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ESTIMATION OF SOME CHEMICAL POLLUTANTS IN DRINKING AND SURFACE WATER IN UPPER EGYPT

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ABSTRACT :

This study was carried out to evaluate some chemical pollutants in drinking and surface water in Upper Egypt. Eighty water samples were collected randomly from Aswan, Qena, Assiut and Beni Suef cities and from River Nile water in Aswan, Assiut, Beni Suef regions in addition to samples from Bahr Yousef canal (10 samples each) during January-June 2000. Samples were analyzed for nitrites, inorganic and total phosphorus, copper, iron, fluorine, manganese, lead and cadmium. Nitrites, inorganic and total phosphorus were estimated spectrophotometrically. Fluorine was estimated by selective ion electrode. Copper, iron, manganese, lead and cadmium were estimated by using atomic absorption spectrophotometer.

The obtained results revealed that 20% of the analyzed samples from the River Nile water in Beni Suef region and Bahr Yousef canal were above the U.S. drinking water standards (1 mg/l) and WHO guide (3 mg/l) for nitrites. These values were accepted for livestock according to the 33 mg/l recommended limit of US EPA (1973) and National Academy of Science (1974). Nitrite averages were 1.46±0.95 and 1.18±2.27 ppm in both River Nile water in Beni Suef region and Bahr Yousef canal, respectively. Inorganic and total phosphorus values can't be evaluted because of the lake of the recommended limits. Copper, iron and fluorine concentrations never exceeded the U.S. and WHO maximum contaminant level (MCL) in all analyzed water samples. Manganese values were above WHO MCL (0.5 mg/l) in 30% of samples from Qena city only. More than 40% of the different water samples were above the U.S. EPA guide (0.05 mg/l). There is no available limit for manganese in livestock drinking water. Lead mean values were more than the U.S. action level (0.015 mg/l) and WHO guide (0.01 mg/l) for lead in all the analyzed samples. Most water sources were accepted for livestock as the MCL is 0.1 mg/l according to U.S. EPA (1973) and National Academy of Science (NAS, 1974). Cadmium mean levels were above the U.S. and WHO MCL (0.005 and 0.003 mg/l) in Assiut and Beni Suef cities and water samples from River Nile and Bahr Yousef canal but most samples were accepted according to U.S. EPA (1975) guide (0.01 mg/l). All sources were within the cadmium recommended guide for livestock (0.05 mg/l). Public health importance of these pollutants was discussed.

INTRODUCTION :

Water pollution is one of the major problems confronting health officials every where, particularly in an expanding industrial economy. One of the less desirable by-products of an industrialized society is the increase of heavy metal accumulation in the environment. Most cities and town evolved and continue to develop along the shores of rivers and coastal areas, and human activities have greatly affected these and other water bodies. The need to maintain clean water for both humans and animals has become a major, even a critical concern (Marquita, 1997). Although natural water is one of the purest compounds known, it is difficult to find a source of fresh water that has not been disturbed by man.

Of the thousands of chemical compounds that have been identified in the U.S. drinking waters, most are probably of little consequence to human health, either because they are present at very low concentrations or because they are not very toxic to humans. The U.S. Environmental Protection Agency (EPA) has set Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), and/or Secondary Maximum Contaminant Levels (SMCLs) for about one hundred organic chemicals, metals and other inorganic species and radionuclides, representing chemicals that may have a significant impact on water quality or present health concerns (U.S. EPA, 1996).

The World Health Organization also has issued guideline values for over a hundred chemicals in drinking water. These values are not mandatory limits but may be used by national governments and agencies to set limits for their jurisdictions, taking into account the national or local context of "environment, social, economic and cultural conditions" (WHO, 1993).

The spill of heavy metals in water may entered the food chain, because of their extreme persistence, high toxicity, and its tendency to bioaccumulate (Hernandez et al., 1999). Fundamental problem with heavy metals is that although some of them are needed by organism in trace amounts, when present in excess they cause enzymes to denature, alter a number of parameters of the host's immune system leading to increased susceptibility to infections, autoimmune diseases and allergic manifestations (Bernier et al., 1995). Also, Several million people are currently exposed to elevated concentrations of toxic metals and metalloids in the environment and suffering from subclinical metal poisoning (Miragu, 1988).

The present work aimed to screen the concentration of some chemical pollutants in drinking and surface water of some cities and regions of the River Nile in Upper Egypt and evaluate their health risk on human and livestock.

MATERIALS AND METHODS :

Eighty representative water samples were collected randomly during the period between January and June 2000. Each sample was taken in two liters clean acid washed glass containers from different localities in Upper Egypt; Aswan, Qena, Assiut and Beni Suef cities, the River Nile running water in Aswan, Assiut, Beni Suef and from Bahr Yousef canal (El Fayoum Governorate). Containers were twicely washed with the water to be tested before sampling. All water samples were directly transported into the laboratory, shaken well

and prepared for analysis of nitrites, inorganic and total phosphorus, copper, iron, fluorine, manganese, lead and cadmium.

Nitrites were determined spectrophotometrically according to Quentin et al., (1988). Phosphorus was estimated also spectrophotometrically according to Kegley and Andrews, (1998). Fluorine was estimated by using Orion Research Expandable ion Analyzer (EA 920) with specific fluorine electrode according to Fry and Taves, (1970). Copper, iron, manganese, lead and cadmium were estimated by using atomic absorption spectrophotometer (GB 906 AA) according to Madera, (1982). Copper, iron, manganese, lead and cadmium detection limits were 0.1, 0.1, 0.02, 0.01 and 0.002 mg/l.

RESULTS AND DISCUSSION :

Metals are introduced into aquatic systems as a result of the wethering of soils and rocks, from volcanic eruptions, and from a variety of human activities involving the mining, processing, or use of metals and/or substances that contain metal contaminants. Although some metals such as manganese, iron, copper and zinc are essential micronutrients, others such as mercury, cadmium and lead are not required even in small amounts by any organism. Virtually all metals including the essential metal micronutrients are toxic to aquatic organisms as well as humans if exposure levels are sufficiently high (Laws, 1993).

Nitrites (NO_2) are intermediate decomposition products oxidized to nitrates. It considered as a typical circulatory and blood poisons (Bartik and Piskac, 1981). Nitrates toxicity arise due to its conversion into nitrites in the food or within the gastrointestinal tract (Khalil, 1970) and considered one of the drinking water contaminants that represent immediate threats to human health when present in drinking water at above standard levels. It is converted to nitrite in the infant stomach more readily than the stomach of an adult or older child. After the nitrite is absorbed into the bloodstream, it reacts with the iron in the infant's hemoglobin to produce methemoglobin, a form of hemoglobin unable to carry oxygen. The result may be " blue baby" syndrome and excessive ingestion of nitrate has resulted in infant deaths (Marquita, 1997). High levels of nitrite produces methaemoglobinaemia and of more recent concern is the production of nitrosamines of which N-nitroso compounds represent a major important class of carcinogens and mutagens (Klaassen et al., 1986).

Nitrates in groundwater have increased greatly over the years, and the demonstration of endogenous nitrosation among highly exposed subjects raises concern of elevated cancer risk (Cantor, 1997). Usual concentrations of nitrites in natural water are in the range of some tenths of a mg per liter. High amounts are present in sewage and industrial wastes, especially in biologically purified effluents, and in polluted streams (Madera et al., 1982).

This study revealed that nitrites mean levels were 0.3±0.179, 0.15±0.08, 0.13±0.03 and 0.10±0.0 in water samples from Beni Suef, Assiut, Aswan and Qena cities, respect. Samples taken from Bahr Yousef canal, River Nile water in Beni Suef, Assiut and Aswan regions contained 1.18±2.27, 1.46±0.95, 0.15±0.13 and 0.15±0.05 ppm nitrites, respectively (tables 1 & 2). Our result showed that nitrites values were above the maximum acceptable concentrations (3 mg/l)

recommended by WHO (1993) and U.S. drinking water standards (1 mg/L) recommended by the United States Environmental Protection Agency (Kegley and Andrews, 1998 & Stephen, 1998) in two water samples (20%) from River Nile in Beni Suef and Bahr Yousef canal, although 100% of the tested water samples were above the maximum permissible limit (0.01 mg/L) reported by WHO (1974). All these levels of nitrites were accepted in livestock drinking water according to the U.S. EPA, (1973) and the National Academy of Science (NAS, 1974) recommended limits (33 mg/l).

Zaki et al., (1994) found that 64.1% of analyzed water samples from Assiut Governorate contained more than 0.01 mg/l, the maximum permissible limit documented by WHO, (1974). Bakry et al., (1991) reported that the nitrites concentration in Kafr El-Zayat, Kaluob, Benha, Mostorod, Keha, Abou Zabaal, Shubra and El-Hawamdia were 0.04±0.1, 0.45±0.2, 0.19±0.1, 0.41±0.1, 0.40±0.1, 1.30±0.2, 0.60±0.1 and 1.40±0.4, respectively which go parallel sometimes with our results. Nitrite is sometimes found at higher concentrations in surface water polluted with nitrogen-containing wastes, such as sewage or runfrom agricultural lands (Stoskopf, 1993), which may explain the high levels of nitrites in some water samples from the River Nile in Beni Suef region and Bahr Yousef canal.

Phosphorus in the organic and inorganic phosphate forms is probably the key nutrient in controlling eutrophication of surface waters. It is an essential micronutrient for plant growth. The natural distribution of phosphorus is rather limited; it is commonly found only in one mineral, apatite. Runoff waters from areas of phosphate rock may contain high amounts of phosphate; otherwise, its usual source is organic pollution and phosphate detergent (Fetter, 1980). Fertilizer usually consists of a mixture of the ionic compound ammonium nitrate, potassium nitrate and ammonium dihydrogen phosphate. If too much fertilizer is applied or if it rains hard after an application of fertilizer, the runoff from fields can be a major source of nutrient pollution of both surface and ground water. Agricultural runoff and municipal waste discharges containing is the main sources of phosphate. In natural water, phosphorus exists mainly in combination with oxygen in the form of phosphate. Excess phosphate can also pose serious environmental problems (Kegley and Andrews, 1998).

In the nutrient cycle, (phosphorus cycle), plants obtain their phosphorus from the soil either as dihydrogenphosphate or as hydrogenphosphate. Phosphorus remains as phosphate and in this form it is found in a number of compounds including phosphorylated carbohydrates, nucleic acids and fats. Phosphate detergents increased water treatment costs, reduced availability of fish, shellfish, and associated species; color and odor associated with algal growth and impairment of recreational uses. Phosphate causes algal blooms, death of algae results in low oxygen levels and reduced diversity and growth of large plants; reduced diversity of animal and kills fish (Eldon and Smith, 2000).

The highest average of inorganic phosphorus is present in the River Nile water from Aswan (4.93±0.03 ppm) followed by Bahr Yousef canal and Aswan city water (4.55±0.05 and 2.43±0.15 ppm). Total phosphorus mean values were 7.23±3.13, 6.58±2.30, 4.93±0.025, 4.90±0.12 ppm in the

River Nile water from Aswan, Bahr Yousef canal, Aswan city and River Nile water from Beni Suef, respectively (tables 1 & 2). Phosphorus and total phosphorus levels can't be evaluated, as there is no recommended guide. Total phosphorus levels of 0.01 mg/l or greater are potentially eutrophic, as are loading rates of 0.1 to 1.0 grams of total phosphorus per square meter of surface area per year (Fetter, 1980).

Copper is common metal that occurs in nature as both the native metal and various copper minerals and salts. It is an essential trace element for the growth of plants and also required in trace amounts in both vertebrate and invertebrate animals. In excessive amounts, however, copper can be toxic. It is found in relatively low concentrations in natural waters (U.S. EPA, 1976). Although it is rarely found in natural waters, copper may enter a water supply from the use of copper piping or from the dosing of an impounding reservoir with copper sulphate for the reduction of algae (Thomas and Robert, 1973).

A significant increase of copper at the main source of superphosphate effluent on River Nile as a result of rock phosphate usage in superphosphate fertilizer at Manqabad was recorded (Ibrahim, 1983). Chronic copper toxicity in mammals appears in the form of sporadic fever, vomiting, epigastric pain, diarrhea and jaundice. Acute copper toxicity causes hypotension, hemolytic anemia with intravascular hemolysis, uremia and cardiovascular collapse. Copper toxicity causes necrotic hepatitis, brain tissue damage. Wilson's disease is a disorder of copper metabolism in humans (Bryan & Frieder, 1967).

The obtained results revealed that all analyzed water samples contained less than 2.0 mg Cu /l recommended by WHO (1993) and 1.0 mg/L, the maximum permissible limit reported by the U.S. EPA (1986) and Kegley and Andrews (1998). Although most samples were exceeded the U.S. EPA (1973) and NAS (1974) limits for copper (0.5 mg/l) in livestock drinking water (tables 1 & 2). National primary drinking water regulations defined the action level for copper is 1.3 mg/L (Kegley and Andrews, 1998). Zaki et al., (1994) found that copper mean concentration (0.15±0.03) in Assiut Governorate drinking water which was lower than this permissible limit. The drinking water standard is 1.0 mg/l based on a metallic taste at higher levels (U.S. EPA, 1975).

Iron is a very common element and is found in many of the rocks and soils of the earth's crust. It is also an essential trace element for both plant and animal growth. It is toxic to some aquatic species at concentrations of 0.32 to 1.0 mg/l (Warnick and Bell, 1969). Iron chronic poisoning results in hemorrhagic necrosis of the GIT, hepatotoxicosis, metabolic acidosis, and greatly prolonged blood clotting time, elevation of plasma levels of serotonin and histamine. Hepatic damage causes jaundice by raising the serum bilirubin level and inhibiting hepatic enzymes. Iron oxides enhance the carcinogenic action of organic carcinogens such as benzpyrene, presumably becoming inert carriers of the carcinogens into healthy cells and cancer (Braun et al., 1960) and (Anke et al. 1970).

Our results showed that all water sources contained iron values lower than 0.3 mg Fe/l, the maximum contaminant level reported by the U.S. EPA (Kegley & Andrews, 1998). It couldn't be detected in Aswan. There is no

iron established limits for livestock drinking water (tables 1 & 2). Iron in drinking water imparts a metallic taste at concentrations of 1.8 mg/l (Cohen et al.,1960); however, soluble iron at concentrations in excess of 0.3 mg/l can stain surfaces. A water quality criterion for iron of 0.3 mg/l has been suggested for domestic use to avoid objectionable staining of plumbing fixtures (U.S. EPA, 1975). For aquatic life, a maximum iron content of 1.0 mg/l is the criterion (U.A. EPA, 1975). Because of the stability field of ferrous iron, this criterion should be met wherever the water contains dissolved oxygen, and there is no iron pollution.

Fluoride in excess levels in drinking water can cause problems. Fluoride at a concentration of 1 ppm can aid in the prevention of tooth decay, but at levels as low as 3 to 5 ppm, fluoride can cause mottling of teeth, in higher concentrations, fluoride is poisonous, causing bone cancer in rats and at very high dose it is used as a rat poison (Kegley & Andrews, 1998). Dental lesion was the most obvious external sign of fluorosis in cattle (Suttie et al 1985). 100% of calves, 65.6 % of buffaloes and 61.0 % of cattle were affected with dental fluorosis to some degree at a fluoride concentration in the water of 4.0 ppm (Choubisa, 1999). No suggestion that fluoride in drinking water is linked with elevated risk of cancer (Cantor, 1997). Levels of fluorine in muscle tissue of fish reflected its normal concentration in the River Nile water (Seddek et al., 1996).

The U.S. EPA's MCL of 4 mg/l for fluoride in drinking water was set to protect against crippling skeletal fluorosis. The U.S. EPA also sets a secondary MCL of 2 mg/l to protect against dental fluorosis, which the U.S. EPA considers a 'cosmetic' effect rather than an adverse health effect. Moderate to severe dental fluorosis in children is rare when the drinking water fluoride level is in the range of 1 mg/l but begins to become significant at ca. 2 mg/l (Howd et al. 2000). Fluoridation has been practical for 50 years but remains contraversial because some believe it is harmful to health. However, the MCL for fluoride in drinking water is 4 mg/l, is higher than the 0.7-1.2 mg/l considered optimal to prevent caries. In few people who ingest more than 2 mg/l stained or pitted teeth have developed and in few cases, in people who drank water that naturally contained more than 8 mg/l of fluoride for many years a crippling skeletal disease developed (Marquita, 1997). Our results revealed that fluoride levels were below all the MCLs for fluoride in drinking water of human and livestock (tables 1 & 2).

Manganese in the form of methylcy-clopentadienyl manganese tricarbonyl (MMT) has been used in Canada since 1976 as an additive in unleaded gasoline. The combustion of MMT leads to the emission of Mn oxides to the environment and may represent a potential risk to public health (Loranger et al., 1994). Excess of manganese may be present in either ground or surface waters. Manganese is capable of causing permanent brain damage and physical and or personality disorders that are irreversible (James, 1985). Chronic manganese toxicity in humans causes (manganism), affecting the CNS and psychic and neurologic disorders. Nephritis, liver cirrhosis, anorexia, muscular fatigue and leukepenia are the symptoms of manganism (Mena, 1981). Massive feeding of manganese to experimental animals retards growth and causes calcium loss and poor absorption of iron which leads to anemia, negative phosphorus balance and rickets (Suzuki, 1975).

Table (1): Nitrites, inorganic phosphorus, total phosphorus, copper, iron, fluorine, manganese, lead and cadmium levels (range, X±SE, ppm) in water samples collected from some cities in Upper Egypt.

Cities	Nitrites (NO2)	Inorganic phosphorus	Total phosphorus	Copper (Cu)	Iron (Fe)	Fluorine (F)	Manganese (Mn)	Lead (Pb)	Cadmium (Cd)
Aswan	**0.10-0.20** **0.13±0.03**	**2.28-2.88** **2.43±0.15**	**4.90-5.00** **4.93±0.025**	**0.50-0.60** **0.55±0.03**	**ND** **ND**	**0.07-0.65** **0.13±0.06**	**0.02-0.07** **0.044±0.006**	**0.029-0.163** **0.096±0.064**	**ND** **ND**
Qena	**0.10-0.10** **0.10±0.00**	**0.00-0.00** **0.00±0.00**	**0.00-0.00** **0.00±0.00**	**0.75-0.75** **0.75±0.00**	**ND-0.10** **0.05±0.05**	**0.025-0.175** **0.068±0.03**	**0.03-0.534** **0.219±0.113**	**0.019-0.064** **0.042±0.023**	**ND** **ND**
Assiut	**0.10-0.25** **0.15±0.08**	**0.00-0.00** **0.00±0.00**	**0.00-0.00** **0.00±0.00**	**0.50-0.75** **0.63±0.10**	**ND-0.10** **0.067±0.025**	**0.10-0.145** **0.093±0.048**	**0.025-0.364** **0.146±0.016**	**0.012-0.13** **0.06±0.04**	**ND-0.014** **0.01±0.005**
Beni Suef	**0.10-0.50** **0.3±0.179**	**0.00-0.00** **0.00±0.00**	**2.17-2.35** **1.82±0.71**	**0.1-0.75** **0.43±0.15**	**ND-0.20** **0.103±0.048**	**0.05-0.11** **0.093±0.03**	**0.032-0.16** **0.054±0.026**	**0.01-0.062** **0.036±0.026**	**ND-0.016** **0.011±0.004**
U S guide[c]	**1 mg/L[a]**	**-**	**-**	**1.0 mg/L[a]**	**0.3 mg/L[a]**	**4 mg/L[a]**	**0.05 mg/L[a]**	**0.015 mg/L[b]**	**0.005 mg/L[a]**
WHO guide	**3**	**-**	**-**	**2**	**-**	**1.5**	**0.5**	**0.01**	**0.003**
Guide for **(Livestock)[d]**	**33**	**-**	**-**	**0.5**	**No limit**	**2.0**	**No limit**	**0.2**	**0.05**

[a] **MCL= The maximum contaminant level in drinking water for human.**
[b] **AL = The action level (The level at which the authorities must do something to remove the contaminant).**
[c]**According to the United States Environmental Protection Agency after (Kegley & Andrews, 1998).**
[d] Recommended limits in drinking water for livestosk (United States Environmental Protection Agency., 1973 and National Academy of Science, 1974).

Table (2) : Nitrites, inorganic phosphorus, total phosphorus, copper, iron, fluorine, manganese, lead and cadmium levels (range, X±SE, ppm) in water samples of the River Nile collected from some regions in Upper Egypt.

Regions	Nitrites (NO_2)	Inorganic phosphorus	Total phosphorus	Copper (Cu)	Iron (Fe)	Fluorine (F)	Manganese (Mn)	Lead (Pb)	Cadmium (Cd)
Aswan	**0.10-0.20** **0.15±0.05**	**2.90-5.00** **4.93±0.03**	**4.28-15.33** **7.23±3.13**	**0.50-1.00** **0.75±0.25**	**ND** **ND**	**0.12-0.43** **0.31±0.04**	**0.02-0.152** **0.081±0.03**	**0.018-0.63** **0.25±0.09**	**0.002-0.028** **0.011±0.005**
Assiut	**0.10-0.35** **0.15±0.13**	**0.00-0.00** **0.00±0.00**	**0.74-0.75** **0.70±0.003**	**0.75-0.75** **0.75±0.00**	**0.10-0.20** **0.15±0.03**	**0.08-0.315** **0.235±0.02**	**0.02-0.098** **0.046±0.002**	**0.015-0.85** **0.378±0.33**	**ND-0.026** **0.011±0.01**
Beni Suef	**0.10-3.9** **1.46±0.95**	**2.26-2.29** **2.20±0.01**	**4.60-5.10** **4.90±0.12**	**0.74-0.76** **0.75±0.004**	**0.10-0.20** **0.133±0.026**	**0.06-0.135** **0.091±0.03**	**0.04-0.098** **0.059±0.021**	**0.016-0.62** **0.12±0.08**	**ND-0.017** **0.013±0.007**
Bahr You- **sef Canal**	**0.2-6.93** **1.18±2.27**	**2.70-4.90** **4.55±0.05**	**4.28-9.46** **6.58±2.30**	**0.50-0.80** **0.65±0.087**	**ND-0.20** **0.082±0.06**	**0.08-0.28** **0.125±0.09**	**0.02-0.128** **0.078±0.038**	**0.085-0.595** **0.235±0.137**	**ND-0.046** **0.023±0.020**
U S guide[c]	**1 mg/L[a]**	**-**	**-**	**1.0 mg/L[a]**	**0.3 mg/L[a]**	**4 mg/L[a]**	**0.05 mg/L[a]**	**0.015 mg/L[b]**	**0.005 mg/L[a]**
WHO guide	**3**	**-**	**-**	**2**	**-**	**1.5**	**0.5**	**0.01**	**0.003**
***Guide for* (Livestock)[d]**	**33**	**-**	**-**	**0.5**	**No limit**	**2.0**	***No limit***	**0.2**	**0.05**

[a] MCL= The maximum contaminant level in drinking water for human.
[b] AL = The action level (The level at which the authorities must do something to remove the contaminant).
[c] According to the United States Environmental Protection Agency after (Kegley & Andrews, 1998).
[d] Recommended limits in drinking water for livestock (United States Environmental Protection Agency., 1973 and National Academy of Science, 1974).

According to the concentration of 0.05 mg/l manganese given by WHO as the highest desirable level (Twort et al., 1974), and 0.05 mg/l by the US EPA (Kegley & Andrews, 1998) and 0.5 mg/l by WHO (1993) as a maximum permissible level; the given results revealed that manganese levels were between the highest desirable level (0.05 mg/l) and the maximum permissible level (0.5 mg/l) in all sources of water except 30% of water samples from Qena city (tables 1 & 2). Zaki et al., (1994) found that 58.97% of Assiut city water samples contained more than 0.05 mg manganese/l., while 5.1% contained more than 0.5 mg/l. They recorded also that the high concentrations of manganese were measured in both superphosphate wastewater discharges poured in the River Nile (0.981 mg/l) and the River Nile water few meters from the superphosphate factory (0.419 mg/l). Bowen, (1966) stated that the mean concentration of manganese in rivers to be 0.012 mg/l and the range to be from less than 0.001 to 0.130 mg/l.

Cadmium and lead have no well-known biological functions in the animal body, normally present only in minute quantities, and are described as ultratrace elements. Their toxicity is due to in part to their competition with essential metals for binding sites and also their interference with sulfhydryl groups, which are essential for the normal functioning of enzymes and structural proteins. Cadmium blocks sulfhydryl groups in enzymes and competes for sites with zinc and calcium to a lesser extent and lead may replace calcium in structures and react with sulfhydryl groups (Allen, 1994). The origins of high metal concentrations were traced in municipal sewage, uncontrolled industrial effluents and other anthropogenic activities (Tariq et al 1993).

Lead is one of the most toxic and pervasive pollutants in society, and although there has been some lowering of blood lead levels in recent years, the levels continue to be of concern for African, Americans, central city resident, persons of low income and those with low educational attainment (Wyatt et al., 1998). Today lead poisoning is the most common disease of environmental origin in the United States (Landrigan & Todd 1994). The highway or motor boat traffic, industrial and agriculture discharge, tetraethyl lead as petrol additive are the main source (Van Hassel et al., 1980 and El Nabawi et al., 1987). The most prevalent source of lead in drinking water, particularly in soft water regions, is lead pipe in services and plumbing systems or pipe jointing material in distribution systems (Thomas & Robert, 1973). Industrial and/or sewage effluents are the major source of lead in fish from Africa (Sorenson, 1991).

Lead has multiple toxic effects on human body and is a probable human carcinogen. Among its most serious non-carcinogenic effects are decreased intelligence in children and increased blood pressure in adults. The neurotoxic effects in children at blood lead levels below 100 μg/dl may in some cases result in irreversible brain damage (exhibited as a decrease in learning ability) as well as in damage to the peripheral nervous system (Hutton, 1987 and ATSDR, 1990).

The U.S. EPA's MCL Goal of zero for lead in drinking water is based on 'occurrence of low-level effects' and because the U.S. EPA classifies lead as a Class B2 carcinogen (U.S. EPA, 1991). The U.S. EPA has not adopted an MCL for lead in drinking water because they regard the development of such a level as 'not feasible'. The U.S. EPA has an 'action level' of 0.015 mg/l for lead in drinking water (Howd et al. 2000).

All the analyzed water samples had lead values more than the recommended limit (0.01 mg/l) by (WHO, 1993) and the U.S. action level (AL), the level at which the authorities must do something to remove the contaminant except few samples from Assiut and Beni Suef cities. The highest contaminant level recommended by the National Interim Primary Drinking Water Regulations is 0.05 mg lead/l (Daniel, 1980). According to WHO (1972), the international standards for drinking water must not exceed 0.1 mg lead/l. WHO (1984), stated that the natural lead content of lake estimated to be 1-10 μg/l. In a survey of 727 surface water samples in the United States lead was found in about 63% of the samples in concentrations ranging from 0.001 to 0.05 mg/l, only in 3 samples did the concentration exceed 0.05 mg/l (Edward and Elwood, 1966). Zaki et al., (1994) examined water samples in Assiut Governorate and they found that about 33.3% of the analyzed water samples contained more than 0.05 mg/l. Most of these water sources can be accepted for livestock as the U.S. EPA (1973) and NAS (1974) recommended guide is 0.2 mg lead/l.

The obtained data indicated that all cities drinking water samples contained lead averages below 0.1 mg/l, while all surface water contained more than 0.1 mg/l lead. This finding could be attributed to the pollution of surface water and/or air with lead after emission from the highway or motor boat traffic, industrial and agriculture discharge. All the sources of the analyzed surface water samples were very closed to the highway in Upper Egypt.

Cadmium is considered to be the most problematic of the heavy metals. It is a cumulative toxic element that is mainly deposited in the liver and kidneys (Niemi et al. 1991). Its levels increases throughout life because its biological half-life is 10-30 years (Klassen, 1985). Chronic cadmium toxicity causes growth retardation, impaired kidney function, poor reproductive capacity, hypertension, tumor formation, hepatic dysfunction, poor lactation and teratogenic effect (Ferm & Carpenter, 1967). Cadmium accumulates in the soft tissues at all concentration levels down to 0.1 mg/l in drinking water resulting in anemia, poor metabolism, possible adverse arterial changes in the liver of man, and death at higher concentrations (Thomas & Robert, 1973). The combustion of gasoline, cadmium containing pesticides, phosphate fertilizers, industrial wastes and industrial concern such as mining and plating may be the main sources of cadmium contamination (Davis, 1984; Oronsaye and Brafield 1984).

Cadmium can't be detected in drinking water from Aswan and Qena cities and in many samples from the other water sources (Tables 1 & 2). The obtained results revealed that cadmium mean values were relatively similar to the U.S. EPA (1975 & 1986) recommended limit (0.01 mg/l) in Assiut and Beni Suef cities, water from the River Nile in Aswan, Assiut and Beni Suef regions. Its cadmium averages were 0.01±0.005, 0.011±0.004, 0.011±0.005, 0.011±0.01 and 0.013±0.007 mg /l, respectively. Bahr Yousef canal contained the highest cadmium average (0.023±0.02 mg/l) that exceeds these guides. All mean levels of cadmium were above the adopted U.S. EPA MCL (0.005 mg/l) of cadmium in the drinking water (Kegley & Andrews, 1998, Stephen, 1998) and (0.003 mg/l) WHO guide (WHO, 1993). All detected levels were below the cadmium guide for livestock drinking water (0.05 mg/l) recommended by U.S. EPA (1973) and National Academy of Science (NAS, 1974).

Zaki et al., (1994) found that 48.72 % of analyzed water samples of Assiut Governorate contained more than 0.01 mg/l cadmium, the

maximum contaminant level recommended by the Public Health Service Drinking Water Standard (Thomas & Robert, 1973). In study of 727 surface water samples in United States, it was found that 54% contained less than 0.001 mg cadmium /l, 42% contained cadmium in the range of 0.001 to 0.001 mg/l in about 4% the cadmium concentration exceeded 0.01 mg/l. The maximum cadmium concentration found was 0.13 mg/l (Durum et al., 1971).

In conclusion, restricted measures must be applied to prevent more addition of pollutants especially lead and cadmium to all water sources in Upper Egypt. The River Nile and its tributaries, which considered the main source of water for Egypt must be also protected from effluents and sewage. All heavy metal sources in drinking tap water should be avoided in water piping. Monitoring of chemical contaminants in water sources should be currently conducted to assure health safety.

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تقييم بعض الملوثات الكيميائية في مياه الشرب
والمياه السطحية بصعيد مصر

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مما لاشك فيه أن الماء مفتاح الحياة للإنسان والحيوان ويعتبر نهر النيل المصدر الرئيسي لمياه الشرب والزراعة في مصر. ولكن مع التقدم في جميع المجالات وكذا انتشار المدن بطول النهر، الأمر الذي قد يترتب عليه إلقاء بعض مخلفات الصناعة والزراعة بالإضافة إلى الصرف الصحي، مما قد يضيف العديد من العناصر السامة في بعض مصادر المياه. أجريت هذه الدراسة لتقدير مدى تلوث مياه الشرب ببعض الملوثات الكيميائية في بعض المدن وكذلك المياه السطحية بصعيد مصر. تم أخذ عينات مياه من مدينه أسوان؛ قنا؛ أسيوط وبنى سويف ومن مياه نهر النيل في أسوان؛ أسيوط وبنى سويف ومن قناة بحر يوسف بصعيد مصر. تم تحليل هذه العينات لمدى تواجد النيتريت، الفسفور غير العضوى، الفسفور الكلى ، النحاس، الحديد، الفلورين، المنجنيز، الرصاص والكادميوم.

أظهرت النتائج أن ٢٠% من العينات التي تم تحليلها للنيتريت من مياه نهر النيل فى بنى سويف وقناة بحر يوسف تزيد عن المعدلات الأمريكية (١ مجم/لتر) ومعدلات منظمة الصحة العالمية (٣ مجم/لتر) المسموحة بمياه الشرب. ويمكن قبول هذه المستويات بالنسبة للاستهلاك الحيواني فقط والذي تصل معدلاته إلى (٣٣ مجم/لتر) طبقاً لمعدلات الهيئة الأمريكية لحماية البيئة والأكاديمية القومية للعلوم.

أوضحت النتائج أن تركيزات النحاس، الحديد والفلورين لم تتعد المستويات المسموح بها في أمريكا أو المقررة من منظمة الصحة العالمية سواء في مياه الشرب بالمدن أو في مياه نهر النيل. أما مستوى المنجنيز فكان أعلى من المستوى المسموح به من قبل منظمة الصحة العالمية (٠,٥مجم/لتر) في ٣٠% من عينات مياه الشرب بمدينة قنا، إلا أن ٤٠% من إجمالي العينات

التي تم تحليلها للمنجنيز احتوت على مستويات أعلى من المعدل الأمريكي المسموح به (٠,٠٥ مجم/لتر) في مياه الشرب.

وقد تبين من الدراسة أن تركيز عنصر الرصاص أعلى من الحد المسموح به من منظمة الصحة العالمية (٠,٠١ مجم/لتر) والهيئة الأمريكية لحماية البيئة (٠,٠١٥ مجم/لتر) فى جميع مصادر المياه. وتعتبر معظم مصادر هذه المياه صالحة للاستخدام الحيواني طبقاً للمعدل الأمريكي المسموح به من الهيئة الأمريكية لحماية البيئة والأكاديمية القومية للعلوم (٠,١مجم/لتر). وقد زادت مستويات الكادميوم عن المعدلات الأمريكية المسموح بها (٠,٠٠٥مجم/لتر) ومعدلات منظمة الصحة العالمية (٠,٠٠٣ مجم/لتر) فى مياه الشرب بمدينتي أسيوط وبنسويف والمياه السطحية من نهر النيل بجميع المناطق ، وكذا قناة بحر يوسف. واحتوت غالبية العينات على تركيزات دون المستوى الأمريكي المسموح به (٠,٠١ مجم/لتر) بمياه الشرب عام ١٩٧٥ من قبل الهيئة الأمريكية لحماية البيئة. وتبين بوجه عام أن جميع مصادر المياه كانت مقبولة كمياه شرب للاستخدام الحيواني طبقاً لمعدلات الهيئة الأمريكية لحماية البيئة. كما تم مناقشه نتائج هذه الدراسة بالنسبة لتأثيرها على الصحة العامة.