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# Evaluation of DTPA-Extractable some Heavy Metals in Soils and Water in Qena Governorate, Egypt.

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## ABSTRACT

This study aims to assess some heavy metals in the soils and water of Qena governorate. To achieve this objective, 25 water and 25 soil samples were collected from different locations a Qena governorate. The collected samples were analyzed for their trace element contents include Fe, Mn, Zn, Cu, Ni, Pb, Co, and Cd by Inductively Coupled Plasma (I C P). The result indicated that the trace element contents were found much lesser in irrigation canals water as compared to drainage canals which mixed with untreated industrial and domestic sewage. Cu, Pb, Fe, Ni and Cd were found in normal concentration in irrigation canals. Metal concentrations in water were found in most locations as following order: Fe > Zn > Pb > Mn > Ni >Cu > Cd> Co; whereas they follow the order of Fe > Mn > Zn > Cu > Co> Pb > Ni >Cd in surface soil samples . All the metals attained their maximum values at Al-Tawaby drainage canal (Abu-Mnaa Bahary) as waste industrial for Qus paper factory, This may be attributed to the huge amounts of raw sewage, agricultural and industrial wastewater discharged into canal water. Industrialization have contributed to the large scale of pollution currently observed in Qus city notably. However the content of DTPA – extractable heavy metals in soils were within the permissible limits.

**Keywords:** trace elements, water pollution, DTPA-extractable heavy metal.

## INTRODUCTION

Trace elements present in some pesticides and in fertilizers, such as micronutitional or bicidal components, present as naturally occurring pollutions or introduced when waste materials are used to formulate fertilizer products.

The accumulation of trace elements in the soil could be attributed to use of waste water in irrigation. The application of waste water irrigation can lead to increasing the productivity for plant, but also increases the pollution of heavy metals such as (Zn, Mn, Cu, Ni, Pb and Cd) in plants. (Jayadev 2013).

Pollution of the aquatic environment by inorganic chemicals is considered a major threat to the aquatic organisms. The agricultural drainage water containing pesticides , fertilizers and effluents of industrial waste .In addition to sewage effluents supply the water bodies and sediment with large quantities of inorganic anions and trace elements. (ECDG, 2002).

Sanitary sewage services and the installation of sanitation have not expanded proportionally to the increase in population and villages in the governorate of Qena. These villages dump the sewage into a trench system first and then into water drains or directly into the water drains. Water pollutions may be due to the sewage effluents and untreated industrial waste disposal into the aquatic environment and can lead to so many dangerous effects (Akpor and Muchie, 2011).

This present study was aimed at finding out the levels of contamination of eight trace elements viz. Iron, Manganese, Zinc, Copper, Nickel, Cobalt, Lead, and Cadmium, in irrigation water and soils for Qena governorate.

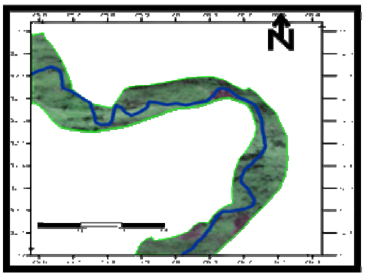
## MATERIALS AND METHODS

**Water samples and analysis:** Twenty five samples were collected from the irrigation canals, drains and wastewater at several different locations explained in Fig (1), two bottles were prepared for each sampling site, one liter were used for chemical and heavy metal analyses, respectively, water samples of 100 ml were acidified using 1 ml of concentrated analytical nitric acid to be analyzed for the heavy metals. All the collected water samples were put in an ice box and taken to laboratory where they remained in the refrigerator until analysis.

Potential hydrogen was measured using a glass electrode, water salinity was determined by measuring the electrical conductivity – Ecw dS/m−1 and Calcium , magnesium, carbonates ,bicarbonates and chlorides in water samples were determined by titration while sodium and potassium were measured by a flame photometer (jackson, 1973).The sodium absorption ratio (SAR) was calculated by

$$\mathbf{SAR}= \frac{Na^{+}}{\sqrt{\frac{Ca^{2+}+Mg^{2+}}{2}}}.$$

Trace elements in the water samples (Fe, Mn, Zn, Cu, Ni, Pb, Co and Cd) were determined using by (I C P) absorption spectrometry



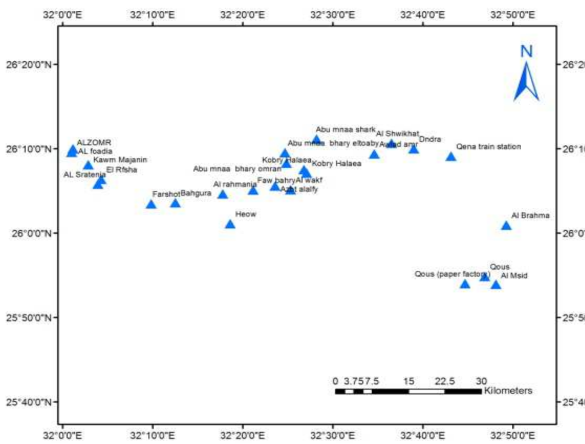



**Fig. 1. Location of water samples**

**Soil samples and analysis :** Explained in Fig (2) soil samples were collected from 25 locations in eight major cities of Abu-Tasht, Farshout, Ngi Hmmadi, Dishna, Qena, Dndra, Qft and Qus, respectively in Qena Governorate, Egypt .All soil samples were placed in a plastic bucket and carried to the laboratory .The collected surface soil samples were air-dried and sieved through a 2 mm sieve, then stored in air-tight polyethylene bottles. Determination of some physical and chemical properties and available trace elements (Fe, Mn, Zn ,Cu, Ni, Pb, Co and Cd) concentration were estimated in the soils and water laboratory, Faculty of Agriculture, Sohag University.

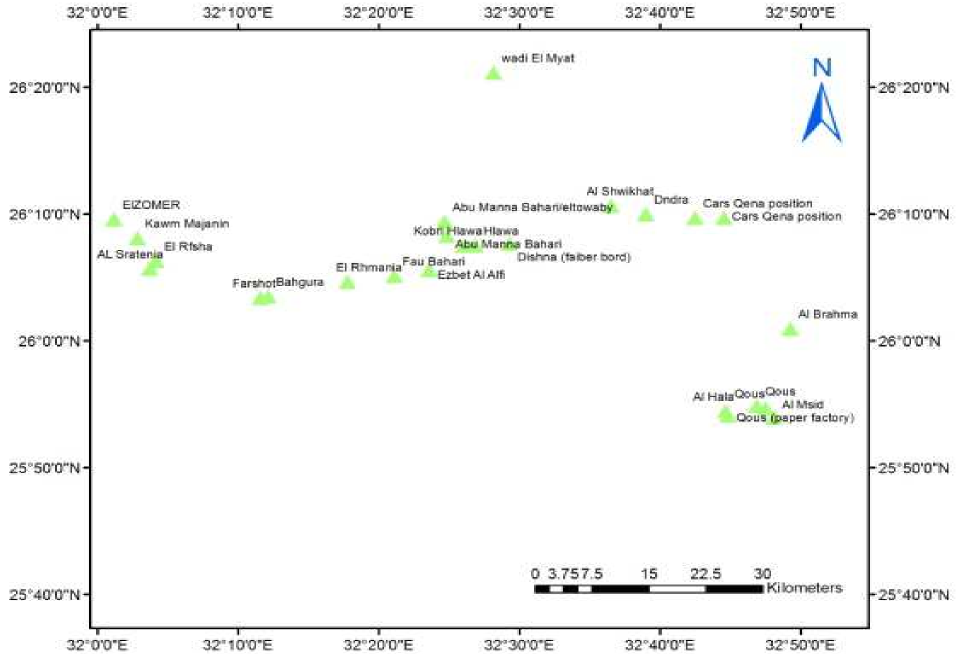



**Fig. 2. Location of soil samples**

The soil pH was measured by means of a digital pH meter_ (Cole Parmer). Mechanical analysis was determined by the pipette method for particle size distribution (Page et. Al, 1982). Organic matter was estimated by the rapid titration method of (Klute and Dirksen, 1986). Total soil salinity (ECe) was measured by electrical conductivity meter. Soluble cations and anions were determined in the soil paste extract. Calcium , magnesium, carbonates ,bicarbonates and chlorides in surface soil samples were determined by titration while sodium and potassium were measured by a flame photometer (Page *et al*, 1982) .Chemically-extractable heavy metal were determined in diethelyne-triamine-pentaaceticacid (DTPA) at pH 7,3 using (I C P) according to (Lindsay and Norvel, 1978).

## RESULTS AND DISCUSSION

**Chemical characteristics of water samples:**

Results in Table (1) showed the pH of the water samples ranged from 6.39 to 8.00 with a mean value of 7.19 The maximum mean pH (8.00) was observed in Qus (paper factory), while the minimum (6.39) in Dishna (kalabia canal). A low value of pH was noted in all branches of Al- kalabia canal. The low pH in water sample of majorly occurs as a result of untreated industrial waste disposal (fiber board factory of Dishna) in to Al-Kalabia canal, These waste water are considered a rich source of organic matter and acid compounds in the process of fiber board production, large quantities from organically loaded factory waste occur. They are strongly polluted by wood ingredients, such as organic acids, saccharides and aldehydes. (Brimblecombe, *et. al,*1992).

Electrical conductivity (ECw) of water samples from all 25 sites ranged from 0.26 to 11.14 dSm−1 with a mean value of 1.52 dSm−1. In addition, the samples from ground water(Abu mnaa Shark) and Eltwaby canal - Abu mnaa Bahary ) had higher ECw concentration than the permissible concentration limits recommendations (Rhoades, 1982) This may be due to dump the sewage directly into the water drains (Eltwaby canal).

The SAR of the water samples ranged from 0.70 to 14.5 with a mean value of 2.99. The maximum mean SAR (14.5) was observed in Dishna (Eltwaby canal - Abu mnaa Bahary) samples, while the minimum (< 2) were found in most samples study. The cationic composition of the soluble salts is mostly dominated by sodium and /or calcium followed by magnesium, while potassium is the least. Sodium concentrations varied widely from one location to another, increase of sodium concentrations in the study area under the urban and industrial sites may be due to the sewage and industrial wastes which reach the water surface directly into the water drains. Meanwhile, the anionic distribution has variable trends with tend highest of bicarbonate and chlorides followed by sulfate.

**Physical and Chemical characteristics of soil samples:**

Table (2) Results showed that the sandy loam fraction was prevailed followed by silt loam over the other size fractions in the study area. In addition, results showed the clay content weather least, this may be attributed to the migration of clay with the percolating irrigation water following the agricultural practice. The organic matter contents of soils ranged between 0.28 and 2.81 %. These results agree with those obtained by (Ibrahim, *et. al,* 2001) who report that the organic matter percent of the soil of Sohag region ranges between 0.1 and 2.6 %. The data revealed that calcium carbonate percent in the studied soils ranged from 0.16 to 18.66%. The maximum calcium carbonate (to 18.66%.) was observed in Dishna (El Myat) samples, while the minimum (0.1%) were found in location (17) Qena.

**Table 1. Some properties of surface water in Qena governorate.**

| No | Sampling sites | $Ec_w$ dS/m | pH | Soluble cations and anions me/l | | | | | | | SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | $Cl^{-}$ | $HCO^{-3}$ | $SO_4^{--}$ | |
| 1 | ALZOMR | 0.533 | 7.10 | 1.78 | 0.87 | 1.94 | 0.74 | 3.51 | 1.55 | 0.27 | 1.68 |
| 2 | AL foadia | 0.592 | 7.33 | 1.78 | 0.97 | 2.18 | 0.99 | 3.57 | 2.33 | 0.02 | 1.85 |
| 3 | Kawm Majanin | 0.278 | 7.21 | 1.29 | 0.13 | 1.26 | 0.08 | 1.48 | 1.21 | 0.09 | 1.49 |
| 4 | El Rfsha | 0.352 | 7.01 | 0.95 | 1.32 | 0.87 | 0.36 | 2.18 | 1.21 | 0.13 | 0.81 |
| 5 | AL Sratania | 0.304 | 7.11 | 0.77 | 1.25 | 0.72 | 0.28 | 1.96 | 0.93 | 0.15 | 0.71 |
| 6 | Farshut | 0.323 | 7.33 | 1.53 | 0.10 | 1.47 | 0.12 | 1.22 | 1.42 | 0.59 | 1.62 |
| 7 | Bahgura | 0.293 | 7.20 | 0.68 | 1.30 | 0.70 | 0.24 | 1.32 | 1.20 | 0.41 | 0.70 |
| 8 | Al Rahmania | 0.595 | 6.69 | 1.16 | 1.87 | 1.98 | 0.93 | 2.88 | 2.42 | 0.65 | 1.60 |
| 9 | Heow | 1.400 | 7.63 | 3.38 | 2.72 | 6.46 | 1.43 | 7.45 | 4.90 | 1.64 | 3.69 |
| 10 | Faw Bahry | 0.772 | 6.53 | 2.73 | 0.83 | 3.12 | 1.03 | 5.23 | 2.15 | 0.34 | 2.33 |
| 11 | Azbt Alalfly | 0.627 | 6.85 | 1.46 | 1.31 | 2.52 | 0.97 | 3.25 | 2.35 | 0.67 | 2.14 |
| 12 | Abu Mnaa Bahary Amar (agricultural drainage water) | 3.160 | 7.37 | 12.43 | 4.69 | 13.6 | 0.82 | 17.80 | 11.60 | 2.20 | 4.66 |
| 13 | Eltwaby canal - Abu Mnaa Bahary | 10.93 | 6.60 | 23.12 | 15.2 | 63.5 | 7.41 | 40.60 | 63.8 | 4.90 | 14.5 |
| 14 | Klabia | 0.646 | 6.39 | 2.34 | 0.91 | 2.62 | 0.59 | 4.25 | 1.95 | 0.26 | 2.05 |
| 15 | Kobry Halaea | 0.666 | 6.53 | 1.47 | 1.24 | 3.31 | 0.63 | 3.62 | 2.48 | 0.56 | 2.84 |
| 16 | Abu Mnaa Shark | 11.14 | 7.25 | 26.54 | 16.2 | 54.2 | 13.4 | 67.33 | 37.46 | 6.61 | 11.71 |
| 17 | Awlad Amr | 0.525 | 7.18 | 1.51 | 0.93 | 2.18 | 0.63 | 3.00 | 1.85 | 0.40 | 1.97 |
| 18 | Al Shwikhat | 0.266 | 7.90 | 1.07 | 0.26 | 1.18 | 0.13 | 1.64 | 0.86 | 0.16 | 1.44 |
| 19 | Qena train station | 0.511 | 7.72 | 0.94 | 1.08 | 2.61 | 0.48 | 3.44 | 1.15 | 0.52 | 2.59 |
| 20 | Al Brahma | 0.261 | 7.50 | 0.92 | 0.48 | 1.11 | 0.08 | 1.62 | 0.68 | 0.31 | 1.32 |
| 21 | Al Msid | 0.270 | 7.30 | 1.03 | 0.53 | 0.99 | 0.13 | 1.57 | 0.93 | 0.20 | 1.12 |
| 22 | Qus | 0.538 | 7.62 | 1.46 | 0.95 | 2.31 | 0.64 | 2.55 | 2.45 | 0.28 | 2.10 |
| 23 | Qus (paper factory) | 1.950 | 8.00 | 4.08 | 3.60 | 10.6 | 1.18 | 12.48 | 4.52 | 2.50 | 5.42 |
| 24 | Al wakf | 0.534 | 7.23 | 1.72 | 0.93 | 1.94 | 0.74 | 3.20 | 2.10 | 0.04 | 1.68 |
| 25 | Dndra | 0.575 | 7.23 | 2.21 | 0.64 | 2.34 | 0.55 | 3.64 | 1.24 | 0.15 | 1.96 |

**Table 2. Location and some soil physical properties of soil samples .**

| Location of soil samples | | | Soil texture | | | | OM% | $CaCO_3$ % |
|---|---|---|---|---|---|---|---|---|
| province | NO | Location | Sand% | Silt% | %Clay | Texture | | |
| | 1 | Kowm Majanein | 52.0 | 26.4 | 21.6 | Sand clay lom | 2.02 | 0.73 |
| Abu -Tasht | 2 | ElZOMR | 70.1 | 25.2 | 4.7 | Sand lom | 1.13 | 2.13 |
| | 3 | AL Srateinia | 56.2 | 27.5 | 16.3 | Sand lom | 0.87 | 2.21 |
| | 4 | El Rafsha | 37.1 | 54.9 | 8.0 | Silt loam | 2.31 | 2.3 |
| Farshout | 5 | Farshout | 37.5 | 51.5 | 11.0 | Silt loam | 1.15 | 0.32 |
| | 6 | Bahgora | 24.0 | 56.3 | 19.7 | Silt loam | 0.86 | 0.73 |
| Ngi Hmmady | 7 | El Rhamania | 22.6 | 53.1 | 24.3 | Silt loam | 2.31 | 0.73 |
| | 8 | Fau Bahary | 53.7 | 28.7 | 17.6 | Sand loam | 0.86 | 1.06 |
| | 9 | Ezbet Al AlfY | 65.4 | 24.8 | 9.8 | Sand loam | 0.57 | 1.47 |
| | 10 | Abu Manna Bahari | 46.8 | 43.5 | 9.7 | Loam | 0.57 | 2.05 |
| Dishna | 11 | Kobri Hlawa | 52.4 | 28.4 | 19.2 | Sand loam | 0.73 | 2.05 |
| | 12 | Dishna (fiber board) | 62.8 | 22.9 | 14.3 | Sand loam | 0.57 | 0.25 |
| | 13 | Abu Manna Bahari/ Eltwaby | 41.3 | 36.0 | 22.7 | Loam | 2.81 | 9.51 |
| | 14 | Wadi El Myat | 84.5 | 13.4 | 2.1 | Loam sand | 0.45 | 18.66 |
| | 15 | Cars Qena position | 59.2 | 31.5 | 9.3 | Sand loam | 0.28 | 0.16 |
| Qena | 16 | Al Brahma | 81.0 | 15.4 | 3.6 | Loam sand | 0.28 | 1.80 |
| | 17 | Cars Qena position | 33.7 | 34.6 | 31.7 | Clay loam | 0.57 | 3.36 |
| Dndra | 18 | Dndra | 68.2 | 23.9 | 7.9 | Sand loam | 0.86 | 1.23 |
| Qeft | 19 | Al Shwikhat | 9.0 | 73.5 | 17.5 | Silt loam | 1.02 | 3.36 |
| | 20 | Al Msid | 64.5 | 21.9 | 13.6 | Sand loam | 1.17 | 0.90 |
| Qus | 21 | Qus | 41.0 | 42.6 | 16.4 | Loam | 1.88 | 3.85 |
| | 22 | Qus | 53.3 | 41.2 | 5.5 | Sand loam | 1.73 | 2.46 |
| | 23 | Hlawa | 9.30 | 71.5 | 19.2 | Silt loam | 0.86 | 18.53 |
| | 24 | Qus (paper factory) | 41.2 | 23.8 | 35.0 | Clay loam | 2.60 | 4.92 |
| | 25 | Al Hala | 53.0 | 21.0 | 26.0 | Sand clay loam | 0.28 | 0.49 |

Table (3) represent the chemical characteristic of soil study, the results indicated that the pH values of the soil samples ranged between 7.2 and 8.68. The ECe values of soil samples varied widely from one location to another ranged from non saline to slightly saline, as evidenced from the ECe values which range from 0.77 to 6.01 dSm -1 in most soil samples within exceptional cases are found in site 5&22 where ECe 9.09 and 15.47 dS/m-1, respectively. The soluble cations follow the order Na > Ca > Mg> K. for most of soil samples. Meanwhile, the soluble anionic distribution has variable trends with tend highest of HCO-3 and Cl- while SO4-- is the least.

**Content of some trace elements in the water samples:**

**Iron :-**Table (4) and Fig (3) showed that the iron concentration in the water samples ranged from 0.22 to 2.86 with a mean value of 1.29 mg/L. In this study, clearly indicates that, in all the cases, the concentration of Fe are considerably below the limits for irrigation water, recommended by (5 mg/L) (Ayers, et.al, 1985) except for drainage water(Amar canal) which had the concentrations of iron being higher than the permissible concentration limits of irrigation water (9.21 mg/L) In general, sources of iron in water include human activities such as chemical fertilizer application, waste disposal, and long-term irrigation of wastewater in agricultural land and atmospheric deposition (Koch and Rotard, 2001; Bilos, *et al* 2001) .

**Table 3. Some soil chemical properties of the representative soil samples.**

| NO | Soil extract | | Soluble cations and anions me/l | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Ece dS/m | PH | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | HCO | $Cl^{-}$ | $SO_4^{--}$ |
| 1 | 2.83 | 8.6 | 12.6 | 7.4 | 7.12 | 1.03 | 15.8 | 9.4 | 3.1 |
| 2 | 0.95 | 8.1 | 2.6 | 1.2 | 4.11 | 1.19 | 4.2 | 5.2 | 0.1 |
| 3 | 0.77 | 8.6 | 1.4 | 1.8 | 4.14 | 0.16 | 4.2 | 3.0 | 0.5 |
| 4 | 2.26 | 7.8 | 5.4 | 3.4 | 11.6 | 1.41 | 4.6 | 16.8 | 0.6 |
| 5 | 9.09 | 7.6 | 47.4 | 17.4 | 23.31 | 2.01 | 37.4 | 48.6 | 4.9 |
| 6 | 1.96 | 8.1 | 9.4 | 3.6 | 4.65 | 1.58 | 10.2 | 7.8 | 1.6 |
| 7 | 0.88 | 8.2 | 3.0 | 1.2 | 3.67 | 0.81 | 5.2 | 3.4 | 0.2 |
| 8 | 0.96 | 8.0 | 3.2 | 1.6 | 4.05 | 0.32 | 5.2 | 4.4 | 0.1 |
| 9 | 1.23 | 8.2 | 5.8 | 1.2 | 4.82 | 0.32 | 5.2 | 6.4 | 0.7 |
| 10 | 0.88 | 7.9 | 2.0 | 1.6 | 4.48 | 0.51 | 5.2 | 3.4 | 0.2 |
| 11 | 1.86 | 7.5 | 4.6 | 5.0 | 7.84 | 0.57 | 12.8 | 5.6 | 0.2 |
| 12 | 2.09 | 7.6 | 7.2 | 2.8 | 8.38 | 1.96 | 7.0 | 13.4 | 0.5 |
| 13 | 5.05 | 7.8 | 27.0 | 19.0 | 3.73 | 0.06 | 22.0 | 24.8 | 3.7 |
| 14 | 4.13 | 8.5 | 7.8 | 5.6 | 26.05 | 0.68 | 6.8 | 34.2 | 0.3 |
| 15 | 1.01 | 8.1 | 2.2 | 2.4 | 4.24 | 1.02 | 3.4 | 5.4 | 1.3 |
| 16 | 1.56 | 7.6 | 4.8 | 1.6 | 7.43 | 1.58 | 8.4 | 7.0 | 0.2 |
| 17 | 0.97 | 8.1 | 2.8 | 2.4 | 3.86 | 0.53 | 6.2 | 3.2 | 0.3 |
| 18 | 3.08 | 7.9 | 14.6 | 7.2 | 7.52 | 1.19 | 18.1 | 12.4 | 0.3 |
| 19 | 3.09 | 7.5 | 24.0 | 2.0 | 4.66 | 0.67 | 11.6 | 18.6 | 0.7 |
| 20 | 1.22 | 8.0 | 6.4 | 3.4 | 1.47 | 0.67 | 5.6 | 6.6 | 0.1 |
| 21 | 2.59 | 8.6 | 5.6 | 2.6 | 17.01 | 0.21 | 15.4 | 10.4 | 0.1 |
| 22 | 15.47 | 7.5 | 78.4 | 28.8 | 32.82 | 13.82 | 15.0 | 138.6 | 1.1 |
| 23 | 0.96 | 8.2 | 5.8 | 1.4 | 1.92 | 0.27 | 7.2 | 2.0 | 0.4 |
| 24 | 6.01 | 7.2 | 24.6 | 16.2 | 10.02 | 8.76 | 45.2 | 14.6 | 0.3 |
| 25 | 5.78 | 8.1 | 28.4 | 7.4 | 18.64 | 2.65 | 11.6 | 46.0 | 0.2 |

**Table 4. Heavy metal concentration in water sample**

| No | Concentration mg $L^{-1}$ | | | Concentration ug/L | | | | |
|---|---|---|---|---|---|---|---|---|
| Normal | Fe | Mn | Zn | Cu | Ni | Pb | Co | Cd |
| water Median | 5.0 | 0.2 | 0.2 | 200 | 200 | 5000 | - | 10 |
| 1 | 0.22 | 0.10 | 0.91 | 81 | 60 | 171 | 1.4 | 6 |
| 2 | 0.67 | 0.14 | 0.8 | 15 | 120 | 150 | 0.8 | 3 |
| 3 | 1.57 | 0.23 | 0.63 | 24 | 110 | 112 | 1.5 | 6 |
| 4 | 1.62 | 0.15 | 0.16 | 26 | 170 | 123 | 1.2 | 5 |
| 5 | 1.21 | 0.04 | 0.25 | 5 | 160 | 64 | 1.8 | 3 |
| 6 | 0.63 | 0.12 | 0.71 | 17 | 53 | 58 | 0.2 | 3 |
| 7 | 1.21 | 0.03 | 0.18 | 16 | 27 | 41 | 2.1 | 2 |
| 8 | 0.77 | 0.13 | 0.71 | 82 | 370 | 243 | 1.8 | 14 |
| 9 | 0.62 | 0.13 | 0.46 | 18 | 21 | 389 | 1.5 | 5 |
| 10 | 1.04 | 0.21 | 0.63 | 105 | 632 | 176 | 1.6 | 17 |
| 11 | 0.39 | 0.13 | 0.71 | 12 | 24 | 115 | 1.7 | 3 |
| 12 | 9.21 | 0.42 | 2.47 | 141 | 336 | 490 | 1.3 | 17 |
| 13 | 2.34 | 1.27 | 1.53 | 237 | 660 | 603 | 1.6 | 26 |
| 14 | 0.59 | 0.15 | 0.85 | 182 | 283 | 35 | 1.3 | 16 |
| 15 | 0.41 | 0.18 | 0.98 | 57 | 226 | 31 | 0.3 | 12 |
| 16 | 0.27 | 0.02 | 0.28 | Nil | 33 | 327 | Nil | 1 |
| 17 | 0.24 | 0.02 | 0.55 | 14 | 6 | 118 | 1.4 | 9 |
| 18 | 0.68 | 0.02 | 0.32 | 26 | 25 | 91 | 1.1 | 2 |
| 19 | 1.65 | 0.35 | 0.27 | 221 | 174 | 525 | 1.4 | 17 |
| 20 | 1.54 | 0.02 | 0.65 | 17 | 68 | 16 | 0.6 | 2 |
| 21 | 0.62 | 0.13 | 0.28 | 13 | 41 | 195 | 1.2 | 3 |
| 22 | 1.37 | 0.32 | 0.32 | 190 | 42 | 142 | 3.6 | 2 |
| 23 | 2.86 | 0.26 | 1.82 | 241 | 1220 | 912 | 5.6 | 220 |
| 24 | 0.37 | 0.22 | 0.43 | 34 | 27 | 385 | 0.1 | 2 |
| 25 | 0.26 | 0.14 | 0.52 | 18 | 45 | 416 | 0.8 | 4 |

**Manganese:-** The results showed that manganese concentrations in the water samples in the study area ranged (0.02 to 1.27 mg / L) with a mean value of 0.18 mg/L, Table (4) and Fig (4). It was observed that, in few of the water sample, the concentrations of manganese were higher than the permissible limits of irrigation water, recommended by (0.2 mg/L). (Ayers, et.al, 1985). This result agree with those obtained by (Gonzalez *et al*, 2000).

**Zinc:-** Table (4) and Fig (5) showed that the Zinc concentration in the water samples ranged from 0.16 to 2.47 mg/L with a mean value of 0.69 mg/L. These results show that Zn content of canal water found in the safe range while in agricultural drainage water it is slightly above the maximum permissible level, recommended by (2.0 mg/L). (Ayers, et.al, 1985). This may be due to the intensive uses of the chemical fertilizers in agriculture.. These results agree with those obtained by (Komosa, 1999) who found that the Zn content did not exceed the permissible concentration limit in waste water introduced to soils.

**Copper:-** Table (4) and Fig (6) showed that the copper concentration in the water sample did not exceed the permissible limit to 241.0 ug/L with a mean value of 71.68 ug/L. The maximum concentration of Cu 241.0 ug/L in water was observed at Qus (paper factory), This may be due to the mixture of industrial and domestic wastewater contains on trace elements with surface water (Kennish .1992).The concentration of Cu are considerably below the limits for irrigation water, recommended by (200 ug/L) (Ayers, *et.al* .1985) with the exception of surface water (Qus and Al-Tawaby canal) which had the concentrations of Cu higher than the permissible concentration limits of irrigation water (241.0 and 237.0 ug/L, respectively).

**Nickel:-**Table (4) and Fig (7) showed that the nickel concentration in the water samples ranged from 6.0 to 1220 ug/L with a mean value of 230.0 ug/L. The maximum concentration of Ni 1220 & 660 ug/L in water surface was observed at Qus (paper factory) and El- Tawaby canal Abu Mnaa Bahary, respectively, This is expected due to the fact that El- Tawaby canal water is mixed with sewage water.

These results show that Ni content of canal water found in safe range while in water it is slightly above the maximum permissible level, recommended by (200 ug/L). (Ayers, et.al, 1985). The nickel content is increased towards the industrial zone and sewage. This may be attributed to the sewage effluents which considered not only a rich source of organic matter and other nutrients but also they elevate the concentration of trace elements such as Ni, Fe, Mn, Cu, Zn, Co and Cd in receiving soils (Singh *et al.* 2004).

**Lead (Pb):-**Lead concentrations of the studied water samples found were by table (4) and Fig (8) ranged from 16 to 912 ug/L with a mean value of 230 ug/L.( Komosa .1999) who found that river sediment contamination with lead content did not exceed the permissible concentration limit in sewage sludge introduced to soils.

The data showed that the concentration of lead (Pb) in all sites did not exceed the permissible concentration limits for irrigation water recommended by FAO (5 mg/L).(Ayers, *et al* .1985).

**Cobalt:-** Table (4) and Fig (9) showed that the cobalt concentration in the water samples did not exceed the permissible limit ranged from to 5.6 ug/L with a mean value of 1.4 ug/L. The majority of detected cobalt concentrations were less than 50 ug/L. FAO guidelines for cobalt concentration in irrigation water. The maximum concentration of Co, 5.6 ug/L was observed in water at Qus (paper factory). These results agree with those obtained by (Smith and Carson. 1981). They reported that cobalt concentrations in streams close to populated areas range from 1 ug/L to 10 ug/L. The major anthropogenic sources of environmental cobalt include mining and phosphate fertilizers on soil, and atmospheric deposition from activities such as the burning of fossil fuels and smelting and refining of metals.

**Cadmium:** In the water samples collected from different sites ranged from 1.0 – 220.0 ug/L with a mean concentration of 7.0 ug/L. The maximum concentration of Cd 26.0 ug/L in water was observed at Qus (paper factory) No. 23,. while minimum concentration of Cd (1.0 ug/L) was observed at Abu Mnaa shark desert (ground water) Table 4 and Fig (10). Disposal of sewage water and industrial wastes is a great problem; often it is drained to surface water, The concentration of Cd above the permissible limits might be due to the mixing of sewage water and industrial waste effluent into the canal, These results agree with those obtained by(Ahumada *et al*., 1999) who reported that a high concentration of Cd content in untreated wastewater increase their concentrations in the applied soils.The concentrations of cadmium was in permissible limits of irrigation water, recommended by FAO (0.01mg/L). (Ayers, *et.al* 1985).

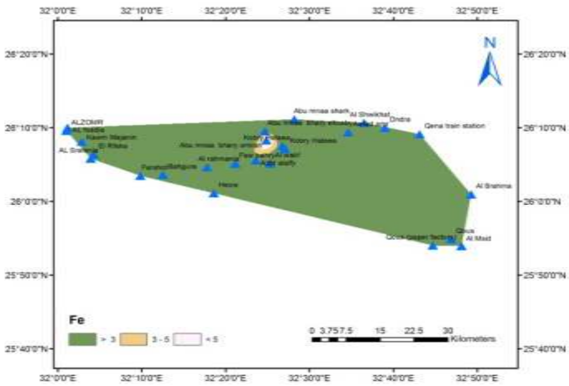



**Fig. 3. Iron concentration of the surface water samples**

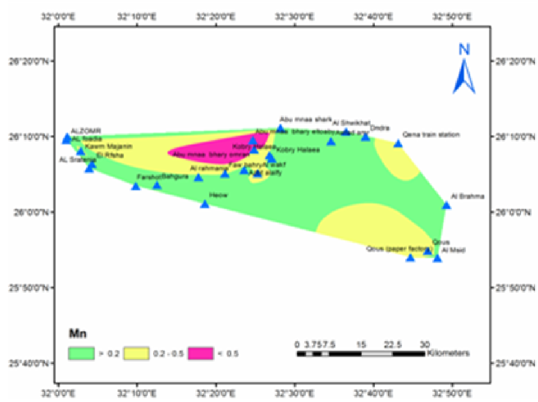



**Fig. 4. Manganese concentration of the surface water samples**

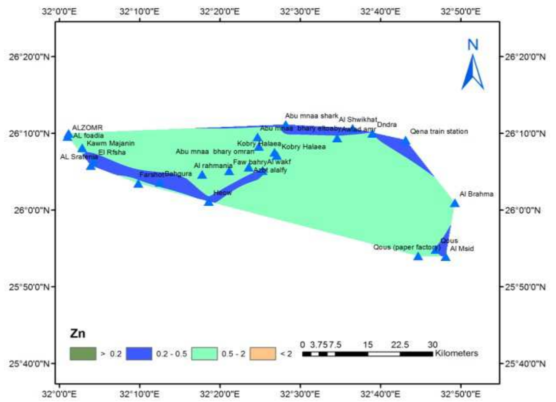



**Fig. 5. Zinc concentration of the surface water samples**

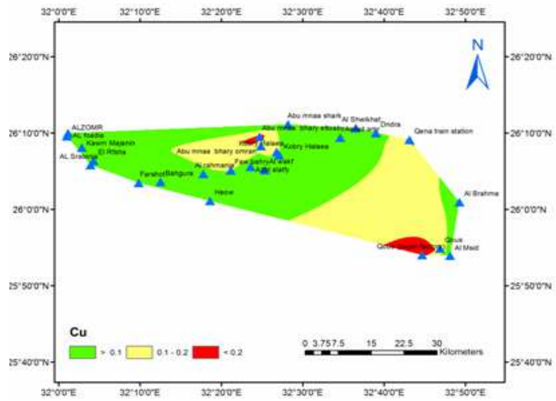



**Fig. 6. Capper concentration of the surface water samples**

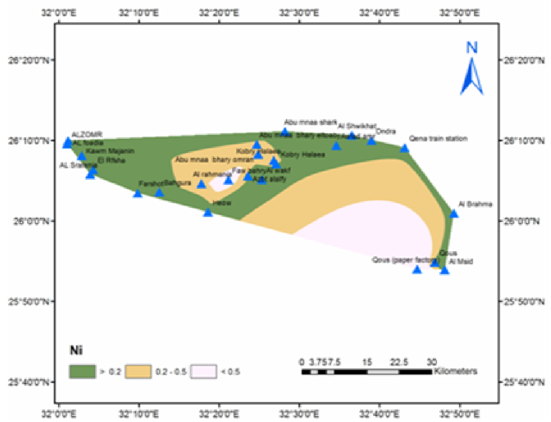



**Fig. 7. Nickel concentration of the surface water samples**

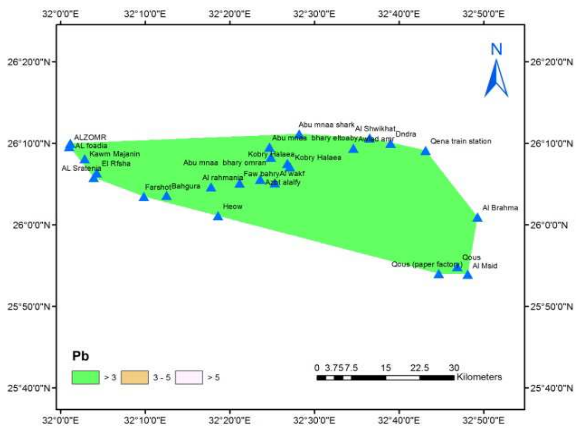



**Fig. 8. Lead concentration of the surface water samples**

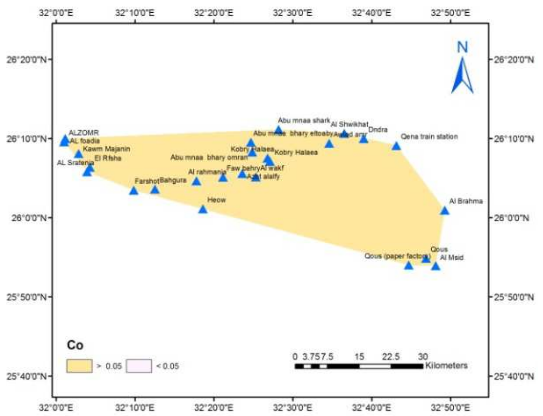


Fig. 9. Cobalt concentration of the surface water samples

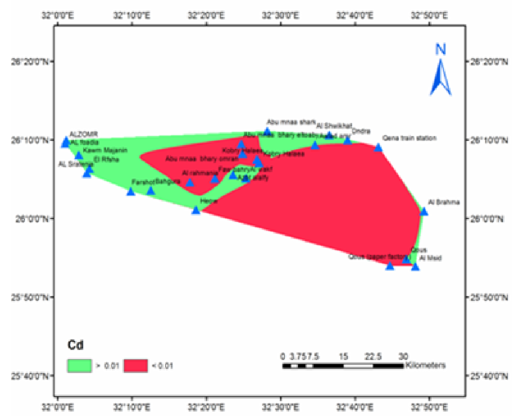


Fig. 10. Cadmium concentration of the surface water samples

**DTPA-extractible Fe, Mn, Zn, Cu, Ni, Pb, Co and Cd in soil samples.**

Table (5) shows the distribution patterns of DTPA-extractable Fe, Mn, Zn, Cu, Ni, Pb, Co and Cd in all the studied soil sampling sites. DTPA-extractable metals have been considered as available nutrients, Lindsay and Norvell, (1978). It is obvious that the soil samples taken from the Qena governorate area contained DTPA-extractable metals followed the sequence Fe> Mn> Zn> Cu> Co >Pb > Ni > Cd.

**Table 5. Dtpa Extrctable Heavy Metals Concentration In Soil Samples.**

| No | Trace elements concentration mg/kg$^{-1}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fe | Mn | Zn | Cu | Ni | Pb | Co | Cd |
| 1 | 3.21 | 9.22 | 1.8 | 0.42 | 0.21 | 0.57 | 0.62 | 0.01 |
| 2 | 8.79 | 19.81 | 1.2 | 0.13 | 0.92 | 0.05 | 2.41 | Nil |
| 3 | 12.5 | 2.18 | 0.82 | 0.94 | 0.23 | 0.92 | 2.6 | 0.04 |
| 4 | 3.52 | 1.05 | 0.79 | 0.82 | 0.71 | 0.03 | 0.51 | 0.01 |
| 5 | 7.85 | 0.81 | 0.96 | 1.53 | 0.05 | 1.3 | 2.81 | 0.02 |
| 6 | 11.67 | 12.6 | 0.43 | 2.24 | 0.72 | 0.31 | 3.1 | 0.03 |
| 7 | 5.5 | 3.43 | 0.64 | 0.54 | 0.21 | 0.34 | 0.26 | Nil |
| 8 | 12.64 | 16.0 | 0.53 | 0.18 | 0.45 | 1.76 | 2.03 | 0.02 |
| 9 | 15.7 | 13.6 | 0.31 | 1.76 | 0.70 | 0.65 | 0.41 | Nil |
| 10 | 5.41 | 14.2 | 0.75 | 1.64 | 1.10 | 0.23 | 0.27 | Nil |
| 11 | 7.31 | 13.7 | 0.89 | 2.88 | 0.95 | 0.17 | 0.53 | 0.01 |
| 12 | 33.42 | 15.5 | 8.12 | 2.46 | 1.23 | 1.74 | 2.63 | 0.10 |
| 13 | 19.75 | 14.3 | 3.16 | 1.40 | 1.00 | 0.75 | 0.21 | 0.05 |
| 14 | 4.85 | 3.32 | 0.04 | 0.33 | 0.85 | 0.58 | 0.49 | 0.01 |
| 15 | 10.54 | 7.47 | 3.02 | 1.08 | 0.78 | 2.1 | 2.06 | 0.02 |
| 16 | 6.12 | 0.53 | 0.5 | 2.00 | 1.15 | 0.73 | 0.89 | 0.02 |
| 17 | 12.32 | 8.14 | 2.45 | 1.81 | 0.11 | 0.54 | 1.24 | 0.01 |
| 18 | 4.32 | 6.34 | 1.13 | 0.76 | 0.23 | 0.52 | 0.23 | 0.01 |
| 19 | 7.86 | 5.00 | 0.72 | 1.15 | 0.48 | 1.48 | 0.64 | 0.01 |
| 20 | 20.76 | 8.77 | 2.26 | 2.81 | 1.26 | 0.83 | 0.18 | 0.02 |
| 21 | 4.25 | 9.00 | 1.47 | 2.14 | 0.24 | 0.42 | 0.35 | 0.01 |
| 22 | 9.32 | 10.4 | 5.92 | 1.27 | 1.22 | 0.78 | 0.32 | Nil |
| 23 | 12.33 | 7.92 | 2.54 | 1.35 | 0.71 | 0.31 | 0.15 | 0.01 |
| 24 | 19.43 | 7.75 | 7.43 | 4.92 | 1.12 | 2.00 | 1.00 | 0.01 |
| 25 | 4.84 | 5.79 | 1.54 | 3.21 | 0.23 | 1.00 | 1.22 | 0.01 |

**DTPA-extractable iron (Fe)**

Table (5) and Fig (11) showed that the level of DTPA-extractable Fe in soil samples ranged from 3.2 to 33.42 mg/kg, with an average value of 9.25 mg/kg. The highest Fe concentration of 33.42 mg kg$^{-1}$ soil was detected at Dishna (faiber bord)), which is located at industrial area. Generally, Fe concentration tended to decrease with distance from the factory. Low pH values in industrial site could possibly increase the solubility and mobility of metals in the soils. The wastewater disposal resulting in a greatly decreased the soil pH by two to three units and consequently can affect on the forms and availability of nutrients and biological activity (Ibrahim et.al, 2010). The varying concentration levels of the DTPA-extractable Fe were due to the differences in location and sampling sites. All soils have DTPA-Fe above the critical value of 4.5 mg kg$^{-1}$ ( Lindsay and Norvell,1978).

**DTPA-extractable manganese (Mn)**

Table (5) and Fig (12) present the level of DTPA-extractable Mn in all the studied soil sampling sites which ranged from 0.53 to 19.81 mg/kg, with an average value of 8.67 mg/kg. Levels of DTPA-extractable Mn in the surface layers were relatively higher in the industrial zone and cultivated soil. This may be due to the intensive uses of the chemical fertilizers in agriculture. In general, for all the soils showed a very wide range of variation between the minimum and maximum values. All soils have DTPA- Mn above the critical value of 2. 0 mg kg$^{-1}$ Lindsay and Norvell (1978).

**DTPA-extractable zinc (Zn)**

The results of the DTPA-extractable Zn in the studied soils are shown in table (5) and Fig (13). The data show that the level of DTPA-extractable Zn in the studied soils ranged from 0.04 to 8.12 mg/kg$^{-1}$ with an average value of 1.97 mg/kg$^{-1}$. The highest values of available zinc were found in the soil samples that represent the soil of Dishna, while the least content was found in wadi El Myat, the lowest concentration (0.04 mg kg$^{-1}$ soil) this was related to calcium carbonate and higher pH content of the soils. Generally, DTPA-extractable levels of zinc decreased with increasing pH and calcium carbonate content. Similar data have been reported by (Mathur *et al*, 2006).

**DTPA-extractable copper (Cu)**

The concentrations of extractable Cu for all the soils showed a very wide range between the minimum and maximum values. concentration of extractable Cu was found above the natural background level in some soil sample, this is also due to effluents and solid wastes of dying industry. In addition, available Cu content at most of the sites was found in the normal range in cultivated soil with few exceptions contained (< 1.0 mg kg$^{-1}$) Lindsay(1978). Table (5) and Fig (14) present that the level of DTPA-extractable Cu in all the studied soil sampling sites ranged from 0.13 to 4.92 mg/kg$^{-1}$, with an average value of 1.59 mg/kg. More or less, similar results were obtained by Gowd *et al* (2010).

**DTPA-extractable nickel (Ni)**

Table (5) and Fig (15) showed that the DTPA extractable Ni concentration in soil sample ranged from 0.05 -1.26 mg/kg$^{-1}$ with mean value of 0.67 mg/kg$^{-1}$.Maximum concentration of Ni was observed in samples collected at industrial sites. Nickel concentration at most of the sites was found in the normal range of 0.02-5.2 mg/kg$^{-1}$ in the soil (Alloway, 1990).The highest and the lowest Ni content were recorded at Dishna and Farshut, respectively. These results agree with those obtained by (Kumar and Srikantaswamy, 2012)

**DTPA-extractable lead (Pb)**

The results of the DTPA-extractable Pb in the studied soils are shown in Table (5) and Fig (16). The data show that the level of DTPA-extractable Pb in the studied soils ranged from 0.03 to 2.10 mg/kg$^{-1}$ with an average value of 0.80 mg/kg$^{-1}$, It was observed that the high concentrations of lead were associated in the areas near of the paper factory (Qus) and cars Qena position. Extractable Pb of the industrial area increased in adjacent sample to the paper factory. The factory may pollute the soil with lead directly through the air by smokes and particulates that come out of the chimney (Abd El-Tawab, M.M, 1985).

**DTPA-extractable cobalt (Co)**

The available extractable cobalt concentrations in soil samples are shown in Table (5) and Fig (17),the available Co content in these soils ranged widely between 0.21 and 3.1 mg kg$^{-1}$ with a mean value of 0.25 mg kg$^{-1}$. It was observed that the high concentrations of cobalt were associated by higher clay and silt content as compared to others. considering 0.25 mg kg$^{-1}$ of available Co as the critical limit (Stewart, 1953). The toxicity of cobalt under the present soil conditions depends not only on the concentrations of cobalt in soil but also, on several other factors such as soil reaction, clay content, fixation and /or complexing of cobalt by organic matter, and Its relevance to other elements. (Maher and Youssef 2008).

**DTPA-extractable cadmium (Cd)**

Data presented in table (5) and Fig (18) show that the values of chemically available (DTPA-extractable) cadmium in the soils did not exceed the permissible limit being 0.1 mg kg$^{-1}$ with an average value of 0.017 mg/kg$^{-1}$. The highest values of available cadmium were found in the soil samples that represent the soil of industrial zone. Extractable Cd levels in the surface soil samples increased due to industrial contamination occurung around the factory ,while the lowest ones belongs to the coarse textured sandy soils and cultivated soil. It was observed that the high concentrations of cadmium were in the areas near of the fiber board factory. This suggests that there might be possibility of the soil Cd reaching critical toxic levels around the factory this may be attributed to the passage of industrial waste water along that sampling area. The second highest contents of Cd was observed in the deposits canals and drains, in addition, cadmium enters the soil through various anthropogenic sources including application of phosphate fertilizers, waste water, Cd contaminated sewage sludge and manures and metal industries. These results are in agreement with (Jitendra, *et al* 2013) and ( ATSDR, 2000).

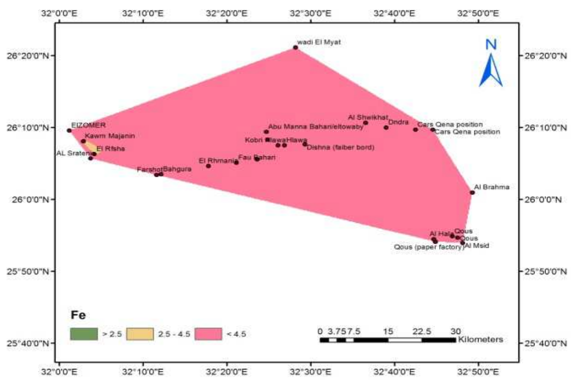


Fig. 11. Iron concentration of the surface soil samples

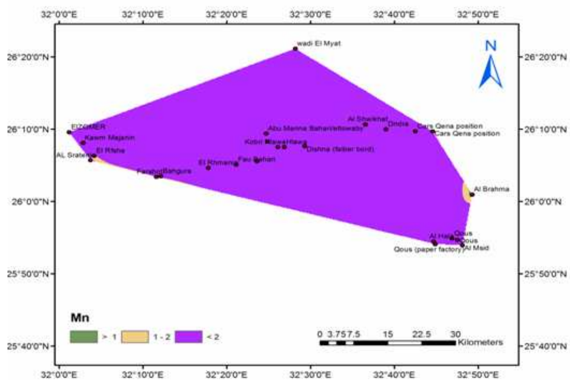


Fig. 12. Manganese concentration of the surface soil samples

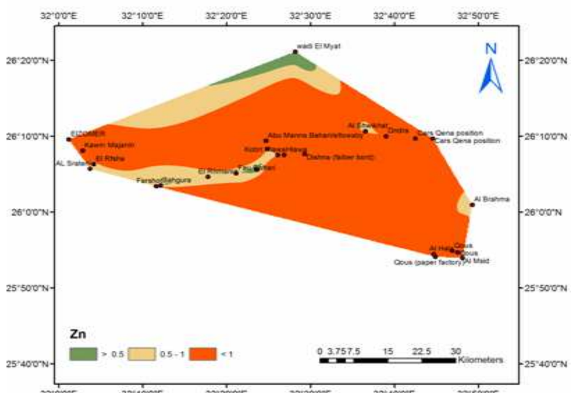


Fig. 13. Zinc concentration of the surface soil samples

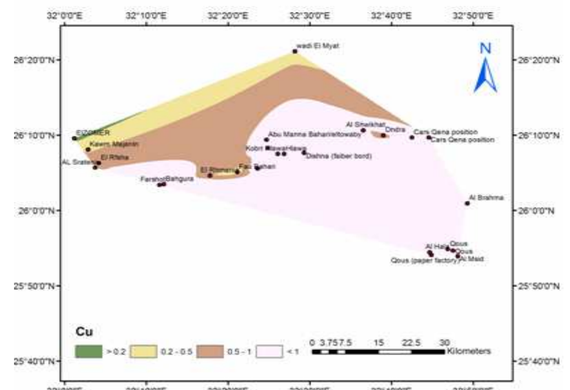


Fig. 14. Copper concentration of the surface soil samples

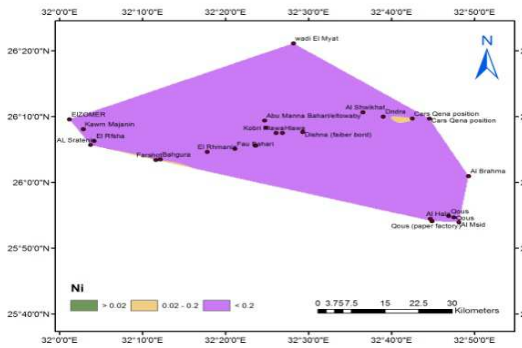



**Fig. 15. Nickel concentration of the surface soil samples**

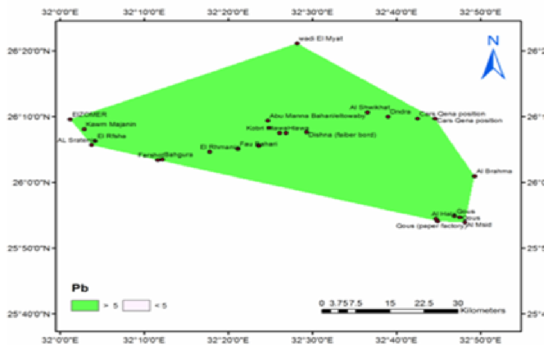



**Fig. 16. Lead concentration of the surface soil samples**

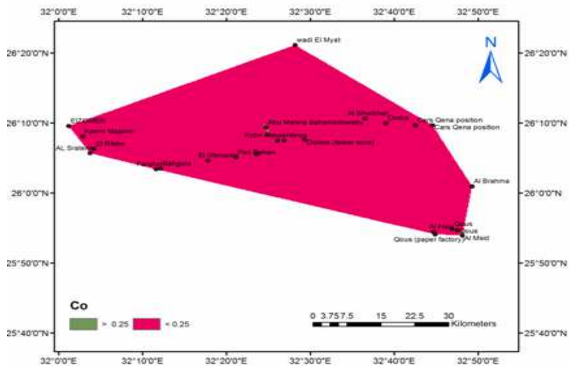



**Fig. 17. Cobalt concentration of the surface soil samples**

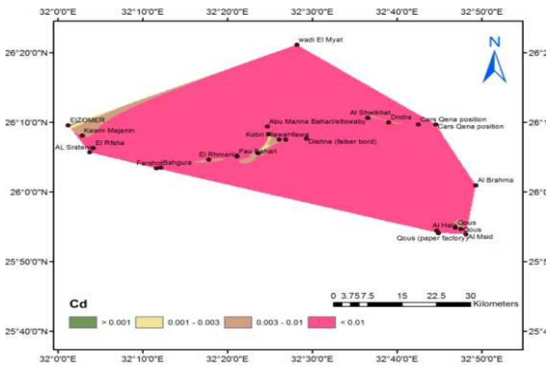



**Fig. 18. Cadmium concentration of the surface soil samples**

## CONCLUSION

**Chemical Properties and Heavy Metal Concentration in Water sample:** Electrical conductivity (EC) of the water samples:- most water samples are non saline to slightly saline .The entry of raw sewage and industrial waste into the water canal examined in the present study has contaminated it and reduced its pH and increased the water its EC, SAR and trace elements, this is expected due to the fact that El-Klabia, El-Towaby- Dishna and Qus canal water is mixed with sewage water and industrial waste. Trace elements concentration (Fe, Mn, Zn, Cu, Ni, Pb, Co, and Cd) in water samples were found higher in some sites this may be due to discharge of sewage and industrial waste into canal Qus and Dishna area.

These results show that trace elements content of canal water found in safe range while in canal water in El-Towaby and waste water in industrial site it is slightly above the maximum permissible level.

DTPA-extractable trace elements concentrations in soil sample (Qus –Dishna ) are mostly higher than those in the soil ( Abu- Tasht& Farshot) for control due to metals emitted from factories and other sources. This study indicated to most trace elements were above the natural trace elements concentration of soil surface. The data shows that iron had the highest concentration in the soil samples following by Mn> Zn> Cu> Co >Pb > Ni > Cd. The results indicate rising trend with time permissible levels where the results indicate rising trend with time Therefore, it is recommended that some safe ways should be used for the disposal of these wastes.

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## تقييم بعض الفلزات الثقيلة المستخلصة بالـ DTPA في اراضي ومياه محافظة قنا مصر

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أجريت هذه الدراسة بهدف تقييم بعض الفلزات الثقيلة لأراضي ومياه محافظة قنا ولإنجاز هذا الهدف تم جمع 25 عينة تربة سطحية و25 عينة ماء من مواقع مختلفة تمثل منطقة الدراسة وتم استخدام نظم المعلومات الجغرافية"GIS" في تخزين واسترجاع البيانات والمعلومات وعرض النتائج في شكل خرائط. واوضحت النتائج ان التركيز الكلي للأملاح EC في عينات التربة يختلف اختلافاً كبيراً من أراضي غير ملحيه إلى شديدة الملوحة مع عدم انتظام توزيعها من موقع لآخر، كما وجد سيادة كاتيون الصوديوم وانيون البيكربونات والكلوريد في مستخلص عجينه التربة المشبعة. ومن خلال الدراسة يتضح ان مستويات الفلزات الثقيلة المستخلصة بالـ DTPA لعينات التربة كانت على الترتيب التالي $Fe > Mn > Zn > Cu > Co > Pb > Ni > Cd$. اظهرت النتائج ان تركيز الأملاح EC في قنوات مياه الري في المدى الامن بينما في قنوات مياه الصرف سواء الزراعي او الصناعي اومياه المجاري تتفاوت من ملحية الي شديدة الملوحة . ومن خلال قيم pH لعينات المياه أتضح انها تميل الى مياه حمضية لعينات ترعة الكلابية بدشنا ويرجع ذلك الي التخلص من نفايات ومياه الصرف الصناعي لمصنع الفيبر بورد والتي تكون غنية بالمادة العضوية والمركبات الحمضية في عملية انتاج اللوح الليفي (الفيبربورد) الي ترعة الكلابية مباشرة اوضحت النتائج ان منطقة قوص ودشنا تحتوي على اعلي نسب من العناصر الثقيلة المستخلصة بالـ DTPA مقارنة بالمناطق الأخرى. اظهرت النتائج الى ارتفاع محتوي الفلزات الثقيلة في عينات المياه لقنوات مياه الصرف سواء الزراعي او الصناعي اومياه المجاري وخاصة عينات المياه الممثلة لمركز قوص (مصنع الورق) حيث قد تتجاوز تركيزاتها الحدود المسموح بها مما يتضح ان التلوث بالعناصر الثقيلة يرجع الي مياه المجاري ونفايات المصانع وعليه تعد بيئة محافظة قنا من البيئات الغير ملوثة الى قليلة التلوث بالفلزات الثقيلة مثل الكادميوم و النيكل ثم النحاس والزنك وغير ملوثة بعنصر الحديد والمنجنيز .التوصيات من هذه الدراسة العمل علي إبقاء تركيز العناصر الثقيلة تحت مستويات جائزةِ حيث تُشيرُ النَتائِج إلى الاتجاه المتزايد ، انشاء شبكة صرف صحي لمراكز وقري محافظة قنا لتؤمن نقل مياه المجاري والمياه الملوثة الي بعيدا عن المنطقة المأهولة ومعالجتها لتخفيف الاضرار الناتجة عنها ،ضرورية التَقييم المستمر لمستويات المعادنِ الثقيلةِ في البيئةِ بسببِ النشاطاتِ البشرية.