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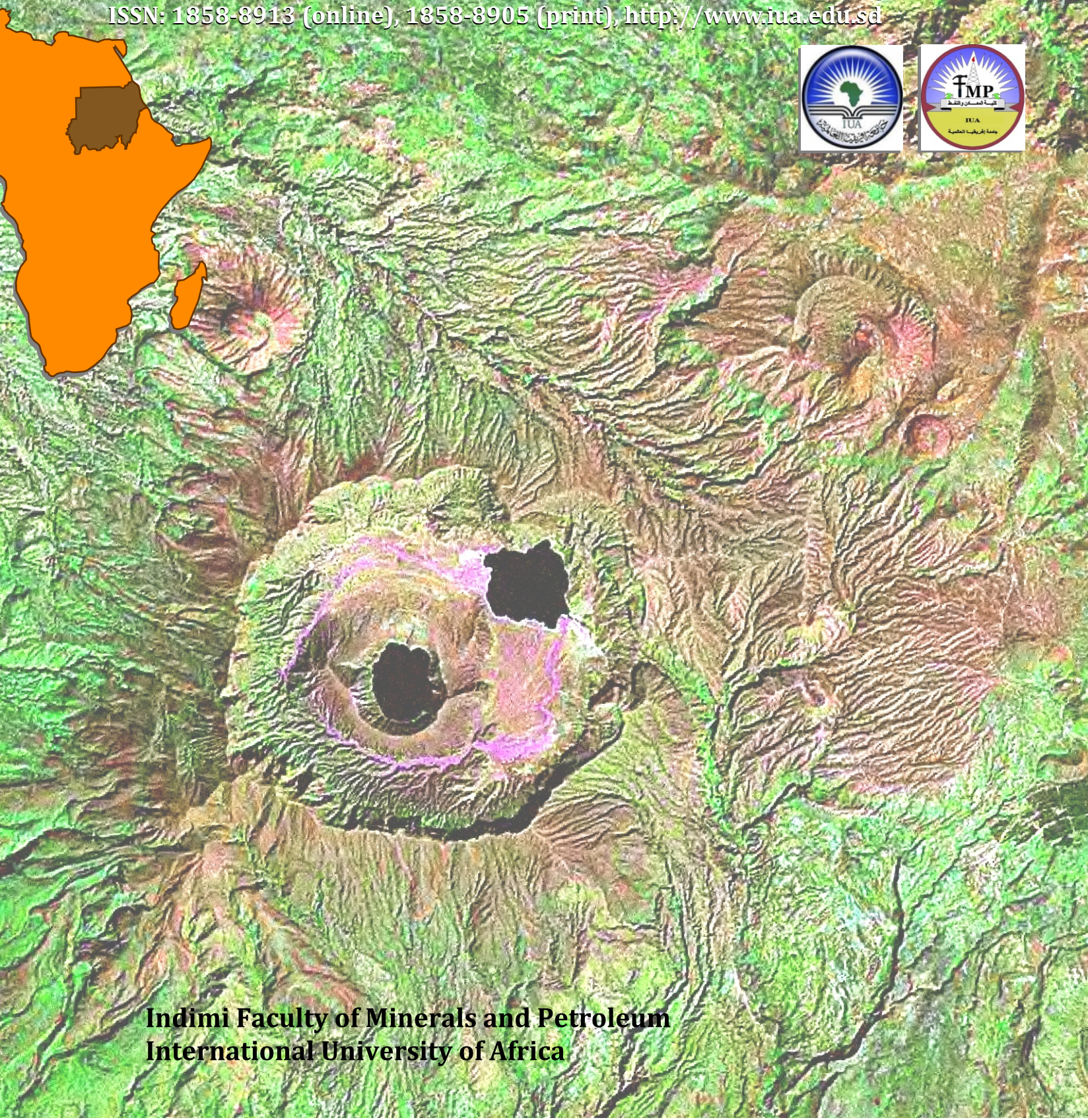

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Effect of Physiochemical Parameters, Chemical Parameters and Pesticides Residual on Drinking Water in El-Managil Area, Algazeera State, Sudan

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Abstract

This study was undertaken to evaluate the effect of some physiochemical properties and pesticides residual of drinking water in El-Managil area. Ninety-nine samples were collected from different villages around El-Managil, town. The samples were collected in July 2013 from *zeer* supplied *Turaa*, zeer supplied by tank and tank supplied by well. Water samples were analyzed for physiochemical variants such as Turbidity (using turbidity meter), pH, ((using pH meter), Chemical Parameters such as Chlorides, Nitrates, (measured by titration method), Cadmium, Copper, Iron, lead, (measured by Flam Atomic Absorption Spectrophotometer), Phosphorus (P) (using Spectrophotometer) and pesticides such as (Sevin,) (measured by High Performance Liquid Chromatography), Malathionand, Cypermethrin (using gas Chromatography)**.** Among the studied physiochemical parameters, pH values for all ranged (7.1 to 8.2) were within WHO permissible limit. Turbidity level was higher in surface water than ground water. Conductivity in untreated water samples varied widely according to water sources and locations. Minerals concentration Copper, their readings were below WHO permissible limit. Cadmium, lead, iron and phosphorus show slightly increase compared to WHO permissible limit in samples. Chlorides, was lower than the maximum permissible level except the Nitrates, was higher than the maximum permissible level. The values for malathion (0.0032 ppm) in western Wad Alamin village, water source *Zeer* filled from *Turaa,* which was higher than WHO permissible limit, Cypermethrin concentrations values were higher than the WHO permissible limit, with value (0.032 ppm) recorded in Abood village for the source *Zeer* filled from tank, Sevin residue in some locations exceeded the WHO permissible limit, The study gave an over view that the water of the *Turaa* was the most important source of pollution for pesticide residues. As for the chemical and physical variables, the pollution included the water of the canals and the water of the tank. Whereas the study did not cover all the areas of the project,

Keywords: Drinking water, physical, chemical, pesticides, parameters

1. Introduction

El-Managil is a town in central Gezira State in Sudan, located between 14 15, 13 45 N; 33 15, 23 30E. It is about 412 meters (1351 feet) above sea level, 156 kilometers (96.9 miles) away from Khartoum and 62 kilometers (38.5 miles) from Wad Madani (Fig 1). It is one of the largest industrial centers in Sudan. The area is located in the central of Algazeera Formation which characterized by black cotton soil and the general slope of the drainage system pattern toward the White Nile River. However, Algazeera Formation have a flat surface and rarely outcrops appear (Fig, 2). The groundwater level is a round (25- 40 m) below ground surface. The climate is characterized by higher temperature ranged (15 to 40˚C). Sources of water are acted in ground water and *turaa*. Different types of water can be affected by different factors whether in the source, or in the different passages (Gleick, 1999). It is not sufficient merely to have access to water in adequate quantities; the water also needs to be of adequate quality to maintain health and it must be free of harmful biological and chemical contamination. Often water which is of a sufficiently high quality at the point of collection is contaminated before it is used because it has to be carried and

stored before use or because of unhygienic practices. Water provision cannot be separated from two other inter-related factors - sanitation and health. This is because one of the primary causes of contamination of water is the improper disposal of human and animal excreta (WHO, 2001). Water that looks drinkable can contain harmful elements, which could cause illness and death if ingested. Elhag (2004) found that the amount of lead in tap water at the Gezira State was in the range 0.004 mg/l to 0.016mg/l. Hagar (2009) found that in the drinking water at the Gezira state the amount of heavy metals, while surface water was free of lead, Copper was higher in surface water than in ground water .The levels of cadmium and lead were found in ground water. Elhag (2004) found that the. Lead could enter drinking water from the corrosion of pipes distribution systems. the levels of cadmium in drinking water should be less than 1.0µg /L and found that the medium level in tap water was0.01µg /L. Cadmium could be released to the environment in the waste water, also might cause pollution by contamination from fertilizers the levels of cadmium in drinking water should be less than 1.0µg /L and the medium level in tap water was0.01µg /L. Iron is an essential element in human nutrition and the minimum daily.

Nurrain (1998) found that the amount of chloride in canal and well water was 9.8mg/l and 120mg/l respectively in the Gezira area, Phosphorus is a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. It is an essential element for plant life, but when there is too much of it in water, it can speed up eutrophication (a reduction in dissolved oxygen in water bodies caused by an increase of mineral and organic nutrients) of rivers and lakes. Soil erosion is a major contributor of phosphorus to streams. Bank erosion occurring during floods can transport a lot of phosphorous from the river banks and adjacent land into a stream, (Koshy and Nayar 1999).

Mahgoub, (1984) found that the pH value from the three Niles ranged from7.5 to 8.5.The pH values for the tap and canal water ranged from (7.9 to 8.8). The quality of drinking water in the Gezira state is affected by the turbidity level in ground water that ranged 0.3 to0.95NTU,while that in surface water ranged 5.5to 197NTU,thus being higher than the maximum acceptable level stated by WHO standard as 5NTU (Hagar 2009). found that the turbidity of Nile ranged from0.05 to 0.07 O. D, for wells water it ranged from 0.01 to 0.56 O. D, and for tap water it was 0.01 O. D. (Abdelmagid et al., 1984) found EC for tap water to be 0.17 µs /cm.

Abdellatif (2007) found that the result of residue analysis for organophosphorus, chlorpyriphos and malathion bout 33% of the samples collected from Khartoum (Elgreef) were found to contain profenophos with average concentration of 0.00061mg/l and ranged of ND- 0.00183mg/l, cypermethrin residues were detected in 33.3% of the water samples collected from Sinnar with an average of 0.00085mg/l and range of ND-0.00256 mg/l and from, Dongla, the main Nile with an average of 0.00005mg/l and arrange of ND-0.00015mg/l. the results of malathion residue were not detected in White Nile water samples collected from Gabel Awlia.

Fig. 1. The location map of study area (El Managil area).

1.1 Statement of the problem

Some parts of Gezira state are suffering from scarcity of suitable drinking water. Some people of the area get water from streams and ground water, the problem facing the citizens of those areas is attributable to lack of sufficient healthy drinking water due to pollution which mainly caused by bad use of water resources. The most important water pollution problems related to agriculture are: (i) excess nutrients accumulating in surface and banks waters that cause eutrophication, hypoxia and algal blooms; (ii) accumulation of nitrates in groundwater; and (iii) pesticides accumulated in groundwater and surface water bodies. Water pollution caused by nutrients (particularly nitrate) and pesticides has increased as intensive farming methods have proliferated, such as increased use of chemical fertilizers and higher concentrations.

1.2 Objectives of the study

The objectives can be summarized as follows:

1. Assessment of some physiochemical parameters and pesticides residual in drinking water in El-Managil area.
2. Compare the drinking water quality to the international standards adopted by WHO for drinking water.
3. To determine any special variation in water quality according to locations, water kinds and sources.

2. Materials and Methods

Ninety nine water samples were collected representing large areas from Al-Managil as shown in Table (1).They were collected in July 2013, from tap water (Net (turaa+ well)), Zeer supply from Turaa, (water canal). Zeer (handmade clayey pot for keeping drinking water) supplied from Tank and Zeer supplied from tap water (Net (turaa+ well)) and samples from tank and Turaa directly (Fig.3).

Samples were collected in one-liter plastic bottles after washing, and cleaning with tap and distilled water consequently, by immersing it closed and then opened at approximately (30cm) in depth and then were closed inside the water directly after filling. Water samples were conserved at 4C^{o} and for later laboratories analysis (APHA, 2005).

Table 1. Sampling sites, direction, sources and kind of waters used in the study.

Sites	Direction	No. of samples	Sources	Kind of water
Al-Managil	Middle	12	tap water (Net (*turaa*+ well)) and *Zeer*	Treated
Altiquia	North Al-Managil	30	*Turaa*, Tank and *Zeer*	Untreated
Wad- Halawy				
Shasha				
Umm-Talha	South Al-Managil	21	*Turaa*, Tank and *Zeer*	
Kambo 26				
Maktab84	East El-Managil	24	*Turaa*, Tank and *Zeer*	
Abood				
WadMahmoud				
Maktab Elnasih				
El-Krimit Wad Alameen	West El-Managil	12	*Turaa*, Tank and *Zeez*	

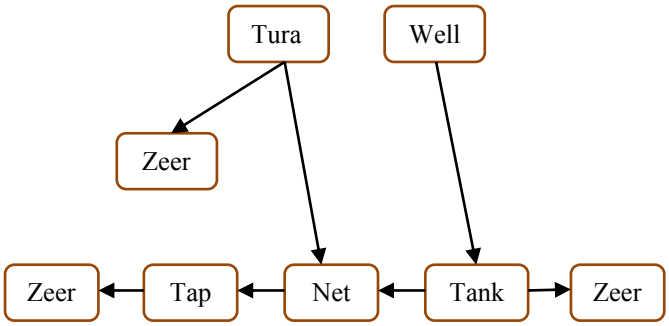

Fig. 3. Sources of water samples

The samples were obtained to determine the turbidity by used Turbidity meter model LH- TB02, pH used pH meter model HANNA pH 209, conductivity used conductivity meter Model 4510.

The metals and heavy metals such as Cadmium (Cd) copper (Cu), iron (Fe) and Lead (Pb) were predicted by using calibrated atomic absorption spectrometer instrument Flame Atomic absorption spectrophotometer (210VGP Buck Scientific) double beam manufactured by United States of America (2005) depend on (AAS, 1994).

Determination of chloride and phosphorus, in the samples of water by using the method in (ISO, 1990). To Determine Nitrate using the method in (Tandon, 1993).

The investigated Pesticides residues analysis included the following:

Determine Malathion and Cypermethrin residues, samples preparation were measured by using the method in (AOAC. 2005), and analyzed by GC**.** Gas Chromatography

Determine Cypermethrin residues, sample preparation is measured by using the method in (AOAC. 2005), Gas Chromatography

Determine carbamate (Sevin) residues, sample preparation is measured by using the method in (AOAC. 2005), and analyzed by (HPLC)

Data was analyzed as complete randomized design. Analysis of variance (ANOVA) was performed According to procedure described by Gomez and Gomez (1984). Means were separated by Using least significant difference (LSD) and T test.

3. Results

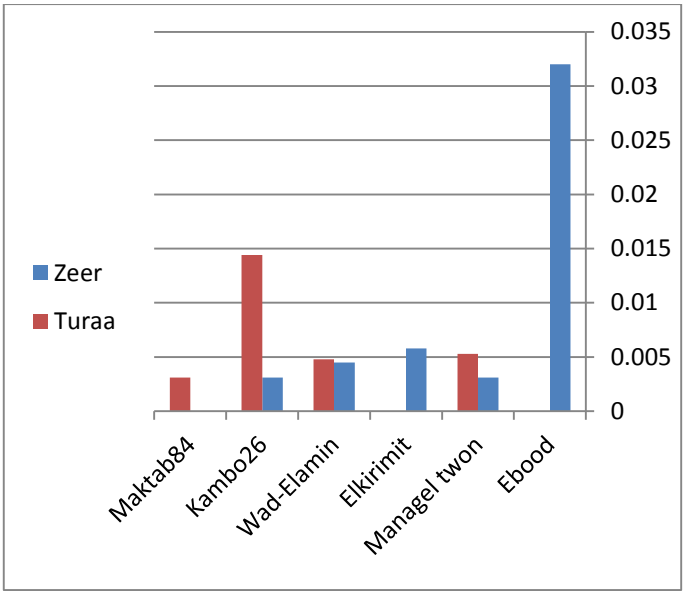

Fig. 4. Concentration of pesticides residual (cypermethrin) in the study water sample from *Zeer and Turaa*

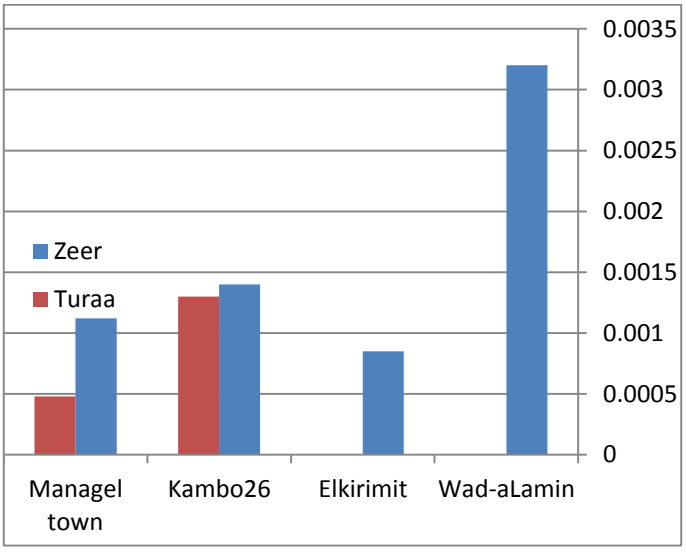

Fig. 5. Concentration of pesticides residual (Malathion (ppm)) in the study water sample from Zeer and *Turaa*

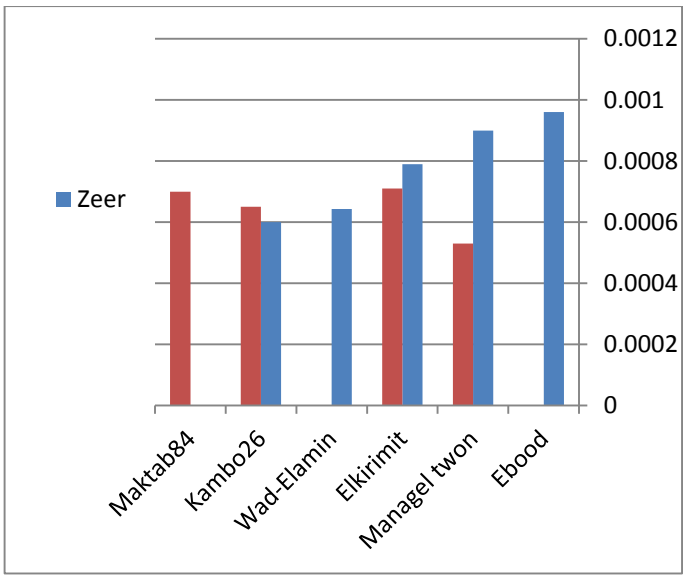

Fig. 6. Concentration of pesticides residual (Sevin (ppm)) in the study water sample from Zeer and *Turaa*

Table 2. Physiochemical properties of studied water samples in El-Managil

The values	pH (WHO 6.5-8.5	Villages	Sources	The values	Conductivity WHO≤ 200 µS/CM	Villages	Sources	Turbidity (WHO) 0.1-5.0 NTU	Villages	Sources
Higher	8.2	Maktab Elnasih	Zeer supply From Tank	Higher	0.70	Abood	Tank supply from well	842.	Maktab (84)	Turaa
lower	7.1	Wad Mahmoud	Tank supply from well	Lower	0.30	Maktab (84)	Zeer supply From Turaa	0.00	Wad Mahmoud	Tank supply from well
Higher	7.7	Wad Alamin	Turaa	Higher	0.20	El.krimit	Turaa	1618.70	Wad Alamin	Turaa
lower	7.3	El.krimit	Tura	Lower	0.20	El.krimit	Tura	115.20	El.krimit	Turaa
Higher	7.96	UmTalaha	Turaa	Higher	70.805	Kambo26	Turaa	1596.60	Kambo26	Turaa
lower	7.39	Kambo26	Zeer supply From tank	Lower	0.222	Kambo26	Zeer supply from tura	1.78	UmTalaha	Zeer supply From tank
higher	8.00	Shasha	Tank supply from well	Higher	0.898	Altiquia	Tank supply from well	254.33	Altiquia	Zeer supply From Turaa
lower	7.60	Altiquia	Turaa	Lower	0.205	Altiquia	Turaa	0.00	shasha	Tank supply from well
higher	8.20	Midle of Almanagle	Zeer supplay from tap water	Higher	0.921	Midle of Almanagle	Tap water	130.33	Midle of Almanagle	Zeer supply from tap water
lower	7.50			Lower	0.194		turaa	0.00		tap water

Table 3. Concentration of anions (mg/l) in studied water samples in El-Managil

Values	NO_3^-WHO 10mg/l	Villages	Sources	Cl^- WHO 250mg/l	Villages	Sources
Higher	8.8	Abood	Tank supply from well	4.4	Maktab Elnasih	Zeer supply From Tank
lower	1.9	WadMa-hmoud	Zeer supply from turaa	1.5	Maktab 84	Zeer supply FromTuraa
Higher	4.300	El.krimit	Zeer supply from turaa	2.5	El.krimit	Zeer supply from Turaa

lower	1.900	Wad Alamin	Tura	1.5	Wad Alamin	Tura
Higher	10.080	Kambo26	Tank supply from well	5.133	UmTalaha	Turaa
lower	2.053	UmTalaha	Zeer supplay from tank	2.267	Kambo26	Zeer supply Fromtank
higher	4.940	Altiquia	Turaa	96.0	Shasha	Tank supply from well
Lower	0.000	Wad hallawy	Tank supply from well	2.00	Wad hallawy	Zeer supplay from turaa
higher	14.560	Midle of Almanagle	Zeer supplay from tank	4.267	Midle of Almanagle	Zeer supplay from net
Lower	1.86	Midle of Almanagle	Zeer supplay from tap water	2.133	Midle of Almanagle	turaa

Table 4. Concentration of metals and heavy metals (mg/l) in studied water samples in El-Managil

Values	**Cd (0HW) .005**	**Villages**	**Sources**	**Cu (WHO) 2.0**	**Villages**	**Sources**	**Fe (WHO) ≤0.30**	**Villages**	**sources**
Higher	0.006	Maktab(84)	turaa	0.034	Maktab (84)	Turaa	0.4340	Maktab 84	Turaa
lower	0.002	Wad mahmoud	Tank supply from well	0.007	Abood	Tank supply from well	0.012	Wad mahmoud	tank supply from well
Higher	0.007	El.krimit	Zeer supply From Turaa	0.020	El.krimit	Zeer supply From Turaa	1.240	Wad Alamin	Turaa
lower	0.004	Wad Alamin	Turaa	0.014	Wad Alamin	Turaa	0.043	El.krimit	Tura
Higher	0.009	UmTalaha	Turaa	0.027	UmTalaha	Zeer supply from Tank	0.207	Kambo26	Turaa
lower	0.002	UmTalaha	Zeer supplay from	0.013	Kambo26	Turaa	0.024	Kambo26	tank supply From well
higher	0.007	Waad hallawy	Zeer supply from tank	1.55	Shasha	Zeer supply from tank	1.57	Shasha	Zeer supply from tank
Lower	0.001	Waad hallawy	Tank supply from well	0.009	Waad hallway	Zeer supply from tank	0.021	Altiquia	Zeer supply from tank
higher	0.009	Midle of Almanagl	turaa	0.023	Midle of Almanagl	Zeer supplay from tank	0.754	Midle of Almanagle	turaa
Lower	0.004	Midle of Almanagl	Tap water	0.012	Midle of Almanagl	Tap water	0.033	Midle of Almanagle	Tap water

Table 4. Concentration of heavy metals (mg/l) in studied water samples in El-Managil

The values	**P WHO** ≤ 2	**Villages**	**Source**	**Pb WHO** 0.01	**Villages**	**Source**
Higher	32.0	Maktab Elnasih	Tank supply from well	0.024	Maktab 84	Zeer supply from Turaa
lower	1.33	Maktab84	Zeer supply from Turaa	0.008	Abood	Zeer supply from tank
Higher	57.00	El.krimit	Zeer supply from Turaa	0.073	El.krimit	Zeer supply from Turaa
lower	5.00	El.krimit	Turaa	0.010	Wad Alamin	Tura
Higher	9.333	Kambo26	Turaa	0.027	UmTalaha	Zeer supply from tank
lower	0.667	Kambo26	Tank supply from well	0.010	Kambo26	Zeer supply from Turaa
higher	30.00	Waad hallawy	Tank supply from well	0.035	Altiquia	Turaa
lower	1.00	Altiquia	Zeer supply from tank	0.006	shasha	Zeer supply from well
higher	1.000	Midle of Almanagle	Turaa	0.021	Midle of Almanagle	Zeer supply from tank
lower	0.000	Midle of Almanagle	Zeer supply from tank	0.015	Midle of Almanagle	Tap water

4. Discussions

Concerning the physiochemical, as shown in Table (2) The study results found that PH values for all (water samples, sources and locations) ranged (7.1 - 8.2) were within the WHO permissible limit (6.5 - 8.5). The pH values are not affected by turbidity constituents which are almost clay material (Aluminum silicate).

Turbidity values in majority tested water samples were above WHO permissible limit, the highest Turbidity values ranged (130.33 to 1618.7 NTU). The variation was due to the source and in order Turaa > Zeer supply from Turaa > Zeer supply from tank > tank supply from well. The high value (1618.7 NTU) noticed at Wad Alamin the site West of El-Mnagil the source of water turaa. The surface water in the area of study was higher in level of turbidity. The values were recorded during the wet season (Autom). The ground water was low in turbidity (confined reservoir).

Conductivity in untreated water samples varied widely according to water sources and locations. Turaa waters samples show the highest conductivity values ranging (0.2 to 70.805 cm/mS) and in order south El-Managil (Kambo 26) > El-Managil town west El-Managil > North El-Managil (Altiquia) > east El-Managil (Abood) > West El-Managil (Al-krimit).this Tripp to the village based on the reading obtained. The high value (70.805) recorded in Kambo26 the site South of El-Managil the source of water turaa.

Chlorides (Cl^-), was lower than the maximum permissible level except the Nitrates (NO_3^-), was higher than the maximum permissible level it was recorded in the middle of El-Managil town . The water which polluted due to human activities has high concentration of Nitrate. This indicate that the water tend to be stagnant (Table 3).

Metals concentrations in tested water samples show fluctuating readings according to water sources, locations and turbidity value. Copper readings were below WHO permissible limit. While cadmium, lead, iron and phosphorus show slightly increase compared to WHO permissible limit in samples of turaa and zeer supply from turaa. The high value (0.009mg/l) of the cadmium noticed at the middle of El-Managil town (supply from turaa,) and Umtalha (South El-Managil) (supply from turaa). The high value (0.035mg/l) of the lead recorded in Altiquia (North El-Managil) the source of water is turaa. The high value (57.0mg/l) of the phosphorus observed in El-krimit (West El-Managil), the source of water is turaa (Table 4).

Pesticides analysis revealed high value (0.0032 ppm/l) of the Malathion recorded in Wad Alamin Western El-Managil the source of water zeer supply from turaa. This value was above than the maximum Permissible level. The high values (0.032 ppm/l), (0.00096 ppm) of sevin and Cypermethrin respectively recorded in Abood Eastern El-Managil. The source of water zeer supply from tank, the Cypermethrin values was above than the maximum Permissible level.

The increasing of pesticide in Turaa to human agriculture activities , moreover, the open surface waters can be contaminated by air polluted .The low values in water tanks where the Zeer waters have in between because it is mixed by Turaa and T\ank in mid of Almanagil . In the other sites, the Zeer water supplied from Tanks directly, this reflect the absence of residual pesticide or very low in values (Figs. 4, 5, and 6).

5. Conclusion and recommendations

The huge challenge facing the area of study is the water pollution. The pollutants are classified according to the quality of the water into organic matter such as pesticides and inorganic matter such as heavy and toxic metals such as Cadmium, Lead, Iron and phosphorus. Surface and ground water are also exposed to immense pollution due to the human activities when huge agriculture fertilizer are used such as phosphate and nitrates which are in taken by the plants. Parts of these fertilizers swell into the ground water causing ground water pollution. Another pollutant is the elaborated use of detergents which contain phosphate. The pesticides residues transport to drinking water through soil and air.

In two types of drinking (treated, untreated) water according to sources (*turaa*, *zeer* supply from *turaa*, *zeer* supply from tank and tank supply from well) in El-Managil area. Middle, north El-Managil (the villages: Wad Hallawy, Altiquia, Shasha), east El-Managil (the villages: Maktab 84, wad mahamood, Ebood, maktab Alnasih), south El-Managil (the villages: Ummtalha, Kambo 26) and west El-Managil Town the villages (Wad Elameen, Alkrimt).

Among the different physiochemical parameters, pH values for all (water types, sources and locations) ranged (7.1 to 8.2) were within WHO permissible limit (6.5 - 8.5).Total Suspended Solids in untreated water samples varied widely according to water sources and locations. *Turaa* waters samples shows the highest .Turbidity values in majority tested

water samples were above WHO permissible limit, the highest Turbidity values ranged (130.33 to 1618.7 NTU). Conductivity in untreated water samples varied widely according to water sources and locations. *Turaa* waters samples show the highest conductivity values ranging (0.2 to 70.805 mg/l. The high value (70.805) recorded in Kambo26 the site South El-Managil the source of water *turaa*.

Heavy metals concentration in tested water samples show fluctuating readings according to water sources and locations. Copper, the readings were below WHO permissible limit. While cadmium, lead, iron and phosphorus show slightly increase compared to WHO permissible limit in samples of *turaa* and *zeer* supply from *turaa*. The high value (0.009mg/l) of the cadmium noticed at the middle of El-Managil and Umtalha Southern El-Managil the source of water supply from *turaa.* The high value (0.035mg/l) of the lead recorded in Altiquia Northern El-Managil, the source of water is *turaa*.The high value (57.0mg/l) of the phosphorus observed in El-krimit Western El-Managil, the source of water is *turaa*.

Chlorides, was lower than the maximum permissible level except the Nitrates, was higher than the maximum permissible level. It was recorded in the middle of El-Managil where the water was mixed (Turaa and well)

The residual pesticides in treated and untreated water samples were detected. The high value (0.0032 ppm/l) of the Malathion recorded in Wad Alamin Western El-Managil, the source of water *zeer* supply from *turaa*, this value was above than the maximum Permissible level. the high values (0.032 ppm/l), (0.00096 ppm) of sevin and Cypermethrin respectively recorded in Abood , Eastern El-Managil the source of water *zeer* supply from tank, the Cypermethrin values was above than the maximum Permissible level .

Regular maintenance of water stations pipes is necessary to prevent leakages which cause contamination. Periodical cleaning canals from grass, mud and shrubs which restrict water movement .Cleaning water sources (*Zeer*, Tank) to minimize contamination. Surface water in the area of study should be subjected to treatment before use for human consumption.

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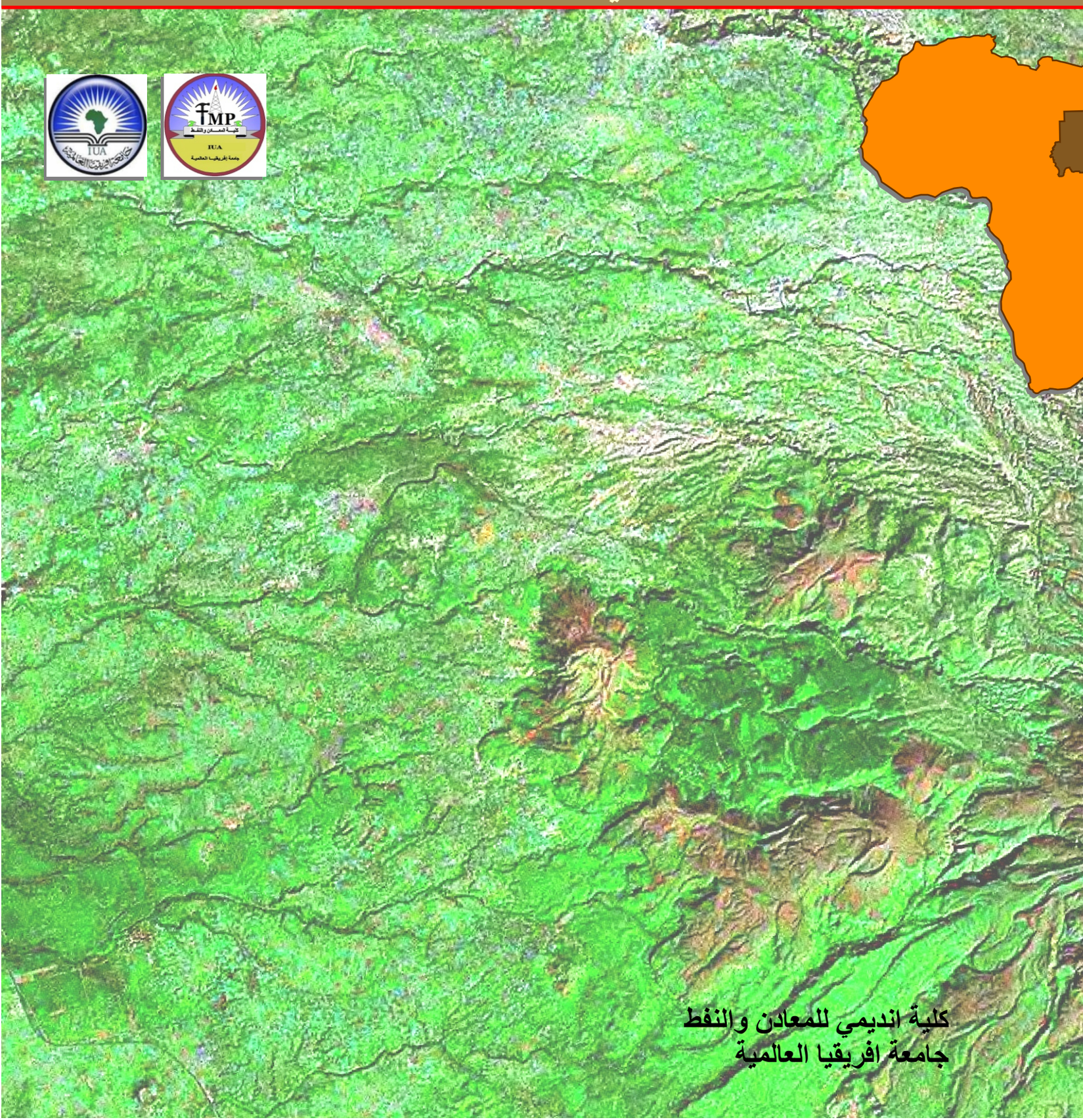
مجلة افريقيا لعلوم الأرض

مجلة علمية محكمة

المجلد الثاني ، ٢٠١٩



كلية انديمي للمعادن والنفط
جامعة افريقيا العالمية