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MONITORING OF DRINKING WATER QUALITY BY BACTERIAL INDICATORS AND TRIAL FOR DETECTION

[1]Farrag [a] A.A; [2] Khalil [a] A.M and [3] El.Bahnasy [b]M.A.

a - Al-Azhar University. Faculty of science, microbiology Department.Nassar City, Cairo, Egypt.
b- Water and waste Water Company .Central lab, El-Gharbia Gavernate.Tanta, Egypt.

ABSTRACT

In this study eight water samples were collected from three plants, (Al-Arida plant, (3 sample),Shobra-blola plant (3 sample), and Meet- maemon plant (2 sample) from AL-Gharbia, Egypt .The results showed that the seasonal variation in heterotrophic and streptococcus bacteria showed the microbial prevalence in raw water of Al-Arida plant, but not detected in filtrated water. On the other hand ,both of total and fecal Coliform bacteria showed microbial prevalence in raw water of Al-Arida plant mean while disappeared in filtrated water. However, Shobra-blola plant and Meet- maemon plant showed seasonal variation in heterotrophic and streptococcus bacteria in a permissible limits. Amazingly new media (Lauryl tryptose broth with mug) has the ability to detect the indicator bacteria in only 24 hr (s). versus conventional methods as Most Probable Number (MPN) and membrane filtration (MF). Accordingly , the pollution level have been indicated as water quality index ,(WQI) for all annual seasons which its arrangement was in descending order as , Winter < Autumn < Spring < Summer respectively .Also, the highest Pollution levels was in winter season as compared with other seasons. This phenomenon may be attributed to the accumulation of wastes of drains which is accompanied by winter stagnant period while lowers water level in River Nile leading to an increase in pollutants loaded and decreased in diluted levels.

Key words: Drinking water, bacterial indicators, Detection trials, total & fecal Coliform bacteria.

INTRODUCTION

The World Health Organization estimates that Diarrhea caused by inadequate drinking water, sanitation and hand hygiene kills an estimated 842,000 people every year globally or approximately 2,300 people per day) Tropical Medicine and International Health, 2014 (.750 million people around the world lack access to safe water; approximately one in nine people, more than twice the population of the United States lives without access to safe water)World Health Organization and United States Census Bureau Estimates 2014). 82% of those who lack access to improved water live in rural areas, while just 18% live in urban areas)World Health Organization and UNICEF Joint Monitoring Programme 2014).

The lack of freshwater is likely to be one of the most critical natural resource issues facing people in the next 50 years. The world's population is expanding rapidly, yet our supplies of freshwater are not, placing greater demand on our water resources, this makes it even more important that the remaining freshwater we have is kept safe and clean (Environmental Protection Agency, 1995).

The Nile River is the principal freshwater resource for Egyptians and represents more than 97% of Egyptian water resources (Korium and Toufeek, 2008). Globally, industrial waste water represents the main source of water pollution. The uprising increase in modern industries, agriculture urbanization, tourism and human activities are the main sources for chemical pollution to both, aquatic environment and its coexisting ecosystems (Gunkel et al., 2007). Heavy metals are persistent contaminants in the environment causing serious illness in fish, animals and human. Regionally, industrial and agricultural runoffs are considered the primary source of metal poisoning to fish and other aquatic animals in Egypt (Eissa et al., 2013)

Contamination of water is a serious environmental problem as it adversely affects the human health and the biodiversity in the aquatic ecosystem. The use of indicator bacteria such as fecal Coliforms (FC) and fecal streptococci (FS) for assessment of fecal pollution and possible water quality deterioration in fresh water sources is widely used (AWWA and WEF, 2005).

Liquid water is a highly versatile material, although it is formed from the tiniest of molecules, it can shape and control bio molecules. The hy-

drogen-bonding properties of water are crucial to this versatility, as they allow water to execute an intricate three-dimensional 'ballet', exchanging partners while retaining complex order and enduring effects. Water can generate small active clusters and macroscopic assemblies, which can both transmit information on different scales. (Nature Reviews Molecular, 2006). Different bacterial genera in the water of the River Nile at Egypt is due to direct contamination caused by human activities and indirect effect by ecological disturbances. Bacteria may enter the distribution system through the failure to disinfect water or maintain a proper disinfection residual; low pipeline water pressure; intermittent service; excessive network leakages; corrosion of parts and inadequate sewage disposal (Narasimhan, 2008). One of the most important factors of water pollution is the microbial contamination; especially with pathogenic microorganisms. Enteric pathogens are typically responsible for waterborne sickness (WWAP, 2009)

MATERIALS &METHODS

SAMPLING LOCATIONS

Eight water sample(s) were collect from El-Gharbia area for each season starting from 21/12/2012 to 21/3/2013 “winter season” also Another eight sample were collect from 21/3/2013 to 21/6/2013 “spring seasons” ” then from 21/6/2013 to 21/9/2013 “summer season and lastly “autumn season” from 21/9/2013 to 21/12/2013.

El-Gharbia samples were collected from (out, in and distribution network system) plant. Selected three plants (Al-arida plant, shobra blola plant and meet maemon plant). The El-Arida plant (filirtrated water plant from the Nile “raw water”), the Shobra-blola plant called (treatment water plant from well) and the meet maemon plant (without treatment) the water direct to the network distribution.

The bacteria present in this study according to family Enterobacteriaceae.

SAMPLING

The water samples were collected in clean, sterile and transparent polyethylene bottles without any dechlorinating agent for the inorganic analysis and sodium thiosulfate (0.1 ml of 3% Na2S2O3) for the microbiological analysis to neutralize residual chlorine present in tap water.

For analysis heavy metals bottle used are made of autoclavable plastic (capacity 0.5 L) and acidify the sample to pH < 2 using 2 ml very pure nitric acid then stored in a refrigerator (APHA, 2005).

BACTERIAL IDENTIFICATION:

The bacterial isolates exposed to different physic &biochemical testes then conformed identification by using Analytical profile Index(API Rapid 20E Kit) used for Enterobacteriaceae (Barry and Badal,1979)

WATER ANALYSIS

The bacteriological, physical and chemical parameters of water samples WERE estimated according to the standard methods for the examination of water and wastewater (APHA, 2005) as well as purification and confirmed identification of waterborne indicator bacteria according to API.

Total organic carbon (TOC) measurement by using sievers 5310 Instrument ((APHA, 2005).

SAMPLING AND STORAGE:

Collected and stored samples were done in glass bottle as protection from sunlight and sealed with Teflon (TFE) septum.

Before use bottles washed with acid (example HCL) and bake at 250 °c for at least 1 hr.

Washing of un- cleaned Teflon (TFE) septa with detergent rinse repeatedly with organic – free water.

Check performance of new or cleaned septa by running appropriate blanks.

Keeping the bottles in a place free from organic contamination

Rinse bottle with sample before filling. When sample collected.

Preserving sample that cannot be examined immediately by holding at 4 °c with minimal exposure to light and atmosphere acidification with phosphoric or sulphoric acid to PH ≤ 2 at the time of collection is especially desirable for unstable samples and may be used on all sam-

ples: acid preservation however invalidates any inorganic carbon determination on the samples APHA,(2005).

RESULTS

Table (1) showing that the seasonal variation of chemicals and biological analysis of raw water (El-Arida plant) during four seasons. It was observed that the seasonal variations in turbidity concentration were found in the ranges of, (8.6, 11, 10 and 9 NTU) during winter, spring, summer and autumn respectively. The highest value of turbidity (11 NTU) was found in the spring season while the lowest value of turbidity (8.6 NTU) was found in the winter season.

Regarding the mean value of seasonal variations in temperature concentration of water was found in the ranges of, (19.3, 27, 29 and 21 °C) during winter, spring, summer and autumn respectively. it was found that highest temperature value was (29°C) in summer season while the lowest value was found in winter season at (19.3°C).

There was no difference in pH in the four seasons as showed in table (1)

The seasonal variation of Electric Conductivity (EC) (µs/cm) concentration was found in the ranges of (403.5, 305, 293 and 310 µs/cm) during winter, spring, summer and autumn respectively. The maximum concentration was recorded in the winter (403.5 µs/cm) and the minimum concentration was occurred in the summer (293 µs/cm).

The seasonal variation of total dissolved solids concentration at (120°C) was found in the ranges of, (201, 154, 146 and 212 mg/l) during winter, spring, summer and autumn respectively. The maximum concentration was occurred in the autumn as (212.5 mg/l) while the minimum concentration was occurred in the summer as, (146 mg/l).

The seasonal variation of total organic carbon (TOC) concentration was found in the ranges of (5.69, 4.95, 4.6and 4.92 mg/l) during winter, spring, summer and autumn respectively. The maximum concentration was recorded in the winter as (5.69 mg/l) and the minimum concentration was occurred in the summer as (4.6 mg/l).

This table presented that seasonal variations of the total bacterial count were found in the ranges of (3148, 3293, 2712 and 2703 colony forming unit) during winter, spring, summer and autumn respectively. The maximum concentration was recorded in the spring as (3293 cfu) and the minimum concentration was occurred in the autumn as (2703 cfu).

The seasonal variation of total Coliform count was found in the ranges of (66, 39, 33 and 37 cfu) during winter, spring, summer and autumn respectively. the maximum concentration was recorded in the winter as (66 cfu) and the minimum concentration were occurred in the summer as (33 cfu) .

The seasonal variation of fecal Coliform count was found in the ranges (16, 11, 5 and 9 cfu) during winter, spring, summer and autumn respectively. The maximum count was occurred in the winter (16 cfu) and the minimum count was occurred in the summer (5 cfu).

The seasonal variation of Fecal Streptococcus count was found in the ranges of (11, 6, 9 and 11 cfu) during winter, spring, summer and autumn respectively. The maximum count was recorded in the winter and autumn as (11 cfu) and the minimum count were occurred in the spring (6 cfu).

Finally as shown in table (1). It was observed that there was inversely relationship between Turbidity and Fecal Streptococcus. Also there was directly relationship between turbidity and presence of fecal Coliform bacteria. Also there was inversely relationship between temperature and presence of bacteria.

The seasonal variation value of chemicals and biological analysis of filtrated water of (El-Arida plant) during the four seasons. It was observed that the seasonal variations in turbidity concentration of it were found in the ranges between (1.2, 1.03, 0.2 and 0.3 Nephleometric turbidity unit" NTU") during winter, spring, summer and autumn respectively. However the Highest value of Turbidity as (1.2" NTU") was detected in the winter season while the lowest value of Turbidity as (0.2 "NTU") was detected in the summer season. Figure (1)

Accordingly and by Regarding the mean value of seasonal variations in temperature concentration of it water were detected in the ranges between (19, 26.5, 29 and 21 °C) during winter, spring, summer and autumn respectively. It was detected that the highest value at (29°C) in summer season while the lowest value was detected in winter season at (19.3°C).

figure (2) also showed that the mean value of seasonal variations in pH concentration of water was detected in the ranges between (7.5, 7.5, 7.5 and 7.5) during winter, spring, summer and autumn respectively. It was found that the pH value was stable in the four seasons at value of (7.5).

Analysis of network distribution of (El-Arida plant) during the four seasons.

Data presented in (table 2) showed that seasonal variation of the Total Plate Counts was found in the ranges between (32, 3, 9 and 20 "CFU") during winter, spring, summer and autumn respectively. The maximum concentration was detected in the winter (32 "CFU") and the minimum concentration was detected in the spring (3 "CFU").

The results in table (2) showing that the seasonal variations in turbidity concentration were detect in the ranges between (0.5, 0.72, 0.64 and 0.32 NTU) during winter, spring, summer and autumn respectively. The highest value of turbidity as (0.72 NTU) was found in the spring season while the lowest value of turbidity as (0.32 NTU) was found in the autumn season.

regarding the mean value of seasonal variations in temperature degree of network distribution of water were found in the ranges between (18, 21, 28 and 20 °C) during winter, spring, summer and autumn respectively. Also, it was found that the highest value as (28°C) was detected in summer season while the lowest value was found in winter season as (18 °C).

Moreover, this table also showed the mean value of seasonal variations in pH concentrations of water was found in the ranges between (7.5, 7.5, 7 and 7.4) during winter, spring, summer and autumn respectively. Interestingly the maximum concentration were occurred stable in the seasons (winter and spring) at the highest value as (7.5) while the lowest value was found in summer as (7).

The seasonal variation of fecal Streptococcus count was found in the ranges (<1, <1, <1 and <1cfu) during winter, spring, summer and autumn respectively. The values were stable less than one (<1).

Table (3) showed the mean value of chemicals and bacteriological analysis of water in (shobra-blola) plant before and after the treatment well during the four seasons. The difference between them showed that the turbidity after treatment is higher than before treatment except spring and the values of these elements (pH,temp,NO2,NO3,NH3,TOC,F,Mg,Ca,SO4,TDS,EC) were slightly different before and after treatment. The values of Iron (Fe) and Manganese (Mn) after treatment is lower than before treatment. The values of (heterotrophic, total Coliform is constant, fecal Coliform and fecal Streptococcus) bacteria after treatment were lower than before treatment.

Figure (2) Relationship between total bacterial count (A) and total Coliform bacteria(B) (before, after treatment and network distribution) seasonal variation of shobra- blola plant.

Figure (2) showing the seasonal variation value of bacteriological analysis indicators of Shobra-blola plant (before, after and network distribution water) during the four seasons. It was observed that the seasonal variations in heterotrophic bacteria ,the maximum counts were observed decrease after treatment and it increase in permissible limit in (network distribution) .This figure illustrated that the total Coliform bacteria of four season were the maximum count before treatment and not found after treatment in the four seasons (less than one).

Table (4) Mean value of chemicals and bacteriological analysis of water in meet -memon plant during the four seasons (direct well and network distribution) .The difference between them showed that the turbidity in direct well is higher than the network distribution except in autumn season. While the values of these elements (pH,temp,NO2,NO3,NH3,TOC,F ,Mg ,Ca,SO4,TDS,EC CaCO3,CL,AL,BOD, CU,Z, total hardness, calcium hardness and magnesium hardness) were slightly different in direct well and network distribution. The values of Iron (Fe) and Manganese (Mn) in direct well are higher than network distribution except autumn season. The values of (heterotrophic) bacteria in direct well was lower than before network distribution. While total Coliform bacteria is constant (> 1)

except in winter (2 CFU) but fecal Coliform and Fecal Streptococcus are constant (> 1) in direct well and network distribution.

Species present in water during studies: This bacteria found in winter and spring seasons of network distribution system of all plants.

KLUYVERA SP

ENTEROBACTER CLOACAE

E.COLI AND PROVIDENCIA STUARTII

Comparison between normal test and rapid test for detection of indicator bacteria in drinking water.

NORMAL TEST: IS DIVIDED INTO TWO TYPES:

(Most Probable Number) MPN technical Use broth media. This use more than one media and take 7 days to obtain bacteria.

Membrane filters technical (use agar media). This use more than one media and take 4 days to obtain bacteria.

RAPID TEST:

By this test detection of the indicator bacteria to measure the quality of water will takes place in only 24 hours by using one culture media as (Lauryl tryptose broth with mug).

Table (1)Mean value of chemicals and bacteriological analysis of raw water during the four seasons inEl-Arida plant.

Parameter	Dec. 458 / 2007 Limits	season	winter	spring	summer	Autumn
		Coordinates (MSL)	raw water	raw water	raw water	raw water
Color	Colorless	Pt/Co	colorless	colorless	colorless	Colorless
Turbidity	1	NTU	8.6	11	10	9
Temperature	-	°C	19.3	27	29	21
Ph	6.5 - 8.5	-	7.9	8	8	8
Electric Conductivity	-	µS/cm	403.5	305	293	310
Total Dissolved Solids (120° C)	1000	mg/l	201	154	146	212
Total Alkalinity as ($CaCO_3$)	-	mg/l	134.6	136	136	157
Chlorides (Cl)	250	mg/l	30.4	19	12	50
Sulfates (SO_4)	250	mg/l	39	28	17	45
Total Hardness as ($Ca\ CO_3$)	500	mg/l	141.6	124	106	123
Calcium Hardness	350	mg/l	83	71	61	89
Magnesium Hardness	150	mg/l	59	53	44	36
Calcium (Ca)	-	--	33	28	25	36
Magnesium	-	--	14	13	9	14
Sodium	2.00	mg/l	30	22	24	25
Zink	3.00	mg/l	ND	0..03	0.006	0.009
Cupper	2.00	mg/l	ND	0.015	0.022	0.046
Toc	-	mg/l	5.69	4.95	4.6	4.92
Floride	-	mg/l	0.27	0.3	0.33	0.26
Almonum(AL)	0.2	mg/l	0.09	0.05	0.04	0.02
Ammonia as (NH_3)	0.5	mg/l	0.30	0.3	0.31	0.3
Nitrites as (NO_2)	0.2	mg/l	0.2	0.13	0.07	0.13
Nitrates as (NO_3)	45	mg/l	3.2	3.2	2.45	2.7
BOD_5	-	mg/l	1.6	0.8	0.7	1.1
Iron (Fe)	0.3	mg/l	0.7	0.6	0.44	0.45
Manganese (Mn)	0.4	mg/l	0.09	0.03	0.02	0.07
Total bacterial Count at 37 °C	> 50	cfu/1ml	3148	3293	2712	2703
Total Coliform	>2	cfu/100ml	66	39	33	37
Fecal Coliform	-ve	cfu/100ml	16	11	5	9
Fecal Streptococcus	-ve	cfu/100ml	11	6	9	11

Key:*Pt/Co =platinum per cobalt, *µS /cm=microseism per centimeter, *mg/l=mill gram per liter *cfu/1ml=colony forming unit per 1ml sample, *NTU =Nephleometric turbidity unit,*(-)or (ND)=not detected(zero volume)*cfu/100ml= colony forming unit per 100ml sample,* TOC=total organic carbon

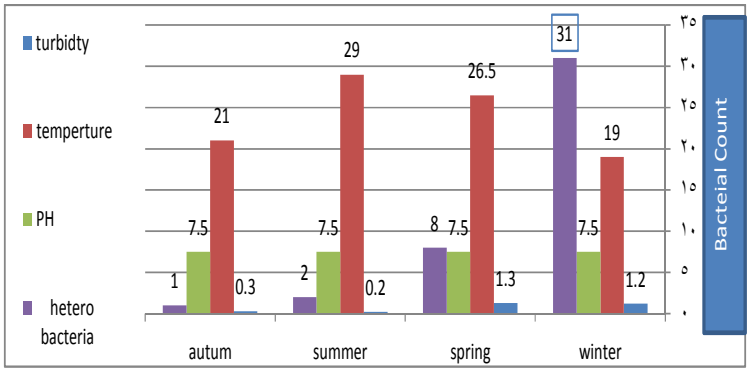
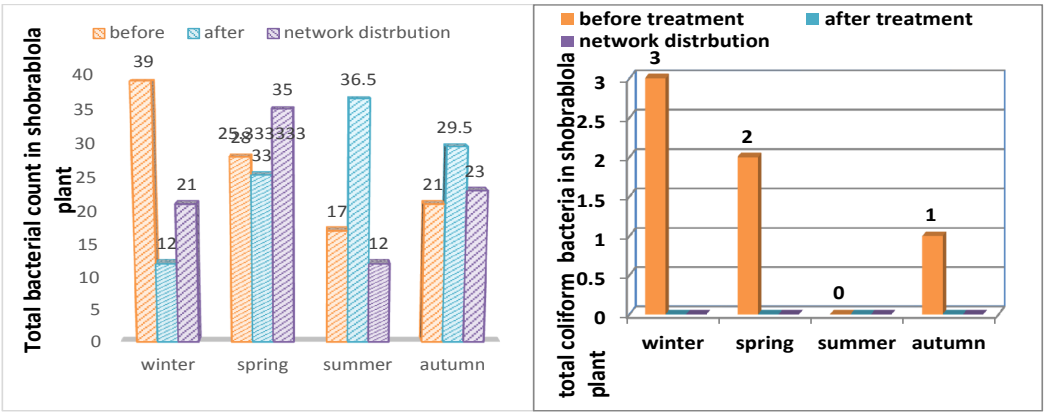


Figure (1)Showing the relationship betweenturbidity,Temperature, PH, andHeterotrophic bacteria in filtrated state of Al-Arida plant.

Table (2) Showing the seasonal variation value of chemicals and biological Analysis of network distribution of (El-Arida plant) during the four seasons.

Parameter	Dec. 458 / 2007 Limits	season	winter	Spring	summer	Autumn
		Coordinates (MSL)	network	Network	network	network
Color	Colorless	Pt/Co	colorless	Colorless	colorless	colorless
Turbidity	1	NTU	0.5	0.72	0.64	0.32
Temperature	-	°C	18	21	28	20
pH	6.5 - 8.5	-	7.5	7.5	7	7.4
Electric Conductivity		µS/cm	423	380	351	333
Total Dissolved Solids (120° C)	1000	mg/l	216	191	188	235
Total Alkalinity as ($CaCO_3$)		mg/l	124	123	122	156
Chlorides (Cl)	250	mg/l	37	24	19	53
Sulfates (SO_4)	250	mg/l	48.5	39	27	53
Total Hardness as (Ca CO_3)	500	mg/l	143	125	106	122
Calcium Hardness	350	mg/l	81	73	62	90
Magnesium Hardness	150	mg/l	59	53	45	60
Calcium (Ca)	-	-	32	29	25	36
Magnesium	-	-	14	13	9	14
Floride	0.8	mg/l	0.26	0.31	0.25	0.36
Sodium	2.00	mg/l	35	29	26	20
Zink	3.00	mg/l	ND	0.009	0.005	0.002
Cupper	2.00	mg/l	ND	ND	0.014	0.012
TOC	-	-	3.18	3.12	3	3.08
Aluminum(AL)	0.2	mg/l	0.17	0.2	0.2	0.2
Ammonia as (NH_3)	0.5	mg/l	0.044	0.03	0.03	0.06
Nitrites as (NO_2)	0.2	mg/l	0.0006	0.005	0.0008	0.008
Nitrates as (NO_3)	45	mg/l	2.5	2.2	1.2	1.8
BOD_5	-	mg/l	0	0	0	0.3
Iron (Fe)	0.3	mg/l	0.03	0.04	0.1	0.003
Manganese (Mn)	0.4	mg/l	0.006	0.0003	0	0.0003
Total bacterial Count at 37 °C	> 50	cfu/1ml	32	3	9	20
Total Coliform	>2	cfu/100ml	1	2	1	9
Fecal Coliform	-ve	cfu /100ml	<1	<1	<1	2
Fecal Streptococcus	-ve	cfu/100ml	<1	<1	<1	<1



(A) (B)

Figure (2) Relationship between total bacterial count (A) and total Coliform bacteria(B) (before, after treatment and network distribution) seasonal variationofshobra-blola plant.

Table (3) Mean value of chemicals and bacteriological analysis of water in(shobra-blola) plantbefore and aftertreatment well during the four seasons.

Parameter	Dec. 458 / 2007 Limits	season	winter	spring	summer	Autumn	winter	spring	summer	Autumn
		Coordinate (MSL)	before treatment well				after treatment well			
Color	Colorless	Pt/Co	colorless	colorless	colorless	colorless	Colorless	Colorless	Colorless	Colorless
Turbidity	1	NTU	0.43	0.65	1.03	1.48	0.6	0.56	3.06	2.2
Temperature	-	°C	24	25	25.5	24.5	25	24	25	24
pH	6.5 - 8.5	-	8	8	7.5	7.5	8	8	7.5	7.6
Electric Conductivity		µS/cm	562	601	598	581	562	585	578	582
Total Dissolved Solids (120o C)	1000	mg/l	299	319	317	307	299	310	307	308.5
Total Alkalinity as (CaCO3)		mg/l	244	221	178	182	219	235	189	182
Chlorides (Cl)	250	mg/l	36	41	73.5	64	29	39	71	75
Sulfates (SO4)	250	mg/l	0	0	24	22.7	0	0	24	26.5
Total Hardness as (Ca CO3)	500	mg/l	203	225	211	226	204	206	227	229
Calcium Hardness	350	mg/l	123	142	135	151	132	128	161	164
Magnesium Hardness	150	mg/l	80	82	75.5	75	71	78	69.5	68.5
Calcium (Ca)	-	-	49	57	54	60	53	51	64	65.6
Magnesium	-	-	19	20	18	18	17	19	17	16
Floride	0.8	mg/l	0.25	0.2	0.18	0.22	0.25	0.2	0.18	0.22
Sodium	2.00	mg/l	35	36	34	35	40	39	37	38
Zink	3.00	mg/l	0.004	0.003	0.001	0.004	ND	ND	ND	ND
Cupper	2.00	mg/l	0.008	0.002	0.0004	0.004	0.01	0.007	ND	0.009
TOC	-	mg/l	1.10	1.08	0.90	0.92	1.15	1.11	0.92	0.94
Almonum(AL)	0.2	mg/l	-	-	-	-	-	-	-	-
Ammonia as (NH3)	0.5	mg/l	0.03	0.15	0.2	0.25	0.05	0.05	0.3	0.2
Nitrites as (NO2)	0.2	mg/l	0.025	0.003	0.009	0.0098	0.007	0.003	0	0.16
Nitrates as (NO3)	45	mg/l	3	1.2	1.3	0.7	3	2	0.7	0.4
BOD5	-	mg/l	0	0	0	0	0	0	0	0
Iron (Fe)	0.3	mg/l	0.5	0.4	0.5	0.5	0.04	0.08	0.15	0.19
Manganese (Mn)	0.4	mg/l	0.7	0.6	0.5	0.7	0.3	0.3	0.2	0.2
Total Plate Count at 37 °C	> 50	cfu/1ml	39	28	17	21	12	25	36	29
Total Coliform	>2	cfu/100ml	3	2	<1	1	<1	<1	<1	<1
Fecal Coliform	-ve	cfu/100ml	2	1	<1	<1	<1	<1	<1	<1
Fecal Streptococcus	-ve	cfu/100ml	1	1	<1	<1	<1	<1	<1	<1

Table (4) Mean value of chemicals and bacteriological analysis of water inmeet memon plantduring the four seasons (direct well and network distribution)

Parameter	Dec. 458 / 2007 Limits	season	winter	spring	summer	Autumn	winter	spring	summer	Autumn
		Coordinate(MSL)	direct from well				network distribution			
Color	Colorless	Pt/Co	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
Turbidity	1	NTU	4.7	2.7	0.64	0.81	1.61	0.25	0.09	0.81
Temperature	-	°C	16.9	16.5	17	16	16.8	18	16.9	16.6
pH	6.5 - 8.5	-	7.6	7.6	7.8	7.8	7.5	7.7	7.6	7.8
Electric Conductivity		µS/cm	397	553.8	650	785	393	749	745	785
Total Dissolved Solids (120o C)	1000	mg/l	196	287.1	345	354.5	367	397	395	354.5
Total Alkalinity as (CaCO3)		mg/l	143	200	240	237.5	140	270	252.5	237.5
Chlorides (Cl)	250	mg/l	38	49.7	62	65.5	40	71	62.5	65.5
Sulfates (SO4)	250	mg/l	34	37.97	33	53	39.2	32	30.8	53
Total Hardness as (Ca CO3)	500	mg/l	214	249	227	278.5	214	264	228.5	278.5
Calcium Hardness	350	mg/l	161	156.6	147	148	158	156	145.5	148
Magnesium Hardness	150	mg/l	83	92.8	80	94.5	88	108	92	94.5
Calcium (Ca)	-	-	72	64.6	58.8	59.2	71	62.4	58.2	59.2
Magnesium	-	-	33	29	19.2	22.68	35.2	25.92	22.08	22.68
Floride	0.8	mg/l	0.20	0.22	0.25	0.21	0.20	0.22	0.25	0.21
Sodium	2.00	mg/l	56	59	73	60	52	55	70	56
Zink	3.00	mg/l	ND	0.15	ND	ND	ND	0.17	ND	ND
Cupper	2.00	mg/l	ND	0.007	ND	ND	ND	0.009	ND	ND
TOC	-	mg/l	0.53	0.6	0.7	0.42	0.55	0.8	0.9	0.46
Almonum(AL)	0.2	mg/l	17.3	16	17.4	16.9	17.04	15.6	16.5	16.9
Ammonia as (NH3)	0.5	mg/l	0.15	0.3	0.27	0.23	0.14	0.13	0.345	0.23
Nitrites as (NO2)	0.2	mg/l	0.35	0.06	0.005	0.013	0.23	0.022	0.111	0.013
Nitrates as (NO3)	45	mg/l	0.8	0.81	0.8	0.78	0.85	3.3	1.52	0.78
BOD5	-	mg/l	0	0	0	0	0	0	0	0
Iron (Fe)	0.3	mg/l	0.18	0.2	0.15	0.21	0	0	0.035	0.21
Manganese (Mn)	0.4	mg/l	0.446	0.2	0.24	0.23	0.16	0.44	0.43	0.23
Total Plate Count at 37 °C	> 50	cfu/1ml	2	1	1	3	1	<1	5	<1
Total Coliform	>2	cfu/100ml	<1	<1	<1	<1	2	<1	<1	<1
Fecal Coliform	-ve	cfu/100ml	<1	<1	<1	<1	<1	<1	<1	<1
Fecal Streptococcus	-ve	cfu/100ml	<1	<1	<1	<1	<1	<1	<1	<1

Table (5)To identification the purification colony by Rapid 20e (biochemical test).

Test / organism	ONPG	LDC	ODC	URE	CIT	PPA	MNT	EST	ARA	XYL	ADO	RHA	CEL	MEL	SAC	TRE	RAF	GLU	IND	VP	OX
kluyvera sp	+	+	+	-	-	-	-	+	+	+	-	+	-	+	+	+	+	+	+	-	-
Enterobacter cloacae	+	-	+	-	+	-	+	-	+	+	-	+	+	+	+	+	+	+	-	+	-
E.coli	+	+	+	-	-	-	-	-	+	+	-	+	-	+	-	+	-	+	+	-	-
Providencia stuartii	+	-	-	-	+	+	-	-	-	-	-	-	-	-	+	+	-	+	+	+	-

DISCUSSION

The lack of freshwater is likely to be one of the most critical natural resource issues facing people in the next 50 years. The world's population is expanding rapidly, yet our supplies of freshwater are not, placing greater demand on our water resources. However, in this study water sample were collected from El-Gharbia government from plants of El-Arida, Shobra-bolola and Meet-memon. At 21-12-2012 to 21-12-2013, these samples were subjected to bacteriological indicator, physico-chemical and chemical analysis.

The obtained results were in agreement with that obtained by Spino (1966) who studied Elevated temperature technique for the isolation of Salmonella from streams, the results showed that there was a relationship between temperatures and the survival of fecal Coliforms. These data indicate that below 15 °C survival was inversely related to temperature but above 15 °C this relationship became less critical.

Current results were also in agreement with, (Bottman, 1967) who investigated that the presence of microorganisms in groundwater is heavily dependent upon geologic conditions such as flow pathways, mechanisms, sunlight, temperature, pH, and soil properties.

On the other hand, Heterotrophic bacteria are members of a large group of bacteria that use organic carbon for energy and growth. Many laboratories measure heterotrophic bacteria by the total plate count. However the presence of total plate count bacteria does not indicate the likelihood of pathogen presence. Also a sudden increase in total plate count bacteria may suggest a problem with treatment or water disinfection (AWWA, 1999).

Amazingly, the present study showed that there was no relationship between total plate count bacteria and the presence of pathogen. Total plate count bacteria were found also in raw water in treated well as (39 CFU) and other bacteria were at level less than one CFU. This study clarified also that Heterotrophic bacteria was detected in too little amount in (infiltrated water, customer water and raw water in well) and the other bacteria was at level less than one CFU. Also heterotrophic bacteria was negative in customer water in well at spring and autumn. Other bacteria were also at level less than one CFU.

The present study showed also that the presence of fecal Coliform and fecal streptococcus was less than one CFU in well water as in raw and customer water.

Contrary to this study, (Washington, 2005), who studied standard methods for the examination of water and waste water determine the correlation between different bacterial indicators and the occurrence of digestive system illness at swimming beaches suggest that the best indicators of health risk from recreational water contact in fresh water are E. coli and enterococci

The present study demonstrated that there was appositive relationship between turbidity and presence of microbial community which in the same line with (Siong, C. 2001) who said that turbidity removal is positively correlated with microbial removal. When turbidity removal rate is compared to microbial removal rate, a positive relationship is identified. This shows the possibility of microorganisms to live among the suspended particles causing turbidity in water. When turbidity is reduced, the Coliform counts are also decrease accordingly and this approach is in agreement with the present results.

The present study demonstrated that four different genera were isolated and identified from some of sample sites as kluyvera sp, Enterobacter cloacae, E.coli and Providencia stuartii. It was observed that turbidity is increased with increasing the bacterial growth in raw water of El-Arida plant. On the other hand, Total bacterial count, total Coliform, fecal Coliform and fecal Streptococcus were increased in permissible limit with decrease of the turbidity network distribution. There was inversely relationship between turbidity and total bacterial count, and also between temperature and presence of bacteria in network distribution and before treatment.

As regards in the present study, it was found that there was a seasonal variation of Iron (Fe) concentration in raw water of El-Arida and be-

fore treatment in Shobra-blola plant. On the other hand, iron was found in permissible limit during winter, spring, summer and autumn respectively as follow: In filtrated water and network distribution of El-Arida plant in ranges between (0.01-0.03 mg/l). After treatment, iron was ranges between (0.04-0.19 mg/l) and in the network distribution, iron was ranges also between (0.2-0.28 mg/l) of Shobra-blola plant. In Meet-memone plant (direct well) iron was ranges between (0.15-0.21 mg/l) and network distribution was ranges between (0 -0.21 mg/l).

Similary , Salisu , (2004) who added that the poor well casing and the effect of this can be considered as pollution of the water through rust. Although, most of the wells in the Majidun community were sited away from dump sites, the poor casing of the well, when corroded, releases reddish-brown substances (rust) into the well, and this could lead to the accumulation of heavy metals such as iron.

Furthermore, the present study presented also that there was Nitrate concentrations in three plants had low value below 4 mg/ L in all sampling site.

Any way the obtained results were in accordance with that obtained by Rodríguez. , et al (2012) who studied the nitrate concentrations in surface water, and showed that low values below 4 mg/ L in all sampling sites was found , while values ranged from 0.05 to 36 mg/ L for drilling and between 0.32 and 37 mg/ for wells. Regarding bacterial load, the highest count of total Coliform was detected in well water and lagoon samples; however, fecal Coliform was detected in surface water and groundwater. Only significant negative correlations were found between nitrate and total Coliform and nitrate and fecal Coliform. The origin of pollution can be attributed point sources and non-agricultural activity.

The present study demonstrated also that there was magnesium concentrations in three plant with low value ranged from (9-33) mg / L. While the permissible level of it (150mg/L) in all sampling site. TDS found to be increased in Shobra-blola and Meet-memone plant during autumn and summer seasons. While TDS was below in the El-Arida plant.

Bhattaraj et al. (2008), said that Magnesium concentration was below the permissible limit in all the sampling sites of his study. This approach was in agreement with the results of present study.

We can concluded from this study that : bacteriological and hydro-chemical result of the present study indicated that the sources of drinking water (coming from the Rosetta branch) in El-Gharbia governorate is divided into three sources filtrated water , treatment water and ground water.

The pollution level have been indicated as water quality index (WQI) for all annual seasons which the, arrangement of pollution level in descending order as, Winter < Autumn < Spring < Summer. Pollution levels were the hights in winter compared to other seasons. This phenomenon may be attributed to accumulation of (wastes of drains which is accompanied by winter closer stagnant period).

The present study confirmed that there was inversely relationship between temperature and presence of bacteria in raw and in network distribution of water.

The common bacteria appears in the present study were E.coli, Enterobacter . cloacae, Providencia. stuartii and kluyvera . sp

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مراقبه جوده مياه الشرب بالدلائل البكتيريه ومحاولات الكشف عنها

[١]د/أيمن فراج أحمد[a],[٢]د/أحمد محمد علي خليل[a] و [٣]مسعد عامرالحلموشي[b]
[a] - جامعه الازهر, كليه العلوم, قسم الميكروبيولوجي, مدينه نصر, القاهره, مصر
[b]–شركه مياه الشرب والصرف الصحي, المعمل المركزي, طنطا, محافظه الغربيه, مصر

تهدف هذة الرساله الي مراقبه جوده مياه الشرب حيث تم تجميع ثمانية عينات من المياه قبل دخول المحطات وبعد معالجتها خلال المحطه وبعد خروجها من المحطه (الشبكه)وذلك في كل من المحطات الاتية (العريضة- شبرابلوله- وميت ميمون). وذلك في الفتره من (٢٠١٢/١٢/٢١ إلى ٢٠١٣/١٢/٢١).وقد تم تعريض هذه العينات للتحاليل البكتريولوجية – والتحاليل الكيميائي – وكذلك التحاليل الفيزيائية وقد أظهرت نتائج التحاليل الكيميائية ان نسب العناصر (العسر الكلي عسر الكالسيوم وعسر الماغنسيوم)و (NO_2,NO_3,NH_3,TOC,F ,Mg ,Ca,SO_4,TDS,EC) انهيوجد فروق طفيفه في جميع المحطات عدا عنصر الحديد و الماغنسيوم في محطه شبرابلوله فانه يقل بعد المعالجه عن قبل المعالجه.كما أظهرت نتائج التحاليل الفزيائية ان (اللون –الpH-العكاره و درجه الحراره) في النسب المسموح بها لمواصفه المياه.

أيضا أظهرت نتائج التحاليل البكتريولوجية بوجود بعض انواع من البكتريامثل *kluyvera sp,* . *Enterobactercloacae, E.coli and Providencia stuartii*في شبكات هذهالمحطاتكما أ ظهرت النتائج أن التحليل الكيميائي والفيزيائي للعينات يكون عالي نسبياولكن (في النسب المسموح بها)وهذا يحدث في فصل الشتاء بسبب السده الشتويهحيث تقل نسب المياه فيالانهار**أما** محاولات الكشف عن الدلائل البكتيريه(القلونيه الكليه- القلونيه البرازيه) وذلك بالطرق العاديه سواء كانت بالترشيح الغشائي اوالعد الاكثر احتمالا فهي تستغرق خمس ايام للكشف عنها ولكن توجد طريقة أخرى تم استخدامها وهى طريقة (لوريل تربتوز بروث +mug) وقد وجد أنة باستخدام هذه الطريقه لا تستغرق سوى٢٤ ساعه فقط للكشف عن الدلائل البكترية .