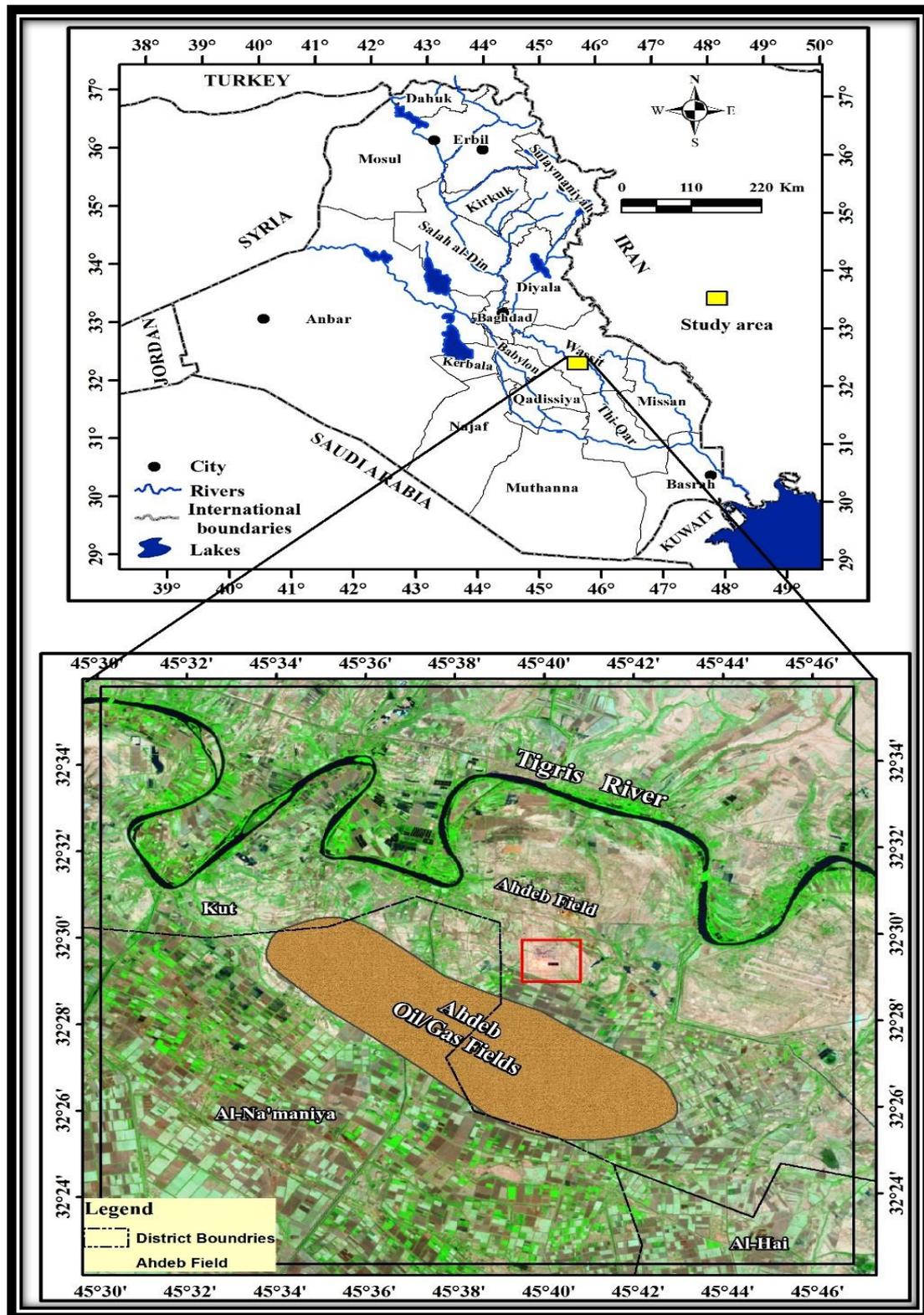


Figure 2- Location map of the study area

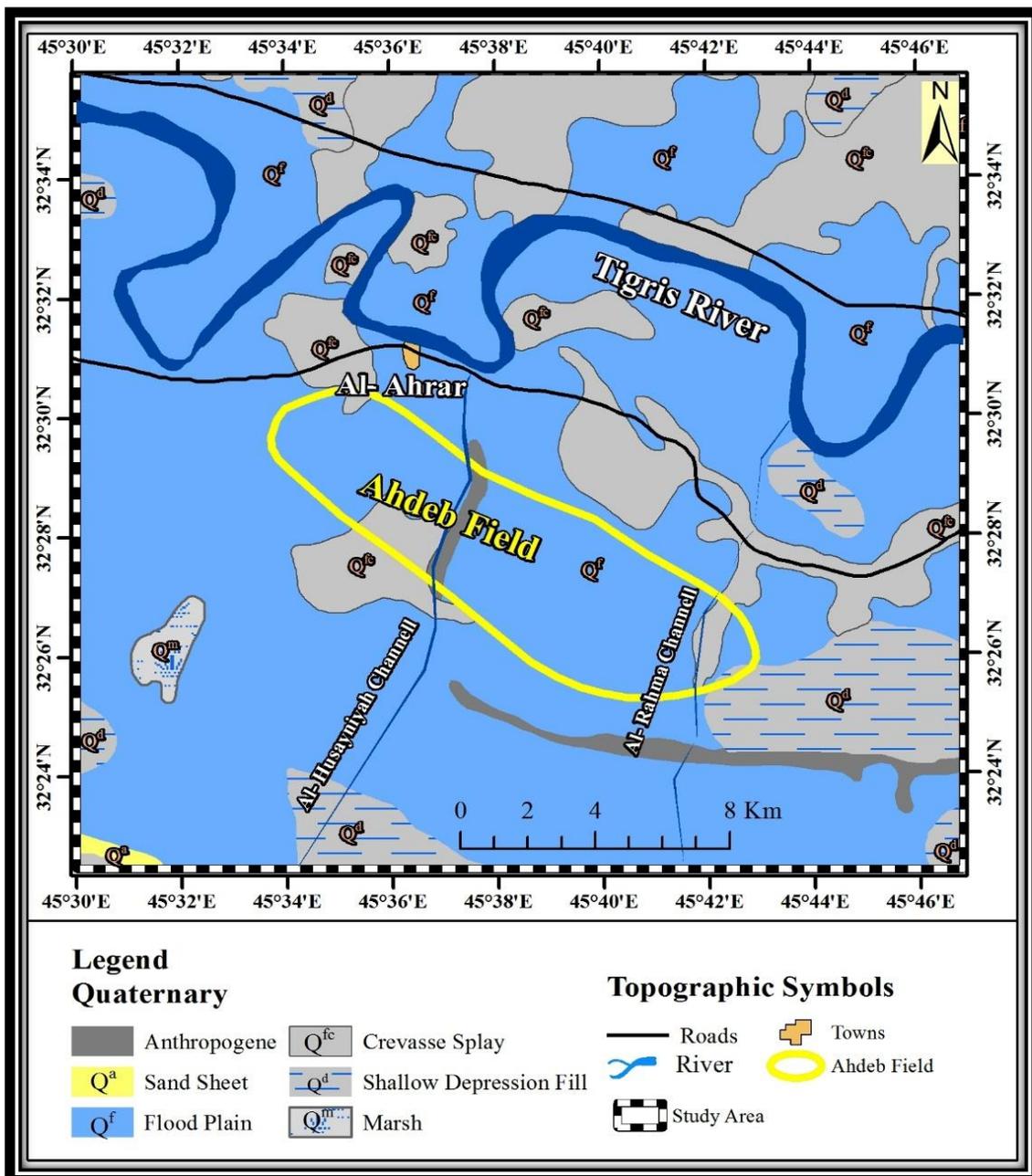


Figure 3- Geological map of the study area, [3]

Materials and methods

The field work includes sampling of water in 5th of December 2016, where eleven water samples were collected from different places to cover the study area, as shown in (Figure- 4). The water samples were from both drainage water (DW) and surface water (SW), where the surface water in the study area refer to artificial channels (Al Husseinia and Al Rahma channels) taken from Tigris river which used by consumers for different activities. The drainage basin in the study area are a low-lying area used reduce Salinization problems on millions of hectares of agricultural lands and to reclaim lands for food production, [4].

The analysis of heavy elements in water samples include (Pb, Fe, Cu, Cd, and Zn) were detected by using atomic absorption spectrometer in the laboratories of Ministry of Science and Technology.

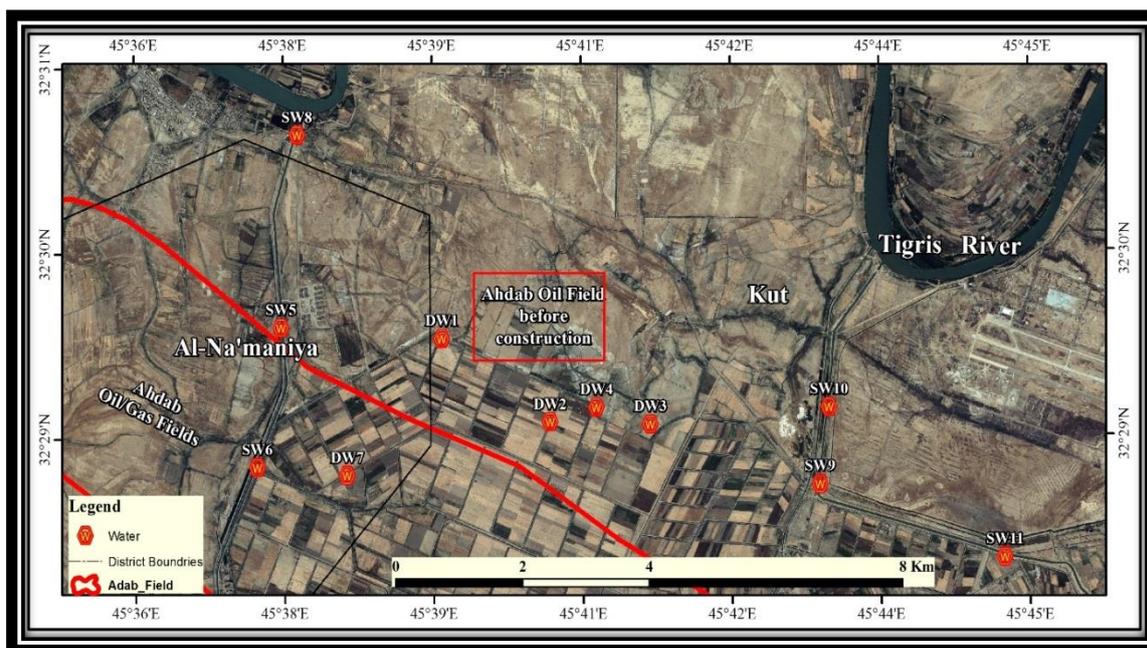


Figure 4- Location map of water samples within the study area

Results and Discussion

1. The concentrations of heavy elements are varied in different locations and the results of concentration of heavy elements compared with the World Health Organization (WHO) and Iraqi standards (IQS), [5] and [6], are shown in Table-1.
2. There is an increasing in concentration of (Pb, Cd) in water samples of the study area, which are exceeded the permissible limits of (WHO, 2008) and (IQS, 2009), this increase in all locations of water samples, as shown in (Figure-5).
3. The high concentration of (Cd, Pb) resulted from many reasons, the main reason is from the industrial waste of Al Ahdeb oil field by the combustion of fossil fuel, in addition to minor reason such as waste from the agricultural processes and sewage municipal.
4. Because the increasing of some heavy elements in water samples of the study area that causes a pollution problem to the study area and spreading of many diseases of the people who living surrounding the oil field due to toxicity of these elements.
5. The concentration of (Cu, Fe, Zn) are within the permissible limits of (WHO, 2008) and (IQS,2009) and there are no hazard effects from these elements.

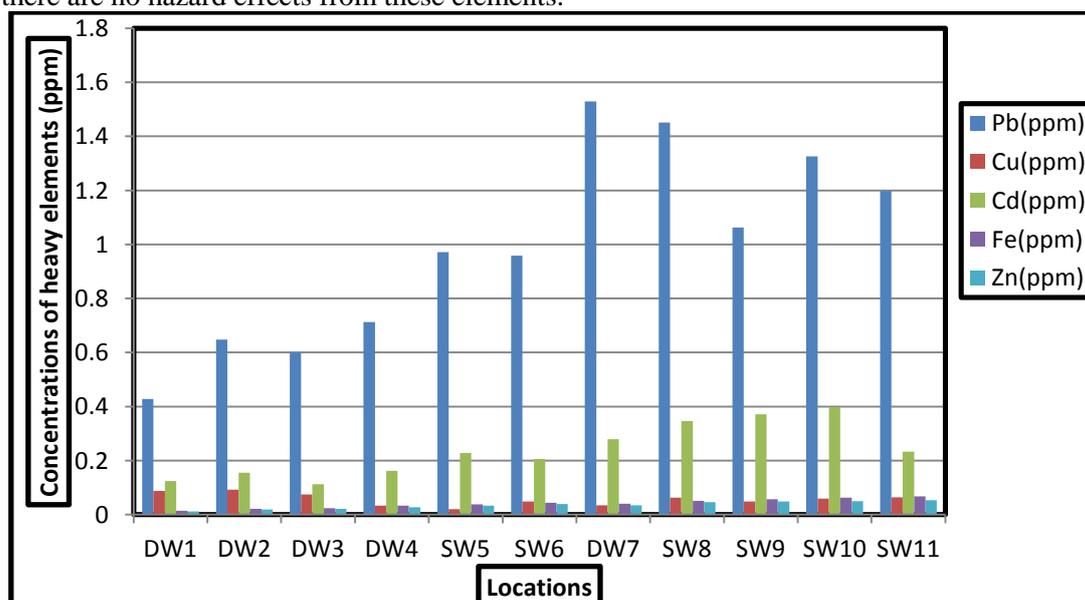


Figure 5- The distribution of heavy elements in water samples of the study area.

Table 1-The concentration of heavy elements in water samples of the study area in (ppm).

| Location | Pb | Cu | Cd | Fe | Zn |
|-----------------------|-------------|-------------|--------------|--------------|-------------|
| DW1 | 0.4276 | 0.0878 | 0.1248 | 0.015 | 0.0125 |
| DW2 | 0.6479 | 0.0925 | 0.1547 | 0.022 | 0.0193 |
| DW3 | 0.6009 | 0.0753 | 0.1122 | 0.024 | 0.0221 |
| DW4 | 0.7127 | 0.0329 | 0.1626 | 0.034 | 0.0278 |
| SW5 | 0.9719 | 0.0205 | 0.2285 | 0.038 | 0.0334 |
| SW6 | 0.958 | 0.0489 | 0.2061 | 0.044 | 0.0391 |
| DW7 | 1.5291 | 0.0348 | 0.279 | 0.041 | 0.0345 |
| SW8 | 1.4514 | 0.0627 | 0.3463 | 0.051 | 0.0467 |
| SW9 | 1.0626 | 0.0486 | 0.3715 | 0.057 | 0.0492 |
| SW10 | 1.3257 | 0.0596 | 0.3972 | 0.063 | 0.0501 |
| SW11 | 1.198 | 0.0643 | 0.2336 | 0.068 | 0.0539 |
| Mean(ppm) | 0.99 | 0.06 | 0.24 | 0.04 | 0.04 |
| WHO,2008 (ppm) | 0.01 | 2 | 0.003 | <3 | 3 |
| IQS,2009 (ppm) | 0.01 | 1 | 0.003 | 0.3 | 0.3 |

Conclusion

The results show that the water samples of the study area are polluted by (Pb, Cd) which are exceeded the permissible limits of (WHO,2008) and (IQS,2009). The concentration of (Cu, Fe, Zn) in water samples of the study area are within the permissible limits of (WHO,2008) and (IQS,2009) and there are no hazard effects from these elements. Because of high increasing of (Pb) element in water samples, the study revealed some diseases that affected people living in the vicinity of the oil field complex such as scabies, vitiligo, eczema, and conjunctivitis.

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