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RESEARCH ARTICLE

ESTIMATING OF PRODUCED WATER QUANTITIES IN SEVERAL FIELDS OF AL-WAHA COMPANY AND ITS IMPACT ON THE ENVIRONMENT

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Abstract

Oil exploration activities generate loads of produced water (PW) up to thousands of tons a day, depending on the age of oil supply wells, soil, rock type, and used techniques. This study revealed the presence of some toxic metal ions in PW such as Cd⁺² (0.51-2.05ppm), Cr⁺³ (0.06-1.81ppm), Pb⁺² (0.03-26.9ppm) and Hg⁺² (<0.61ppm), there are also another pollutants in PW for example, a wide range of oil drops (24-240.5ppm) and dissolved solids (43.5-196.5ppm).

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Introduction:-

The crude oil is a diverse mixture of hydrocarbons, where carbon constitutes (83-87%) of it¹, these organic compounds are transformed into hydrocarbons during the formation of petroleum in the ground, under special conditions of pressure and temperature.

Crude oil has been found in the form of a thick liquid, known as black gold, which contains also some organic and inorganic impurities², this marvelous mixture found in many regions around the world with different types and structures, according to the conditions of its formation and the type of rocks³.

In the early stages of oil extraction, it is often free of water, which is known as associated water or produced water (PW). However, after a period of production time, quantities of water begin to appear and increase as a result of the water creeping higher and reaches about 90% in the final stages of the well production³. Yet, scientifically proved that this water was formed with crude oil at the beginning of its inception through the decomposition of organic materials over a very long period of time extending for thousands of years⁴, in addition to some gases as a result of the different densities, these components are arranged in the well as follows (gases then crude oil and finally water).

PW contains harmful elements⁵, and when thrown directly on the surface of the earth, it causes many environmental problems, such as affecting plants and animals. It may also increase the salinity in groundwater, in addition to hydrocarbon pollutants, PW contains scattered oil droplets, dissolved salts (TDS), chemicals added during the drilling process, and dissolved gases such as hydrogen sulfide and carbon dioxide. Furthermore, different types of bacteria and some living organisms, values of these substances vary from place to place, which complicates the process of treating them.

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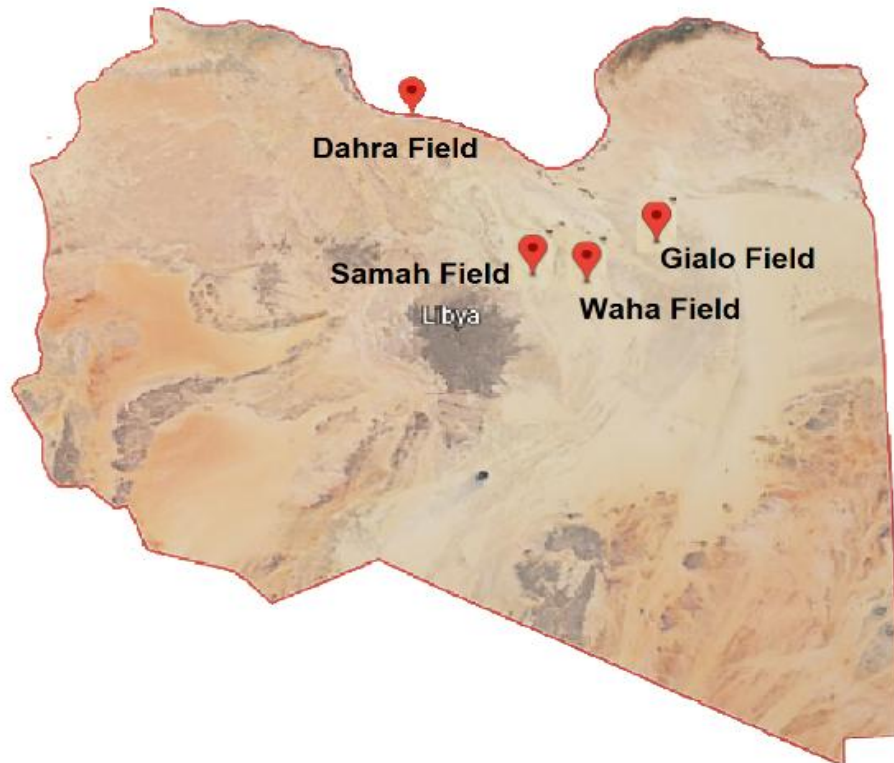
Aims:

Analyzing of associated water, that produced by some fields of Al-WahaCompany in order to estimate the pollution problem in the groundwater and surrounding area. There are five main aims behind this study, which can be summarized as follows:

1. Shedding light on some chemical properties of PWproduced with crude oil.
2. Estimation of PW amount that usually dump into the lakes near the field.
3. Comparing the quantities of PWin each field of this company during the last two years.
4. Evaluation of the amount of oil drops and dissolved solids in PW.
5. Investigation of the concentration of some heavy metals in PW.

Results And Discussion:-

The analysis of PW samples that obtained from reliable sources at Al-Waha company (next map), can be summarized as follows:



Figure(1):-The location of each field belongs to Al-WahaCompany (taken from google earth)

The following table shows the amount of PW (million m³) generated from each field during the last two years.

Table (1):- Shows the amount of PWcollecting from different fields during theperiod (2019-2020).

No	Field	PW quantity (million m ³)	
		2019	2020
1	Waha	9.298	8.555
2	Jialo	11.658	13.325
3	Dahra	3.66	4.597
4	Samah	1.038	1.175

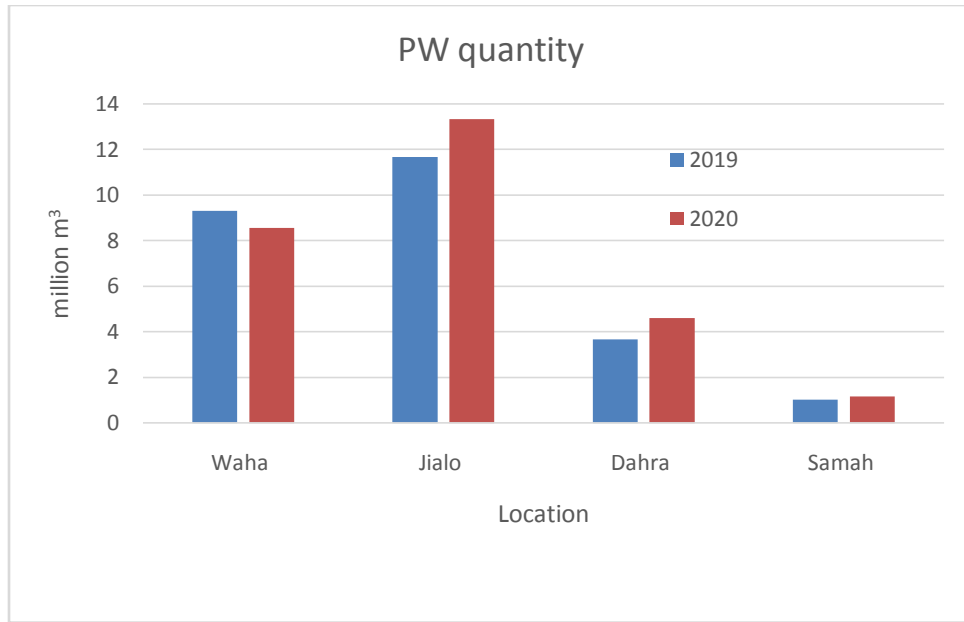


Figure (2):- Shows the difference in the amount of PW by year and location.

Table (2):- Shows the amount of oil drops in PW, collecting from different fields during the period (2019-2020).

No	Field	Oil (ppm)	
		2019	2020
1	Waha	128.5	24
2	Jialo	74	27.5
3	Dahra	63	71
4	Samah	240.5	45

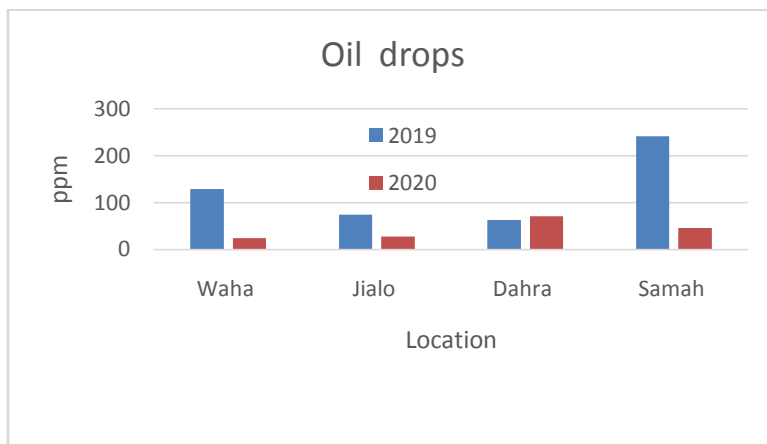


Figure (3):- Shows the difference in the amount of oil drops by year and location.

Table (3):- Shows the amount of dissolved solids in PW, collecting from different fields during the period (2019-2020).

No	Field	Dissolved solids (ppm)	
		2019	2020
1	Waha	98.85	84.4
2	Jialo	156.3	89.7
3	Dahra	67.74	43.5
4	Samah	196.1	190.5

Values of dissolved solids in PW were also very high than in ordinary drinking water (0.2ppm) according to WHO⁶.

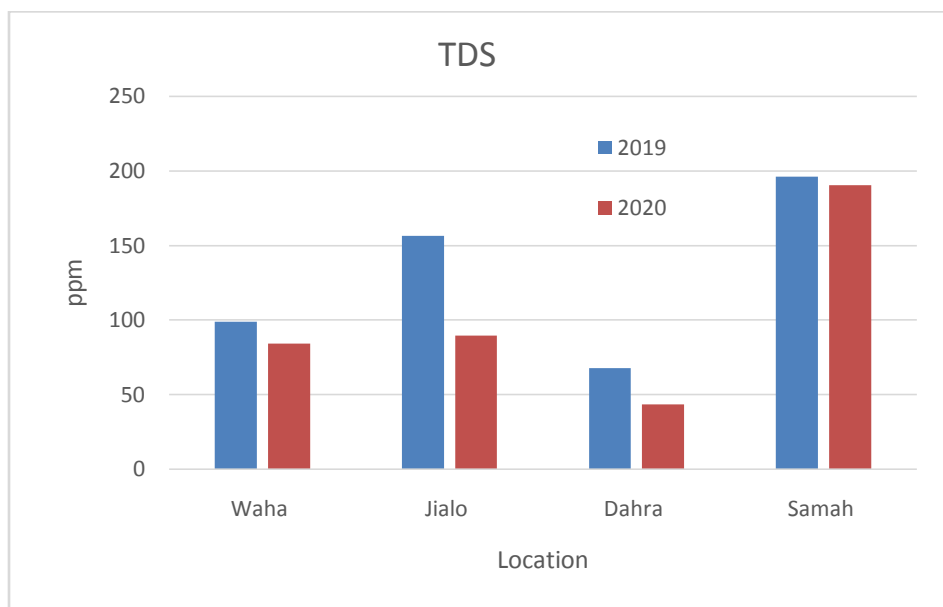


Figure (4):- Shows different amount of dissolved solids for each location.

Table (4):- Shows the amount of some heavy metals in associated water, collecting from different fields during the last two years.

No	Field	2019				2020			
		Cd (mg/l)	Hg (mg/l)	Pb (mg/l)	Cr (mg/l)	Cd (mg/l)	Hg (mg/l)	Pb (mg/l)	Cr (mg/l)
1	Waha	<0.01	<0.36	0.03-0.13	<0.30	0.07-0.1	0.15-0.2	3-5.5	0.2-0.65
2	Jialo	0.08-0.6	<0.23	2.4-26.9	<0.30	0.05-0.09	0.08-0.32	4.5-7	0.05-0.09
3	Dahra	<0.02	<0.23	2.4-5.0	<0.45	0.13-0.1	0.04-0.09	2.4-8	0.1-0.7
4	Samah	<0.11	0.26-0.61	0.06-9.54	<0.37	0.06-0.1	0.07-0.1	5.5-8.5	0.01-0.7

These results show a big difference in the amount of PW between 2019 and 2020, where this quantity increases with time. It is also noted that the amount of PW produced from fields 1 & 3 increases several times compared with fields 2 & 4, which can be attributed to the well naturelocation.

Regarding to heavy metals, by compared the amount of heavy metals revealed by a similar study in Al-Ahdab field at Iraq nation, we noted that quantities of Cd²⁺(<0.6ppm) and Cr³⁺ (0.2-0.65ppm) in Al-waha fields generally are less than in Al-Ahdab field (0.51-2.05ppm), (0.06-1.81ppm), and both are higher than WHO specifications(0.003ppm), (0.05ppm)⁶ respectively, while Pb²⁺ concentration in Al- waha fields was in range of (0.03-26.9ppm), which is higher and much varied than in Al-Ahdab field (5.52-20.6ppm)⁷.

Interestingly at Samah field, Hg²⁺ concentration in 2019 was quite high (0.26 -0.61ppm), while in 2020 became (0.07-0.1ppm)and that could be just a kind of contamination in 2019, while the rest fields show close results in range of (0.04-0.36ppm). However, even the last range is very high compared with guidelines for drinking-water quality, issued by world health organizationWHO (0.006ppm)⁶.

Conclusion:-

Al-waha fields have high levels ofwater pollutants, for examplesome heavy metals are above the regular limits, based onLibyan specifications for drinking water and standard specifications issued byWHO2018.

Therefore PW, considered to be a poor source of drinking water and other routine activities, such as planting, unless this water subjected to adequate treatment.

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