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# Distribution of copper and zinc in Aswan dam reservoir and River Nile water at Aswan, Egypt

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## Abstract

The present study deals with the factors affecting the distribution of copper and zinc in Aswan Reservoir (R), and River Nile (N) waters during 2008. The available data show that the concentrations of Zn were higher in eastern side than those in the western one in the different seasons, due to the different type of wastewater contamination effluent on the east side of Nile at Aswan City. Aswan Reservoir shows that copper is positively correlated with Ca (r=0.90), pH (r=0.85), DO (r=0.73) and it is negatively related to temperature (r=-0.69), EC(r=-0.75), $NH_3$(r=-0.57), $PO_4$ (-0.70). While in the River Nile water it is a negatively significant with temperature (r=-0.60), EC(r=-0.74), $SiO_3^{2-}$(r=-0.55) and it has a strong positively correlation with $NO_2$ (r=0.93), Ca (r=0.72) during the period of study. It appeared from the data given that copper values in Nile water have the same trend of zinc. The high Cu and Zn levels recorded during oxygenated seasons (winter and spring) in Aswan Reservoir and River Nile areas probably due to oxidation of metal sulfide and organic compounds to produce ($CuSO_4.5H_2O$, Cu $(NH_3)_4SO_4$ and $Zn(NH_3)_4$ $SO_4$ ), thus liberates significant amount of these metals from sediment and suspended particles to the surrounding water. It appears from the data given that the levels of different physicochemical parameters in Aswan Reservoir are still bellow the permissible limits. While the water of River Nile at Aswan has a low quality as compared with reservoir water, where many items were exceeded the permissible limits as dissolved oxygen during summer, nitrate in autumn and nitrite in spring.

*Keywords:* River Nile, Old Aswan Reservoir water, copper and zinc, contamination

## 1. Introduction

Heavy metals contamination is a problem associated with areas of intensive industry. About 50% of Zn & Cu contents in River Nile environment is due to urbanization from automobiles, motor as it comes into contract with surrounding medium enter the environment. Copper and zinc are essential for the metabolic cycle of plants and animals at low levels which consider the normal function of some enzymes (Walker *et al.,* 1996).

Copper and zinc in natural water are released from sediment to overlying water with different rate according to the environmental conditions ( Toufeek, 2005).Hence the ability of metals for dissolution from sediment to water depends not only on pH value but also on nutrients level and organic complexes ( Burton *et al.,* 2008, Zhae *et al*., 2009) . Hassoun and Toufeek, (1998) analyzed the heavy metals in El-Sail Drain wastewater and found that the concentrations of Cu &Zn are ranged from 78 to 167 µg $l^{-1}$ . In the meantime, they are discharged from Kema Fertilizer Factory.In general, the major sources of Cu and Zn in River Nile at Aswan area are agriculture, industrial wastes and sludge which discharge through El-Sail Drain.

Typical natural concentrations for copper and zinc of River water are fluctuated between 5 &20 µg $l^{-1}$, while its values in plants food staffs varies from 0.8 to 9.0 and 12 to 60 µg $g^{-1}$ dry weight (Fifed and Haines, 2000). The wastewater contamination products of tourist ships and fishing boats discharged their wastes into River Nile without any treatment which have harmful effects on the water quality of the area. The fundamental changes in Aswan Reservoir after a recent development as the transplantation program of grass carp fish fry implemented by the Ministry of Agriculture and Food Reclamation in the middle of 1990s, also increasing the number of fishing boats and number of tourist ships at this area. The heavy metals as Cu and Zn are accumulated through both water and food to organisms consequently uptake of these metals by fish (FAO, 1987 and Barsy, 2001).

Therefore the aim of the present work deals throw light on the factor affecting the dynamic distribution of copper and zinc in River Nile and Aswan Reservoir water after severe drop in the density of aquatic macrophytes had observed due to the transplantation program of grass carp fish.

## 2. Materials and methods

### 2.1. Study Areas

Two areas representing different habitats were selected for the present study. The first lied between old Aswan Reservoir and the High Aswan Dam (H.D). . It was formed after damming old Aswan Reservoir in 1934. It was built stretching from side of the valley with a total length of 9 km and 2.7 km width. Recently, severe drop in the density of aquatic macrophytes was observed due to the transplantation program of grass carp fish fry implemented by the Ministry of Irrigations in the 1994. In the meantime, the increasing number of tourist boats at this area, represents a major source of water pollution. The second area is the steam of the River Nile located at 25 Km north of Aswan Reservoir. Also, at Aswan City there is a Fertilizer Factory that discharges its effluents directly into the Nile through El-Sail Drain (Figure 1).

The sampling was carried out on quarterly basis from winter to autumn, 2008 and covered four profiles, including 12 sampling stations. Water samples were collected from subsurface and near bottom by Van Dorn bottle and preserved in polyethylene bottle. The sampling program was carried out during winter, spring, summer and autumn from 12 stations during, 2008 was illustrated in Figure (1)

Water temperature, transparency, electrical conductivity (EC), dissolved oxygen (DO), hydrogen ion concentration (pH), carbonate ($CO_3$), bicarbonate ($HCO_3$), chloride (Cl), total organic matter (TOM), total suspended solid (TSS), total dissolved solid (TDS), sulfate ($SO_4$) and nutriens (ammonia, nitrite, nitrate, silicate and orthophosphate) were analyzed according to APHA (1998).

The water samples were filtrated and digested by nitric acid (APHA, 1998) and concentrations of Zn and Cu determined using SHIMADZU Atomic Absorption Spectrophotometer Model AA-6800 and graphite furnace, ASC-6100. The analysis was conducted in the Central Laboratory of NIOF at Alexandria Branch.

The results were analyzed using Excel program of multiple data to determine seasonal and average ± St.D of metals. The correlation coefficients matrix (r) were estimated between Cu &Zn against whole data (n=24 water sample for each area using Minitab program .The correlation coefficient is significant at 0.6 value when the data number of column = 24

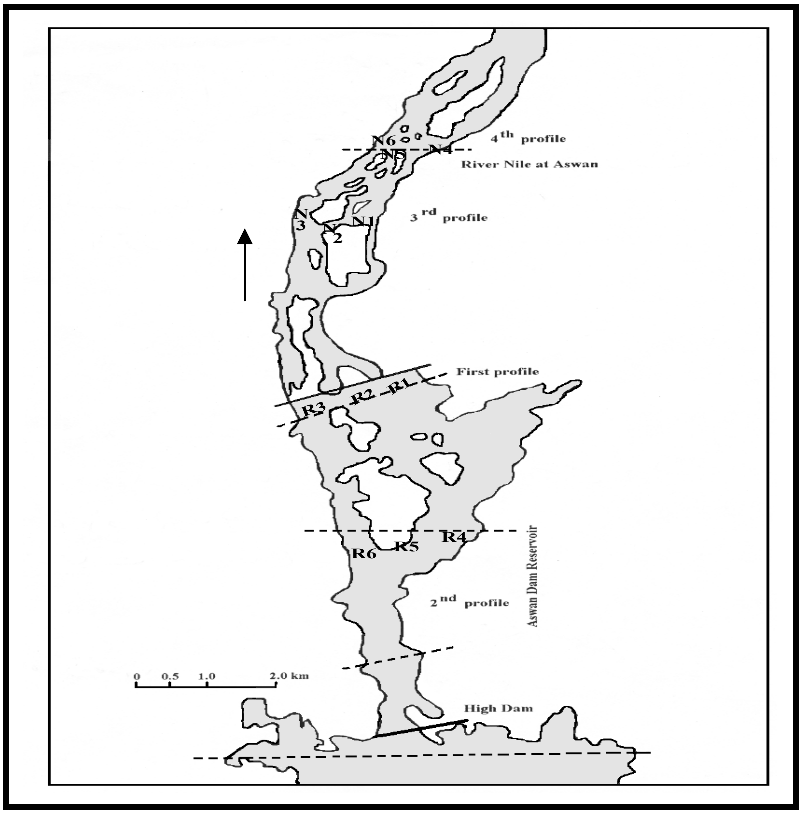


Figure 1. The sampling stations in Aswan Reservoir and River Nile at Aswan City.

## 3. Result and Discussion

The frequencies of various physicochemical parameters during different seasons in the water of Aswan Reservoir and River Nile areas are shown in Tables (1). In Aswan Reservoir, there is difference in water temperature between surface and bottom water layers during summer, where the dissolved oxygen decreases in bottom water layer. The picture in winter is differed than that at hot period where no wide variation due to winter convections. The remarkable observation that water temperature, pH, sulfate and nutrients (ammonia, nitrite, nitrate, and soluble phosphate) are higher than those reported in the previous studied before the transplantation program of grass carp fish in 1995. Transparency was varied between 3.85 and 7.0 m in the present study while it ranged between 2.9 and 4.20 m recorded by (Sayyah *et al*., 1988). Also, the electrical conductivity in River Nile is higher than value detected in 1987 in various seasons (Toufeek, 1988). This is probably due to drop in from the density of aquatic macrophytes resulted the transplantation program of grass carp fish at this area.

The level of different physicochemical parameters in Aswan Reservoir are still bellow the permissible ranges, but it was higher than the previous results obtained by ( Toufeek,1988, Sayyah *e al.,*1988, Elewa *et al.,* 1988 and Toufeek, 1993) before transplantation program of grass carp fish by Ministry of Irrigation since, 1995. While the water of River Nile at Aswan has a low quality as compared with Reservoir water, where many items were exceeded the permissible limits as dissolved oxygen during summer , nitrate in autumn and nitrite in spring according to World Health Organization (WHO, 1996, and USEPA,2009) .

The increased concentrations of nitrate, nitrite and ammonia in the Nile water at Aswan City are mainly related to the domestic sewage and industrial wastes discharged to Nile body through El-Sail Drain which the feeding attains its water supply.

Copper and Zinc are of great importance for different organisms in aquatic environment. The data reveal that the Cu and Zn levels lie below the permissible levels according to (EOS, 1993, FAO, 1992) they reported that the permissible levels of Cu and Zn in water are fluctuated between 1.0-5.0 $mgl^{-1}$.

Copper in Aswan Reservoir water ranged between 7.3 and 71.06, 13.32 and 46.2, and 1.44, and 36.76 $\mu g\ l^{-1}$ with an average values of 28.95± 15.63, 29.80 ± 11.19, 0.44 ± 0.46 , 10.09 ± 12.57$\mu g\ l^{-1}$. In the River Nile its levels varied from 8.72 to 51.4, 6.38 to 243.3, and to 10.22, and to 35.16 $\mu g\ l^{-1}$ with average levels were 28.37±16.08, 40.12± 67.11, 2.56 ± 3.53, 16.86 ± 15.59 $\mu g\ l^{-1}$during winter, spring , summer and autumn respectively Table (2). The absolute maximum value was 243.3 $\mu g\ l^{-1}$ in the 4[nd] profile in Nile water during spring as comparison with the absolute minimum was and found in summer and autumn seasons in different areas under investigation. The data indicated that the concentrations of Cu were comparatively higher in the 1[st] and 4[th] profile than value recorded in the 2[nd] and 3[rd] profile in the different seasons. The concentrations of Cu in River Nile water was higher than those recorded in Aswan Reservoir during all seasons.

The date given in Table (3), show that the concentrations of zinc of Aswan Reservoir varied between 37.88 and 277.42 , 22.82 and 99.42 , 3.18 and 39.20 , 10.46 and 68.14 $\mu gl^{-1}$ during winter, spring, summer and autumn respectively. It can be concluded from the data given that Zn attained its highest levels during winter with a maximum value of 277.42 $\mu gl^{-1}$ at eastern site of 2[nd] profile. The average concentrations of Zn in the 1[st] profile were lower than those reported in the 2[nd] profile in different seasons. It is appeared from the average concentrations of Zn that their values were comparatively high at the eastern sites compared with those found in western ones during the studying period (Table 3). From the data obtained it is showed that the highest Zn levels were observed during winter and spring while their lowest values occurred during summer and autumn in both studied areas.

The pollution of the aquatic environmental refers to an increase of heavy metals concentrations relative to their natural occurrence in aquatic environment. Hence the typical nature of Cu & Zn concentrations of rivers are 5, 20 $\mu g\ l^{-1}$ in water for above mentioned metals respectively. According to United Nation Environmental Program (UNEPA, 2009), the toxicity values of Cu and Zn in aquatic environment are 1.3, 5.0 mg /l respectively.

The relationships between different physicochemical parameters in Aswan Reservoir and River Nile water were studied by (Korium and Toufeek, 2008). It is appeared from the data given that the copper in Nile water has a same trend of zinc during the period of 2008. The high Cu and Zn levels were recorded during oxygenated seasons ( winter and spring) in Aswan Reservoir and River Nile areas probably due to oxidation of metal sulfide and organic compounds to produce ($CuSO_4.5H_2O$, $Cu(NH_3)_4SO_4$ and $Zn(NH_3)_4SO_4$), thus liberating significant amount of these metals from sediment and suspended particles to surrounding water. This is a good agreed with the data obtained by (Toufeek, 2005). In contrast, the decrease of Zn and Cu values during summer is probably due to dissolution of these metals from water resulted to form complexes with humic and organic legend .Also, adsorption of Cu, Zn ions on the surface of suspended particles discharged to sediment, leaving the water with low metal ion values .The low Cu and Zn concentrations recorded during summer and autumn may probably due to the fact that more Cu and Zn ions was readily loosed by adsorption on the surface of suspended particles leaving the water with low content resulted to high water level and suspended solids during these seasons, Table 1 (El-Haddad, 2005 and Schaller *et al.,* 2010).

In contrast, the highest Zn, Cu contents were found during spring and winter ascribed to the decrease of sorption of these metals with the dropped of water level during these seasons. In general; Cu and Zn levels in studied area are lying below the permissible limits according to (WHO, 1996, Singh, *et al.,* 2008 and EOS, 1993). The Cu level in River Nile was higher than those detected in Aswan Reservoir in different seasons with the maximum value 243.3 $\mu g l^{-1}$ probably due to discharges of piped disposal of urban and domestic wastes at this location through El-Sail Drain. Also, more than 450 tourist ships operating in the River Nile between Aswan and Luxor discharged wastes in Nile body without any pretreatment. On the other hand, the increase of Cu and Zn contents in the east side of Aswan Reservoir probably due to increase of tourist and fishery boats at this location.

The correlation coefficient matrix of different physicochemical parameters estimated at Aswan Reservoir shows that copper is positively correlated with Ca ( r=0.90) and DO(r=0.73). In contrast, it has negatively significant relationships with temperature (r= -0.69) , pH (r=-0.85), EC(r= -0.75), , and carbonate( r=-0.66). It is also negatively correlated with nutrient salts ammonia (r=-0.60) and $PO_4$ (r=-0.70). In River Nile water copper has a negatively significant with temperature ( r=-0.60), EC( r=-0.74) and it has a strong positively correlated with $NO_2$ (r= 0.93), Ca (r= 0.72) during the period of study .

The copper and zinc are reversible correlated with temperature and EC in Aswan Reservoir water. This is proved that Cu & Zn are high values at low water temperature and it low in hot periods. The Cu, Zn has a strong positive significant relationships with sulphate (r=0.76, 0.84). In sometime dissolved oxygen is highly correlated with both Cu, Zn in Aswan Reservoir. This is mainly due to formation of a stable soluble compounds in water as ($CuSO_4.5H_2O$, Cu $(NH_3)_4SO_4$ and $Zn(NH_3)_4$ $SO_4$ ) with presence of photosynthetic sulfur bacteria . This is resulted from the oxidation of CuS and Zn S to change to soluble form of metal sulfate.

Also, organic matter content is highly positive significant with Cu, Zn in Aswan Reservoir (r=0.78, 0.80) and River Nile (r=0.81, 0.88) indicate that the organic matter which present in sediment was oxidized and metals ions evolved to overlying water resulted from decomposition of organic matter. This conclusion forms positively significance between organic matters against Zn, Cu in water. Also the positively significance between Cu and $NO_2$ (r= 0.93) indicate that copper is presence in soluble form as $CuNO_2$.

The negative correlation coefficient relationships between metal ions and silicate (r= -0.81), carbonate (r=-0.61) and phosphate(r=-0.66) mainly ascribed to the precipitation of these metals as silicate, carbonate and phosphate forms the following equations:-

$$Me\,Cl_2 + Na_2\,SiO_3 \text{ ------------------}\blacktriangleright Me\,SiO_3\downarrow + 2NaCl$$

$$Me(NO_3)_2 + Ca\,CO_3 \text{ ------------------}\blacktriangleright Me\,CO_3\downarrow + Ca(NO_3)_2$$

$$3Me\,Cl_2 + 2\,Na_3\,PO_4 \text{ ------------------}\blacktriangleright Me_3\,(PO_4)_2\downarrow + 6\,NaCl$$

Where Me is Zn or Pb or Cu....Alc....

The positively significant between different Cu and Zn against Ca probably due to the increase of solubility of these metal salts at the same conditions or formations soluble.

**Table 1. Average ± St.D levels of physicochemical characteristics of Aswan Reservoir (R) and Nile River at Aswan (N) during, 2008.**

| Seasons / Items | Winter | | Spring | | Summer | | Autumn | | STDEV (St.D) |
|---|---|---|---|---|---|---|---|---|---|
| | R | N | R | N | R | N | R | N | |
| Temp. C | 17.7 | 18.1 | 21.2 | 21.0 | 25.5 | 25.8 | 22.4 | 22.6 | 2.981 |
| E.C $\mu moh^{-1}$ | 212.6 | 207 | 211.3 | 218 | 226.5 | 262 | 217.5 | 251 | 20.049 |
| DO $mg\ l^{-1}$ | 8.8 | 7.9 | 7.4 | 5.6 | 4.3 | 1.7 | 4.7 | 2.8 | 2.507 |
| PH | 8.55 | 8.25 | 8.47 | 8.41 | 7.88 | 7.72 | 7.65 | 7.72 | 0.377 |
| $CO_3$ $mg\ l^{-1}$ | 22.0 | 16.5 | 12.0 | 14.2 | 8.0 | 7.30 | 3.0 | 1.33 | 6.979 |
| $HCO_3$ $mg\ l^{-1}$ | 148 | 126 | 130 | 132 | 128 | 118 | 146 | 115.5 | 11.69 |
| $Cl^-$ $mg\ l^{-1}$ | 8.8 | 8.7 | 9.9 | 10.86 | 10.6 | 14.9 | 7.2 | 9.6 | 2.27 |
| $SO_4^{2-}$ $mg\ l^{-1}$ | 18 | 13.2 | 12.7 | 14.42 | 5.1 | 4.82 | 10.2 | 9.42 | 4.54 |
| $NH_3$-N $\mu g\ l^{-1}$ | 165 | 610 | 110 | 430 | 314 | 505 | 185 | 820 | 246 |
| $NO_2^-$ $\mu g\ l^{-1}$ | 75 | 245 | 53 | 1108 | 205 | 46 | 44 | 42 | 364 |
| $NO_3^-$ $\mu g\ l^{-1}$ | 710 | 2580 | 320 | 725 | 1670 | 8045 | 990 | 15140 | 5232 |
| $SiO_3$ –Si $\mu g\ l^{-1}$ | 2.26 | 2.8 | 4.4 | 5.15 | 5.7 | 7.75 | 3.8 | 5.68 | 1.77 |
| $PO_4^{3-}$ -P $\mu g\ l^{-1}$ | 110 | 405 | 72 | 768 | 450 | 94 | 205 | 83 | 248 |
| Ca $mg\ l^{-1}$ | 27.21 | 27.4 | 28.12 | 28.1 | 23.7 | 214 | 22.82 | 22.1 | 2.87 |
| Mg $mg\ l^{-1}$ | 6.88 | 7.72 | 6.38 | 7.88 | 10.45 | 12.15 | 5.56 | 8.66 | 2.179 |
| COD$mgl^{-1}$ | 6.1 | 8.46 | 8.3 | 12.65 | 4.24 | 5.72 | 5.21 | 8.52 | 2.674 |
| Trans. M | 7.0 | 6.1 | 5.2 | 4.5 | 4.10 | 3.2 | 3.85 | 2.75 | 1.44 |
| TSS, $mg\ l^{-1}$ | 11 | 14 | 9 | 12 | 21 | 28 | 29 | 47 | 12.883 |

**Table 2a. Total average ± St.D of copper µg $l^{-1}$ in the water of Aswan Reservoir at Aswan City.**

| | | Winter | | Spring | | Summer | | Autumn | |
|---|---|---|---|---|---|---|---|---|---|
| Profile | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| East | Surf. | 29.26 | 24.02 | 24.8 | 20.0 | Nd | 0.66 | 1.44 | Nd |
| | Bott. | 7.3 | 35.34 | 46.20 | 39.66 | Nd | 0.60 | 36.76 | 4.38 |
| Middle | Surf. | 16.12 | 35.30 | 46.18 | 16.10 | Nd | 0.52 | 0.86 | 16.28 |
| | Bott. | 25.50 | 30.94 | 37.10 | 33.0 | 1.44 | Nd | 16.78 | 15.16 |
| West | Surf. | 71.06 | 20.64 | 13.34 | 20.00 | 0.52 | Nd | 28.72 | Nd |
| | Bott. | 19.92 | 31.96 | 31.82 | 29.42 | 0.86 | 0.70 | 0.70 | 0.8 |
| **Average profile** | | **28.195** | **29.7** | **33.24** | **26.36** | **0.47** | **0.41** | **14.2** | **5.97** |
| **STDEV ( St.D)** | | **22.346** | **6.069** | **12.803** | **9.127** | **0.465** | **0.495** | **15.807** | **7.850** |
| **Season Aver.± St.D** | | **28.95 ± 15.631** | | **29.8 ± 11.192** | | **0.44 ± 0.457** | | **10.085 ± 12.569** | |

,Nd : not detected

**Table 2b. Total average ± SD of copper µg $l^{-1}$ in River Nile water.**

| | | Winter | | Spring | | Summer | | Autumn | |
|---|---|---|---|---|---|---|---|---|---|
| Profile | | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 |
| East | Surf. | 15.6 | 20.54 | 12.0 | 17.54 | 2.18 | 6.44 | 24.4 | 28.2 |
| | Bott. | 40.5 | 51.40 | 17.18 | 83.54 | 3.22 | 10.22 | 21.82 | 7.32 |
| Middle | Surf. | 56.64 | 33.1 | 6.38 | 10.30 | Nd | 2.50 | Nd | 30.18 |
| | Bott. | 37.96 | 9.1 | 19.48 | 27.51 | 0.38 | 0.62 | 3.12 | 35.16 |
| West | Surf. | 18.40 | 8.72 | 15.42 | 12.66 | 0.86 | 0.52 | Nd | 1.80 |
| | Bott. | 15.50 | 24.69 | 16.10 | **243.3** | Nd | 0.52 | 0.52 | 0.70 |
| **Average profile** | | 33.82 | 22.93 | 14.43 | 65.813 | 1.66 | 3.47 | 16.50 | 17.23 |
| **STDEV ( St.D)** | | **16.923** | **16.121** | **4.637** | **91.127** | **1.316** | **4.021** | **11.551** | **15.614** |
| **Season Aver.± St.D** | | **28.37 ± 16.084** | | **40.12 ± 67.11** | | **2.56 ± 3.534** | | **16.86 ± 15.59** | |

Nd : not detected

**Table 3a. Total average ± SD of zinc** µg $l^{-1}$**in Aswan Reservoir water at Aswan City.**

| | | Winter | | Spring | | Summer | | Autumn | |
|---|---|---|---|---|---|---|---|---|---|
| Profile | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| East | Surf. | 72.86 | 28.96 | 22.40 | 24.30 | 4.44 | 14.26 | 17.42 | 66.32 |
| | Bott. | 43.70 | 277.42 | 99.42 | 61.32 | 3.18 | 39.20 | 21.06 | 68.14 |
| Middle | Surf. | 41.30 | 60.72 | 24.72 | 34.40 | 6.89 | 13.50 | 28.50 | 51.26 |
| | Bott. | 95.40 | 50.40 | 22.82 | 71.50 | 11.50 | 4.96 | 24.26 | 27.76 |
| West | Surf. | 37.88 | 44.86 | 30.88 | 25.50 | 19.28 | 11.20 | 10.46 | 51.24 |
| | Bott. | 50.06 | 40.82 | 41.50 | 33.20 | 11.40 | 8.62 | 37.04 | 20.62 |
| Average **profile** | | 56.86 | 83.86 | 40.29 | 41.70 | 9.44 | 15.29 | 23.12 | 47.56 |
| **STDEV ( St.D)** | | **22.641** | **95.402** | **29.846** | **19.818** | **5.926** | **12.197** | **9.176** | **19.598** |
| **Season Aver.± St.D** | | **70.36 ± 67.593** | | **40.995 ± 24.166** | | **12.37 ± 9.638** | | **35.34 ± 19.383** | |

**Table 3b. Total average ± SD of zinc** µg $l^{-1}$ **in River Nile water**

| | | Winter | | Spring | | Summer | | Autumn | |
|---|---|---|---|---|---|---|---|---|---|
| Profile | | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 |
| East | Surf. | 44.72 | 52.20 | 18.8 | 27.24 | 21.40 | 17.22 | 20.40 | 83.32 |
| | Bott. | 46.88 | 286.74 | 13.54 | 70.12 | 9.18 | 32.50 | 68.50 | 99.50 |
| Middle | Surf. | 80.74 | 103.70 | 47.20 | 18.04 | 13.40 | 21.46 | 8.22 | 32.60 |
| | Bott. | 64.96 | 29.52 | 96.28 | 30.80 | 4.36 | 13.44 | 23.92 | 33.10 |
| West | Surf. | 15.50 | 22.52 | 16.28 | 8.34 | 16.44 | 16.36 | 16.82 | 6.10 |
| | Bott. | 25.60 | 57.42 | 51.14 | 5.70 | 22.80 | 4.32 | 21.36 | 3.04 |
| **Average profile** | | **46.4** | **90.36** | **40.50** | **26.4** | **14.60** | **17.55** | **26.54** | **42.94** |
| **STDEV ( St.D)** | | **20.058** | **10.828** | **10.787** | **10.466** | **0.382** | **1.120** | **9.101** | **6.165** |

## 4. Conclusion

From the data given it is concluded that:

1- The levels of different physicochemical parameters in Aswan Reservoir are still bellow the permissible limits .While the water of River Nile at Aswan has a low quality as compared with reservoir water, where many items were exceeded the permissible limits as dissolved oxygen during summer , nitrate in autumn and nitrite in spring.

2- The Cu level in River Nile was higher than those detected in Aswan Reservoir in different seasons with the maximum value 243.3 $\mu gl^{-1}$ probably due to discharges of piped disposal of urban and domestic wastes at this location through El-Sail Drain. Also, more than 450 tourist ships operating in the Nile River between Aswan and Luxor discharged wastes in Nile body without any pretreatment. On the other hand, the increase of Cu and Zn contents in the east side of Aswan Reservoir probably due to increase of tourist and fishery boats at this locations.

3- The high Cu and Zn levels recorded during oxygenated seasons in Aswan Reservoir and River Nile areas probably due to oxidation of metal sulfide and organic compounds to produce ($CuSO_4.5H_2O$, Cu $(NH_3)_4SO_4$ and $Zn(NH_3)_4$ $SO_4$), thus liberating significant amount of these metals from sediment and suspended particles to surrounding water. In contrast, the decrease of Zn and Cu values during summer probably due to dissolution of these metals from water resulted to form complexes with humic and organic legend .Also, adsorption of Cu , Zn ions on the surface of suspended particles discharged to sediment, leaving the water with low metal ions values .The low Cu and Zn concentrations recorded during summer and autumn may probably to the fact that more Cu and Zn ions readily lossed by adsorption on the surface of suspended particles leaving the water with low content resulted to high water level during these periods

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# تقييم الأثر البيئي لعنصري النحاس و الزنك فى مياه خزان أسوان و نهر النيل بأسوان

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فى هذا البحث تم دراسة تأثير تغير العوامل البيئية مثل درجه الحرارة و الأوكسجين الذائب و الأس الهيدروجيني و تركيزات المواد المغذية على توزيع عنصري النحاس و الزنك فى المنطقة الأولى الواقعة بين السد العالي و خزان أسوان و أما الثانية نهر النيل بمدينه أسوان.و قد وجد أن توزيع هذه العناصر فى المنطقة الأولى تأثر بزراعه مبروك الحشائش فى تلك المنطقة حيث التهم معظم النباتات المائية مما أدى الى اختلاف فى بعض الخواص الطبيعية و الكيميائية للمياه و بالتالي تركيزات عنصري النحاس و الزنك.و بالإضافة الى ذلك يوجد أكثر من 300 مركب تنقل السائحون الى معبد فيله و تلقى بالمخلفات الآدمية و الصرف الصحي إلى المياه دون أي معالجه. أما نهر النيل بمدينه أسوان فيوجد الصرف المنزلي والصحي وكذلك الصرف من مصنع كيما للأسمدة الأزوتية و التي تلقى حوالي 756 طن / ساعة من مياه الصرف الصناعي التي تحتوى على تركيزات عاليه من النبرات و النيتريت و الأمونيا التي تساعد على زيادة معدل ذوبان العديد من العناصر الثقيلة من المواد العضوية و الرسوبيات إلى المياه

و خلصت الدراسة إلى أن تركيزات النحاس و الزنك زادت نظرا لاختلاف العوامل السابق ذكرها و لكنها ما زالت فى المدى المسموح به طبقا قوانين الصحة العالمية و قانون البيئة المصرية رقم 4 لسنه 1994.