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HOW SAFE IS DRINKING WATER IN MANSOURA

Sanad, M . I .* and Fatma I. El-Hawary **
Agric. Chemistry Dept*, Fac. of Agric., Mansoura Univ.,Mansoura, Egypt.
Microbiol . Dept. ** Fac.of Agric., Mansoura Univ., Mansoura, Egypt.

ABSTRACT

It is will known that drinking water is very important and essential for human life. Water participates in muscle, lungs, brain and mostly in blood. If water is not good or polluted, man health will be affected and it will causes many diseases. The present work was conducted to evaluate the quality of the drinking water which were withdrawn from two water stations in Mansoura city.

Samples were taken from each water station, from the input and other from the output. The water samples were physically and chemically analyzed for the following parameters: temperature, PH, carbonate, bicarbonate, chloride, calcium, magnesium, calcium hardness , magnisum hardness , total hardness ,electrical conductivity (EC), ammonia, nitrate, and organic matters. High levels of $HCO3^-$, Cl^- and $NO3^-$ for new Mansoursa station raw water with the average values of 240.95 , 37.30 and 68.6 ppm respectively. These values decreased to 183.1 and 58.8 ppm for $HCO3^-$ and $NO3^-$ in treated water, respectively, while Cl^-content increased to be 44.40 ppm. Shark- El-Mansoura station raw and treated water samples have the same high values of Ca^{++} (96.64 ppm) and Mg^{++} (36.24 ppm) ,while the level of NO_3^- was lower than the first one (49.6 ppm).

Organic Matter (OM) contents of raw and treated water samples of new Mansoursa station were 0.033 and 0.02 gm/100ml respectively. Although the values of OM of samples obtained from the other station decreased to be 0.026 and 0.013 gm/100ml, respectively . Pesticides residues were also determined in the treated water samples using GC chromatography in the presence of 19 standards pesticides compounds. Microbiological examination using the same water samples includes: Total viable count (TVC), pathogenic bacteria (coliform group e.g. *Escherichia coli* and spore-forming bacteria (SFB). Moreover green and Blue green algae were also examined .

The results revealed that treated water of Shark- El-Mansoura station is contaminated with bacteria , the (TVC) were ranged from 1.5×10^3 cfu/ml to 2.0×10^4 cfu/ml in both stations . Spore-forming bacteria (*Bacillus spp*) which do not pose any health risk for human reached to maximum of 2.0×10^3 cfu/ml in Shark- El-Mansoura . All collected samples were found coliform free . Green algae and blue green algae were not detected in all the water samples collected from new Mansoursa station . While samples collected from Shark EL-Mansoura station were blue green algae free , and 130 to 221 unit/L green algae in the water samples of Shark- El-Mansora station . After these analysis, It can say that our treated drinking water is safe and with high quality.

Keywords:Electrical Conductivity (EC), Organic Matter (OM), Gas Liquid chromatography (GC),Total viable count (TVC),Spore-forming bacteria(SFB) and Escherichia Coli (E.Coli) .Colony forming unit (cfu)

INTRODUCTION

Water is considered the most important factor for life .So, it must be offered in a good state and to be sure that it free from any pollutants.

WHO, (1984) indicated that increasing of temperature water stimulate the biodegradation of organic matters presented in water and the amounts of

dissolved oxygen decreased. warm water enhances the growth of microorganisms which could be developed objectionable odor and taste of potable water. Also, Viessman and Hammer (1993) mentioned that the temperature of ground water is nearly constant , while surface water temperature depends strongly on climate. Lu *et al* (2003) reported that total dissolved solids (TDS) are including organic and inorganic matters. Narouz (1991) mentioned that high level of TDS has physiological effects such as laxative mainly from both Na_2SO_4 and $MgSO_4$ salts. Moreover, the adverse effect of sodium on certain patients affected with cardiac diseases and women toxemia associated with pregnancy.

Pope *et al* (2002) reported that about 85% organic constituents were found in volatile organic compounds in ground water. USEPA (1991a) stated that water with high acid could leach out lead and copper of pipes and fitting produce health problems. APHA (1992) found that , the alkalinity of natural and unpolluted water related to the presence of bicarbonate and or carbonate alkali earth metals. Therefore, pH value of such water usually not exceeds that 8.3. Narouz (1991) observed that alkalinity of river Nile was ranged from 110 mg L^{-1} as a minimum value to 140 mg L^{-1} as a maximum. Ledin *et al* (2002) mentioned that low pH water is likely corrosive. The pH of drinking water normally ranged from 5.5 to 9. at pH levels of less than 7 corrosion of water pipes may occur, releasing metals into the drinking water. If the concentration of such metals exceed recommended limits, this is undesirable and can cause other problems. Mara (1982) reported that pH of drinking water in the distribution systems influenced the survival and growth of Coliform bacteria. Hence, 50% of organisms survived at least 22 hours at pH 7.3 to 7.9 whereas the time was decreased to one hour at pH 9. WHO (1984) reported that chloride could be found in the raw water as potassium (KCl) and calcium chloride (CaCl2) However in the majority of rivers and lacks their concentration in water bodies is usually small compared with other chief components .

WHO (2003) stated that concentrations of chloride in excess of 250mg/L are increasingly which likely to be detected by taste but consumers may become accustomed to low levels of chloride induced taste . Ferrandiz et al (2004) studied the relationship between mortality from cardiovascular diseases and hardness of drinking water . This relationship is stronger in cerebrovascular disease than in ischemic heart disease, is more pronounced for women than for men and is more apparent with magnisum than with than with calcium concentration levels .

Regulatory limits for pesticide residues in water were decided by Hamilton et al (2003) . They mentioned the maximum levels of some pesticides in drinking water for examples Aldrin and dieldrin 0.01 , Diazinon 1 , Heptachlor 0.05, Lindane 0.05, pirimiphos-methyl 50 , profenofos 0.3 ,thiometon 3 , Hexachlorobenzen 1 and DDT+ isomers 0.06 µg / L .

This perimissible limits were agreed with the Egyptian Standard Specifications For Potable Drinking Water according to decision of population and health minister No . 458 (2007) .

Nancy and Keith (Net site – Cornell University) estimated the amount of a pesticide that a typical person can consume daily for a lifetime with no adverse health effects as follow .

No observed effect level (NOEL) 0.1 mg / kg / day = 7 mg / 70 kg person/ day , Acceptable Daily Intake (ADI = NOEL safety factor of 100) = 7 / 100 = 0.07 mg/person/day , 20% of

daily intake in drinking water 0.07 x 0.2 = 0.014 mg / person / day , Average intake of a liter water per day 0.014 /2 = 0.007 mg liter . Drinking water guideline 0.007 mg / L = 7µg / L or 7 ppb (parts per billion) . The same author added that approximately 50.000 different pesticides are used in some countries , composed of over 600 active ingredients . Although the acute health effects of ingesting large of a pesticide can readily be measured , the chronic effects of long – term exposure to low levels are much harder to define .

Public Water Supply Agency in Mansoura city, comprises of two major water stations (New Mansoura station or Meet Khames station and Shark EL-Mansoura station). They aware to potable water in adequate quantity and quality. Microbiological aspects are the most important indices for potable water whereas living microorganisms survive in potable water (such as virus, bacteria, algae, fungi, protozoa and nematodes) produce an unpleasant taste and odor. Moreover they can carry significant infectious diseases or product harmful toxins especially in the developing countries (USEPA, 1989 and WHO, 2003).

As a matter of fact, there is no drinking water, approximately, free from microorganisms and microelements (Van der Kooij, 1982). Therefore, bacteriological examination is the most important and useful parameter, which has been established for evaluating the quality of potable water. *Bacillus stearothermophilus* is obviously occurring in aquifers, while *E. coli* is commonly used as an indication for water supplies contamination with domestic sewage (Allen and Geldrich, 1978 and USEPA, 2003; 2004). *Escherichia coil* is a sub-group of fecal coliform (Office of Drinking Water System Management, 2004). *E. coil* could by associated with different types of intestinal pathogenic bacteria such as *Escherichia coil*, and *Camylobacter fetus* (Gamal, 1997). Chlorination process can often destroy most of pathogenic microorganisms such as *E. coli*, *Griardia muris* and *Griardia lamblia* and help to remove iron, manganese, ammonia, hydrogen sulfide and other contaminants from the water (Seoville, 1994).

Wells contamination by coliform was associated with the type of faulty geologic formation of the well site. Arafa (1988) reported that 5.7% of water samples collected from Abyssinian pumps in Kalama village (Egypt) contained mesophilic bacteria ranged from 10^3~10^4cfu ml^{-1}, While 63.1% of the samples had bacterial count more than 10^6 cfu ml^{-1}.

Algae are frequently found as normal inhabitants in surface water and in every water supply that is exposed to sunlight. Even though, some species of algae could be grown in the dark such as *Scenedesmus, Euglena, Anacystis, Coelastrum* and *Chlorococcum* (Palmer, 1980). Algae are capable

to change some physical and chemical properties of water such as turbidity, color, pH and alkalinity leading to produce unpleasant odor and taste as well as they produce toxic substances (WHO, 1997).

Moreover it could clog filter beds (Harold and Michael, 1985). Surface water, especially at temperature above 25°C, normally contains high counts of algae comprise the great portion of algal biomass (Williams, 1964). The two major groups of algae, which produce toxins in water supplies, are not affected by the water treatment processing (Ingram and Prescot, 1954). Different species of algae, especially the blue green algae Anabaena, may impart grassy, musty and fishy odor in water (Hakim et al, 1970). It is worthy to note that raw water withdrawn from River Nile nearby Cairo acquired an algal value over 15000 algae ml^{-1} (EL-Khodary, 1977). However, waterworks in Egypt are not submitted an application for algal handling to raw water.

This work was designed to collect some information about the microbiological aspects of potable water in Mansoura city via randomly collection of tape water samples from the distribution system of two stations. This research aims to evaluate the physicochemical properties and bacteriogical examination of drinking water to confirm if potable water in Mansoura city is safe or not .

MATERIALS AND METHODS

Materials :

Two water samples of raw (input) and treated (output) were withdrawn from two water stations in Mansoura city i.e. New Mansoura water station (Meet Khames station , St I)
and Shark El- Mansoura water station (St II) during 2007/2008.

Raw samples were collected from their natural sources which represent Nile water in St 1 and mixture of Nile water and El- Mansoreia channel in St II .Samples were kept in a cool container , protected from light and immediately transported to the laboratory and kept in refrigerator untill analysis.

Methods:

Physical and chemical analysis :

Temperature ,electrical conductivity (EC), alkalinity ,magnesium hardness ,calcium hardness and PH values of water samples were determined according to the method of APHA (1989) . Organic matter ,cations , anions and available nitrogen as ammonia were determined according to the method of Hesse (1971)

Bacteriological examination :

Two hundred ml of each collected treated water samples were serially diluted with sterilized distilled water using sterile pipette. One ml of water sample was diluted till reached to 10^{-7} using three tubes per each dilution. Total viable count (TVC) according to the method described in APHA (1989) was carried out. Spore forming bacteria was detected after the samples were heated at 75°C for 15 min to kill all vegetative cells and then spores were activated to germinate with Trypticase Soy Broth (TSB) according to Barbeau ***et al*****, (**1999). Total coliform count was estimated by pour plate method as recommended by Biomerieux (1986) using MacConkey

agar medium. Blue green algae and green algae were determined according to the method of El-Nawawy (1958).

Determination of pesticide residues :

The estimation of pesticide residues in drinking water samples were done in laboratory of GC , National Research Centre , Dokki , Giza according to the method of Futagami *et al* (1997) .

RESULTS AND DISCUSSION

Physical and chemical analysis :

Tables (1) and (2) indicate the chemical analysis of raw (input) and treated (output) water withdrawn from New Mansoura Station (Meet Khames Station , St.I) and Shark El-Mansoura Station (St.II) . The results show that both water samples of the two mentioned stations were free from carbonate , while bicarbonate (total alkalinity) were detected in 240.95 and 183.10 mg/L (ppm) in raw and treated water of St.I ,respectively. This parameter decrease in raw water of St.II to be 235.20 ppm , while increased in treated water to be 193.20 ppm compared with St.I .

Table (1). Analysis of drinking water in raw (input) and treated (output) water withdrawn from New Mansoursa station (St.I) .

Parameters measured	Raw water (input)	Treated water (output)
Temperature	36.1	36.1
pH	7.64	6.98
Electrical conductivity (EC)	310.00	310.00
Carbonate (CO_3^{--})	0.00	0.00
Bicarbonate (HCO_3^-)	240.95	183.10
Chloride (Cl^-)	37.30	44.40
Calcium (Ca^{++})	31.30	30.3
Magnesium (Mg^{++})	12.10	13.30
Calcium hardness	78.25	75.75
Magnesium hardness	42.35	46.55
Total hardness	120.60	122.30
Ammonia (NH_3)	14.20	14.20
Nitrate (NO_3^-)	68.60	58.80
Organic matter (OM**)	0.033	0.020

*** results are calculated as mg/L (ppm)**

**** OM calculated as gm/100ml**

Chloride (Cl^-) content was observed in raw water of St.I with high level of 37.30 ppm in comparison with the same element of raw water withdrawn from St.II which recorded 28.40 ppm . Treated water showed an increase in chloride content to became 44.40 in St.I and increased to 35.50 ppm in St.II. These results are in agreement with parameters of International Health Organization For Drinking Water (1993) , which decided that the maximum level of chloride in drinking water reach to 250 mg/L. Calcium content in raw and treated water withdrawn from St.I were less than the

values of the same cation obtained from St.II , their values were 31.30 , 30.30 and 96.64 and 96.64 ppm in raw and treated water of the two stations respectively . So, calcium hardness as(Ca CO3) of raw and treated water samples for St.I was less than St.II . Treated water samples in both two stations had calcium hardness 75.75 and 241.6 ppm in both two stations ,respectively.

These results are agreed with permissible limits (up to 350 ppm) as mentioned in Egyptian Standard Specifications For Potable Drinking Water according to decision of population and health minister No . 458 (2007) . A lower values of magnesium content (12.10 and 13.30 ppm) were observed in both raw and treated water samples withdrawn from St.I , however St.II revealed higher values of 36.24 and 36.24 for the same element in raw and treated water samples ,respectively . On the other hand, the values of magnesium hardness as MgCO3 of St.I were lower than St.II . These values were 42.35 and 46.55 ppm for raw and treated water of St.I ,respectively , while magnesium hardness of St.II recorded the values of 126.84 and 126.84 for raw and treated water samples ,respectively .These values are agreed with the permissible limits of magnisum and magnisum hardness in drinking water as mentioned by Egyptian Standard Specifications For Potable Drinking Water according to decision of population and health minister No . 458 (2007) which decided that the maximum magnisum hardness reach to 150 ppm .

Total hardness were calculated as sum of mg CaCO3 and MgCO3 / L of water samples, where these values were 120.60 and 122.30 mg/L in raw and treated water for St.I , while St.II gave the same value of 368.44 mg/L for raw and treated water respectively . Total hardness of treated water of St.I was less than St.II . Total hardness of two stations was agreed with the permissible limits which ranged from 60 – 500 mg/L as reported in standards for drinking water quality as mentioned in Water Quality Regulations (1989) .

Table (2). Analysis of drinking water in raw (input) and treated (output) water withdrawn from Shark El-Mansoura station (St.II).

Parameters measured	Raw water (input)	Treated water (output)
Temperature	36.00	36.00
pH	8.20	7.60
Electrical conductivity (EC)	179.20	192.00
Carbonate (CO_3^{--})	0.00	0.00
Bicarbonate (HCO_3^{-})	235.20	193.20
Chloride (Cl^{-})	28.40	35.50
Calcium (Ca^{++})	96.64	96.64
Magnesium (Mg^{++})	36.24	36.24
Calcium hardness	241.60	241.60
Magnesium hardness	126.84	126.84
Total hardness	368.44	368.44
Ammonia (NH_3)	17.00	13.60
Nitrate (NO_3^{-})	49.60	49.60
Organic matter(OM**)	0.026	0.013

*** Results are calculated as mg/L (ppm)**
**** OM calculated as gm/100ml**

Concerning of calcium and magnisum content in drinking water , high levels of these two elements reduce the risk for mortality from ischemic heart disease and cerbrovascular disease as stated by Ragnar *et al* (1991). They added that Mg^{++} in drinking water is considered as an important activator for several enzymes systems and is essential for cell membrane permeability and neuromuscular excitability. While, the lake of Mg^{++} leads to a decrease in the concentration of intracellular potassium and an increase in calcium levels. Magnesium deficiency may increase the risk for cardiac arrhythmia and the contractility of blood vessels.

Results of electrical conductivity (E.C) of water samples in St.I have higher content than that observed for the same water samples of St.II as shown in Tables (1) and (2) . These results indicated the presence of much higher salts in water of St.I than that of water of St.II , where the values were 310 and 310 ppm for raw and treated water of St.I respectively, while St.II recorded 179.20 and 192 for the same samples respectively . PH values were registered 7.64 and 8.20 in raw water , while treated water have the values of 6.98 and 7.60 in both water samples of St.I and St.II respectively . These PH values of treated water are in agreement with Water Quality Regulations (1989) ,which reported that PH value of drinking water ranged from 5.5 to 9.5 .

High levels of nitrates ($NO3^-$) were observed for raw and treated water in St.I compared with St.II . Average values of 68.06 and 58.80 ppm were detected for raw and treated water samples of St.I , while the corresponding values of St.II were 49.60 and 49.60 ppm respectively . The level of nitrate in treated water of St.II is agree with the parameters of International Health Organization For Drinking Water (1993) which reported that the nitrate contents of drinking water not exceed than 50 ppm . So , it is quite clear from Table (1) that the nitrate level of treated water in St.I was higher than the permissible limits . From Net Informations (Nitrates and your health) which mentioned that , infants less than three months of age have nitrate reducing bacteria in their digestive systems . These bacteria convert nitrates to nitrites ,which bind strongly with blood hemoglobin and prevent sufficient oxygen transport in the baby . Shortness of breath , susceptibility to illness , heart attack , or even death by asphyxiation can result . When baby reach six months , hydrochloric acid level in the stomach rise , killing the nitrate reducing bacteria .

Nitrates are therefore not concern in older children and adults. So, the excess of nitrate in the treated water in St.I must be reduce to protect the infants less than three months or prevent these infants to drink these water until their ages reach to six months. It can be suggest to control high nitrate level in the water station by using splite stream arrangement . In this system , a portion of the water is down off and treated using an anionic nitrate removal process . The treated water is then blended with untreated water to dilute the nitrate concentrations . This system can preferred by consumers who want to control harmful nitrate levels in their home water system . Raw and treated

water samples of St.I showed to have average values of 0.033 and 0.020 (gm /100ml) organic matter ,respectively.

These values decreased in the second station to be 0.026 and 0.013 (gm /100ml), respectively. The same amounts of ammonia 14.20 ppm was found in both raw and treated water samples of St.I, while St.II recorded higher values of 17 and 13.6 ppm for their water samples respectively. It is quite clear that, organic matters of treated water samples of St.I and St.II decreased about 39.39 % and 50 % compared with their raw water ,respectively. The reduction of organic matters quantities in drinking water protect the man health from healthy dangerous diseases. The removal of organic matter from drinking water was carried out by Hugues et al (2007) . Bicarbonate, calcium and magnesium contents of treated water in St.I showed less values than that of St.II . However , St.II drinking water showed to have a decreasing values of chloride , ammonia ,nitrate ,EC and organic matters in comparison with water of st.I .

Pesticide residues in drinking water :

Pesticide is a general term for substances which are used to poison pests (weeds, insects, molds, rodents, etc.). The pesticides most acutely dangerous to man are insecticides and rodenticides.

Nineteen standard pesticides were appeared in chromatograms (1) and (2) and Tables(3) and (4) by using GC technique with their retention time (Rt) and percentages. Chromatograms (3) and (4) showed GC analysis of drinking water (treated water) samples withdrawn from St.I and St.II . By matching the retention time values of chromatograms of drinking water samples (3) and (4) with the standard chromatograms (1) and (2) , the results proved that water samples of St.I and St.II are free from any pesticide residues , as the shift of the retention time values of treated water samples in comparison with those of standard pesticide samples was more or less than 0.01 cm . From Figures(3) and (4) , peaks appeared in chromatograms of treated water are considered as impurities . So, drinking water of both two stations are free from any dangerous pesticide residues and there are no any significant risk for the consumers. The defined drinking water quality is suitable for human consumption and all usual domestic purposes.

Table (3) GC analysis of standard pesticides.

Peak No.	Retention time (Rt.)	Pesticides	Concentration (%)
1	14.247	Hexachlorobenzene (HCB)	16.80
2	15.110	Lindane	27.80
3	20.603	Heptachlor	5.99
4	23.299	Aldrin	5.41
5	31.178	Dieldrin	7.50
6	31.699	O, P. DDD	2.00
7	32.784	Endrin	7.20
8	34.862	P, P. DDD	7.10
9	35.398	O, P. DDT	8.21
10	39.320	P, P. DDT	11.99

Table (4) GC analysis of standard pesticides.

Peak No.	Retention time (Rt.)	Pesticides	Concentration (%)
1	3.241	Methamidophose	42.28
2	3.526	Unknown	19.76
3	4.155	Unknown	3.36
4	4.498	Unknown	0.95
5	13.175	Phorate	1.08
6	13.720	Thiometon	3.73
7	16.520	Diazinon	2.69
8	19.677	Chloropyrifos – Me.	1.74
9	21.989	Pirmophos – Me.	4.58
10	22.945	Malathion	2.49
11	23.468	Dorsbane	14.41
12	30.888	Profenofos	2.93

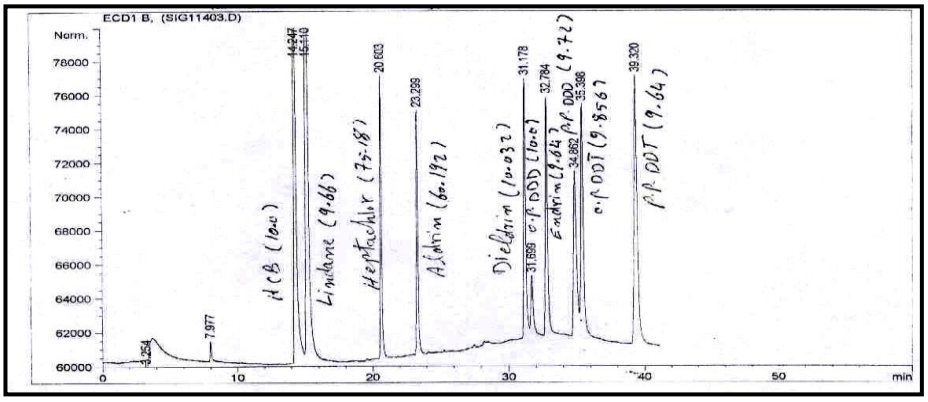

Fig. (1) GC chromatogram of standard pesticides .

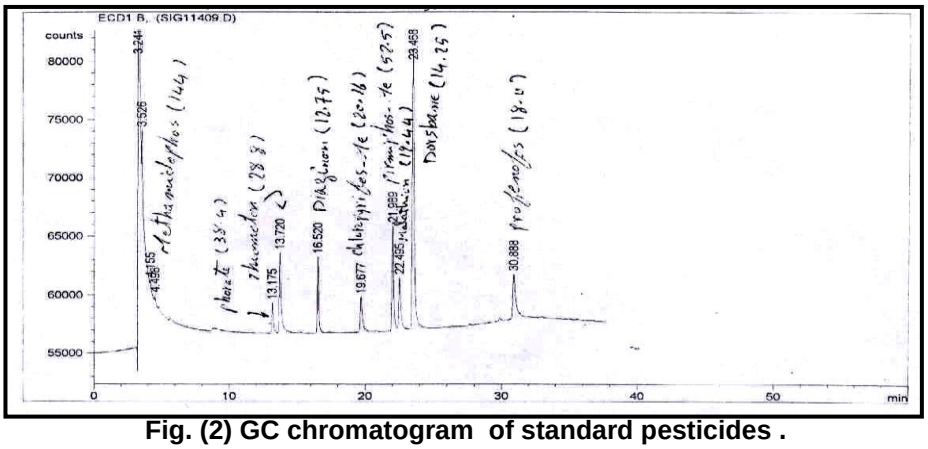

Fig. (2) GC chromatogram of standard pesticides .

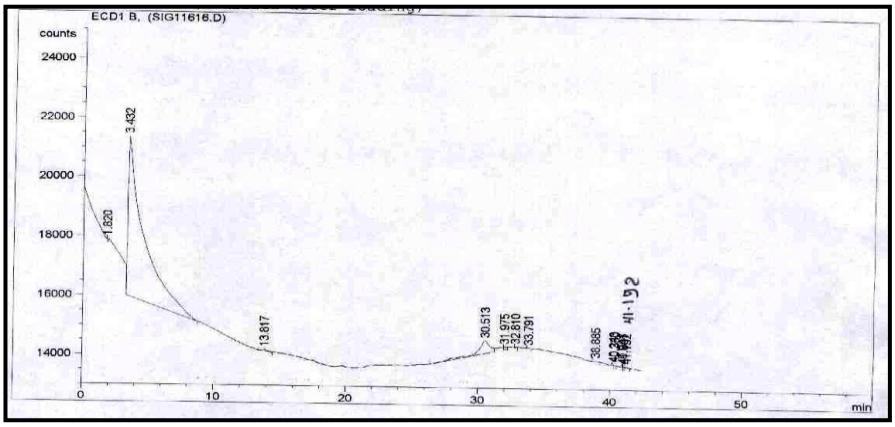

Fig. (3) GC chromatogram of pesticides in treated water sample withdrawn from New Mansoura station

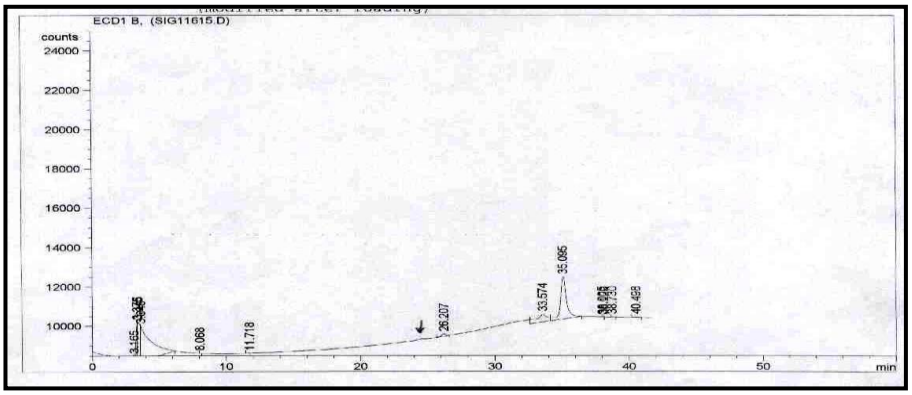

Fig. (4) GC chromatogram of pesticides in treated water sample withdrawn from Shark EL-Mansoura station

Total viable count and spore-forming bacteria

Potable water collected from the different two public water supplies showed that drinking water in Mansoura city was singularly contaminated by bacteria (Table 5) The minimum value of TVC in potable water, was found in water samples of Shark EL-Mansoura ($2.0x10^4$ cfu/ 100ml) followed by new Mansoura station (Meet Khames station) $1.5x10^3$cfu/ 100ml waterworks. Where, water of both waterworks are chlorinated during their treatment. The microbial count in chlorinated water may by belong to the chlorine-resistant and sport forming bacteria. These results are in agreement with Ridgway and Olson (1981) who pointed out that chlorine-resistant bacteria could be survived up to 10 mg L^{-1} of free chlorine. El-Naggar (2002) found that standard plate count in drinking water of some water plants in Alexandria fluctuated between 0.92 to 7.56 cfu /100ml.

Water samples collected acquired a varied counts of spore-forming bacteria, These bacteria are usually found in natural water and do not pose any health risk for humans (Rice *et al*, 1996). However, Presence of water treatment since it being more heat resistant than coliform group. The data of Table (5) display that water samples had the highest value $2.0x10^3$cfu/100ml in Shark EL-Mansoura. It is obvious that water samples new Mansours station were free from spore forming bacteria.

In conclusion, TVC of potable water collected from studied areas in Mansoura city was low contaminated with bacteria but count of spore forming bacteria is almost ignored in the standards recommended guidelines for drinking water quality (Egyptian Standard for Drinking Water Quality, 1995).

Escherichia coli

Drinking water must be free from coliform bacteria and other pathogenic microorganisms (Office of Drinking Water System Management 2004; and USPEA 2004; and Egyptian Standard for Drinking Water quality 1995). As data show *E. coli* was rare speared in the studied water samples. Where, its count fluctuated from 2×10^2 cfu/100 ml in water samples of Shark EL-Mansoura count to 0.5×10 cfu/100ml in water samples of new Mansours station. The presence of such bacteria in potable water of Mansoura city may pose an immediate health risk to consumers.

El-Naggar (2002) found that total coliform count in drinking water collected from different Water plants in Alexandria ranged between 0.79 and 1.79 cfu /100ml. and free from focal coliform. While, only 2 out of 24 samples collected from new Mansoura station were positive to coliform count test (0.5×10 cfu /100ml) . This indicates that the conditions of the water of the previous waterworks was controlled as to give such a wide fluctuation in count of (pathogenic bacteria). Such microbes can survive in water and is considered as water born diseases (Nandan and Patel, 1985). These microbes could be leached out from the distribution pipes network as a result of accident leaking in any branch.

Table (5): Total viable count (cfu/100ml), Pathogenic bacteria(*E. coli*), spore-forming count (cfu/100ml) and green algae (Unit L^{-1})of Potable water samples collected from Different district areas in Mansoura city during 2007/2008.

Districts Area	(TVC) cfu/ 100ml	Pathogenic bacteria (*E. Coli*)	(SFB) cfu / 100ml	Green algae (Unit L^{-1})
New Mansoura Station	$1.5x10^3$	0.5×10	0.00	0.00
Shark EL-Mansoura	$2.0x10^4$	$2.0x10^2$	$2.0x10^3$	130 - 221

Algae count

Algal count is an excellent indice, which could be used for detection and evaluation of water pollution (Nandan and Patel , 1985). Green algal count of potable water in Mansoura city ranged from 340 unit L^{-1} in the water

samples of new Mansoura station to 30 unit L^{-1} in Shark EL-Mansoura station . Temperature of environment has an effect on the total algae count. Whereas the increases the water temperature lead to enhancement in the count of survived algae. Consequently, the highest algae count in the water samples of most studied waterworks was present in surface area while the lowest one was found in deep collected water. The present of algae may be due to the efficiency of water filtration during treatment process (Falwell and Miller 1992). These results are in agreement with El-Naggar (2002) who found that total algae count in drinking water of some water plants in Alexandria varied between 450 to 563 org. L^{-1}.

The present study determined also a survival of blue green algae (BGA) which was taken into account as bacteria (cyanobacterial cells). This type of algae could produce toxins which significantly impair water quality. Data revealed that all water samples collected from both stations are free from BGA

It can be concluded that physicochemical analysis of potable water in Mansoura city proved that drinking water agreed with the standard permissible limits , but the nitrate level of treated water sample of St.I was higher than the permissible limits and must be reduced by using the splite stream arrangement via mixing the high nitrate level of drinking water sample with untreated water to dilute the nitrate concentration. The results proved that treated water samples of St.I and St. II are free from any pesticide residues .

On the other hand the microbiological studies concluded , as mentioned in the Egyptian Standard For Drinking Water Quality (1995) , water must be free from coliform bacteria and other pathogens. Therefore, samples taken from Mansoura city have relatively good quality from the microbiological aspects especially present of algae. The danger of pollution with pathogenic microorganisms and toxic products of biological decomposition is the most immediate problem that can be efficiently eliminated by water chlorination (Stambuk-Giljanovic, 1999).

The recorded high bacterial loads may have adverse effects and cause diseases it may be due to filtering action of the soil (Nikoladze *et al*, 1989). Inspection system of public water supply should be conducted to find and eliminate any possible sources of contamination. Once the source of contamination is identified, it can usually be eliminated by making system repairs, flushing, and / or "shock" chlorinating the system . Finally , the potable water in Mansoura city is safe .

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كيف تكون مياة الشرب آمنة فى المنصورة

مصطفى ابراهيم سند* و فاطمة ابراهيم الهوارى **

*** قسم الكمياء الزراعية - كلية الزراعة - جامعة المنصورة**

**** قسم الميكروبيولوجى- كلية الزراعة - جامعة المنصورة**

من المعروف ان مياه الشرب هامة جدا و أساسية لحياة البشر. تشارك المياه في تكوين العضلات والرئة والمخ ومعظمها في الدم. ولذا فاذا كانت المياه غير جيدة او ملوثة فان صحة الانسان سوف تتأثر وتتسبب بالتالي في العديد من الامراض. وقد جرى هذا البحث لتقييم جودة مياه الشرب المسحوبة من محطتي مياه الشرب في مدينة المنصورة. اخذت عينات المياه من كل محطة من المأخذ (المياه الداخلة للمحطة) وعينة اخري من المخرج. وحللت عينات المياه من ناحية الخواص الطبيعية والكيميائية للمتغيرات التالية: درجة الحرارة والأس الهيدروجيني والكربونات والبيكربونات والكلوريد والكالسيوم والماغنسيوم وعسر الماء الذي يسببه الكالسيوم وعسر الماء الذي يسببه الماغنسيوم و العسر الكلي للماء ودرجة التوصيل الكهربي والامونيا والنترات والمواد العضوية . وقد اثبتت النتائج قياس مستويات عالية من البيكربونات والكلوريد والنترات في المياه الخام لمحطة المنصورة الجديدة بمتوسط قيم تصل الي 240,95، 37,30، 68,6 جزء في المليون علي الترتيب. وقد انخفضت هذه القيم الي 183,1، 58,8 جزء في المليون لكل من البيكربونات والنترات في الماء المعامل علي الترتيب. بينما كان محتوي الكلوريد قد زاد الي 44,4 جزء في المليون. أظهرت عينات المياه الخام والمعالجة بمحطة مياه شرق المنصورة مستويات عالية من الكالسيوم 96,64 جزء في المليون والماغنسيوم 36,24 جزء في المليون. بينما كان مستوي النترات منخفضا بالمقارنة بمحطة المياه الاولي حيث كانت 49,6 جزء في المليون. محتوي المادة العضوية للمياه الخام والمعالجة لمحطة مياه المنصورة كانت 0,033 ، 0,02 جم/100مل علي الترتيب بينما مستويات المادة العضوية للعينات الخام والمعالجة المتحصل عليها من المحطة الأخرى انخفضت لتكون 0,026 ، 0,013 جم/100 مل علي الترتيب. متبقيات المبيدات كانت تقدر ايضا في عينات مياه الشرب المعالجة باستخدام التحليل الكروماتوجرافي الغازي في وجود 19 مركب قياسي من المبيدات. و قد أجري الفحص الميكروبيولوجي باستخدام نفس عينات المياه و الذي شمل العد الكلي المتاح و البكتريا المرضة من مجموعة الكوليفورم من نوع اشرشيا كولاي و بكتريا الاسبورفورمنج. وقد اختبر ايضا وجود الطحالب الخضراء والزرقاء. النتائج اثبتت ان الماء المعالج في محطة مياه المنصورة شرق كانت ملوثة بالبكتريا حيث ان العد الكلي المتاح كان يتراوح من $1,5 \times 10^{3}$ cfu/ مل الي 2×10^{4} cfu/ مل في كل من المحطتين. بكتريا الاسبورفورمنج (الباسيلس) والتي لا تمثل اي خطر علي صحة الانسان اذا وصلت الي الحد الأقصى 2×10^{3} cfu /مل في محطة مياه شرق المنصورة. جميع العينات المتجمعة كانت خالية من بكتريا الكوليفورم. الطحالب الخضراء و الخضراء المزرقة لم تكتشف في كل عينات المياه المتجمعة من محطة المنصورة الجديدة بينما العينات المتجمعة من محطة المنصورة شرق المنصورة كانت خالية فقط من الطحالب الخضراء المزرقة. بينما كانت الطحالب الخضراء تمثل من 130 الي 221 وحدة/لتر في عينات المياه بمحطة شرق المنصورة. من هذه النتائج يمكن القول ان مياه الشرب آمنة وذات جودة عالية.