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# STUDY ON SOME BIOLOGICAL AND CHEMICAL POLLUTANTS IN DRAINS WATER AT Kafr El-Shiekh DISTRICT

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## ABSTRACT

Because of the shortage of irrigation water in Kafr El-Sheikh district, especially in summer of season, agricultural drainage water is used as additional source for irrigation. Therefore, the aim of this work was to record counts of fecal coliform bacteria, $BOD_5$, and $NO^-_{3,}$ in addition to, some heavy metals (Pb , Cd and Cu), E.C and SAR, in main drains at Kafr El-Sheikh district to evaluate the pollution degree of this type of water comparing to standard recommended limits.

The counts of fecal coliform bacteria in all main drains(drain4 ,drain3,drain5 and Gharbiya drain) water of Kafr El-Sheikh district during summer season2012 varied from1800to 6075 M.P.N/100ml. Counts of coliform bacteria at four drains violate the permissible standard limits recommended by FAO (1000 MPN/100ml for crops consumption by human), while, counts of coliform bacteria in all main drains (except drain5 during July) in the studied area were less than standard limits for Fodder crops recommended by FAO (5000 MPN/100ml ).

The studied drains water recorded high levels of biological oxygen demand ($BOD_5$) which, varied from 25.39mg/l to 74.05 mg/l and its value violate the standard limit (10mg/l) recommended by FAO.

$NO_3^-$ concentrations varied from 30.35 to 82.98 mg/l in all main drains water. The concentrations of$NO_3^-$in all studied drains violate the standard limits (45mg/l) recommended by (APHA, 1992).

Pb, Cd and Cu concentrations in drains water and sediments samples of studied area varied from site to another. The concentrations of Pb, Cd and Cu in sediments for all drains were higher than in water. The Pb, Cd and Cu concentrations in water varied from (11.0 to19.0), (2.8 to5.3), and from (31.5 to75.5) /l, while the Pb, Cd and Cu concentrations in sediment varied from (24.5 to 61.0) , (5.3 to 10.0), and from (86.0 to 146.0) /g respectively. Pb, Cd and Cu in all waters and sediments samples (except Cu in water) Recorded higher concentrations comparing with the maximum permissible levels reported by FAO, (10, 3, and 200/l in water, while in sediments 20, 0.3 and 45 /g for Pb, Cd and Cu respectively.

EC (ds/m) and SAR values of all studied drainage water samples were between (1.83 to 2.74 ds/m) and (7.51 to 10.21), respectively. According to USDA diagram these samples are in class $C_3S_1$ (high salinity-low sodium) and $C_4S_2$ (very high salinity-medium sodium).The studied drains water contains high concentration of Pb, Cd and nitrate, as well as, a huge number of fecal coliform bacteria. Therefore, these waters are dangerous, when used for irrigation crops consumption by human, but it can be used for irrigation Fodder crops.

## INTRODUCTION

Drain 4, drain3, drain5and Gharbiya drain are main drains in Kafr El-Sheikh district. They used for discharge of predominantly untreated or poorly treated wastewater (domestic & industrial), and for drainage of agricultural areas.

Therefore, they contain high concentrations of various pollutants such as fecal bacteria, organic matter, $NO_3^-$ and heavy metals. Because of the shortage of irrigation water in this area, such water is used in irrigation and it becomes a dangerous source of pollution.

Coliform organisms are well-recognized indicators of water quality. These organisms refer to Gram-negative rod-shaped bacteria. Coliform bacteria ferment lactose at35-37°C with production of acid and gas, within 24-48 hours. Fecal coliform bacteria are a subset of coliform bacteria that ferment lactose with gas and acid formation within 48 h at44.5°C, According to APHA,(1992) .Fecal coliform bacteria are indicators of fecal contamination and of the potential presence of pathogens associated with wastewater or sewage sludge. The numbers of fecal coliform bacteria present is a good indicator of the amount of pollution present in the water APHA,(1992).Fecal coliform bacteria are no disease causing organisms which are found in the intestinal tract of all warm-blooded animals. Each discharge of body wastes contains large amounts of these organisms. The presence of fecal coliform bacteria in a stream or lake indicates the presence of human or animal wastes.

FAO (1992) reported that the permissible counts of fecal coliform bacteria in wastewater used in agriculture were(less than 100 M.P.N/100ml for vegetables eaten cooked), (less than 1000 MPN/100ml for crops consumption by human) and (less than5000 for Fodder crops). Safaa *et. al.*, (2012) recorded fecal coliform bacteria between 800 to217x$10^5$ CFU/100ml at drains in the Nile Delta and, also, they found $NO_3^-$ concentrations in the same drain was ranged between 40.6and 106.8mg/l and BOD was varied from7 to120mg/l.

According to APHA, (1992) the biological oxygen demand (BOD) is the test measuring molecular oxygen utilized during incubation period(5-days) for the biochemical degradation of organic materials. BOD is a good indicator of the amount of organic pollution present in the water and the permissible limits is 45 mg/l .

Zaghloul and Elwan(2011), found that BOD5 concentrations in Gharbiya drain water was ranged between 23.8 and 63.23 mg/l and its values violate the standard limits recommended by law 48/1982 (10 mg/l).Also, they found$NO^-_3$concentrations in the same drain were ranged between 1.33 and 20.67mg/l and the fecal coliform counts was varied from 10.4x$10^4$ and 4.2x$10^6$ C.F.U/100ml.

The mean problem concerned with water pollution was heavy metals when water containing these metals, as a pollutants, used for irrigation, it will contaminate and enrich soils and crops (Mireles *et. al.,* 2004).

It was known that heavy metals could accumulate in tissues during aquatic organism growth (bioaccumulation) and often biomagnified up the food chain interfering with the health and reproduction of both wildlife and humans (Abd El-Razik, 2006).

Antar *et. al.* (2012) found that nitrate concentrations in North Delta, Egypt exceed the U. S. Environmental Protection Agency (1991)

Therefore, the aim of this study concentrated on counting total coliform bacteria, fecal bacteria, BOD and $NO_3^-$ , in addition to some heavy metals (Pb, Cd and Cu), EC and SAR in drain 4, drain3, drain5and Gharbiya drain at Kafr El-Sheikh district. In order to, assessment pollution degree of this type water compared to the international levels.

## MATERIALS AND METHODS

**Studying area:**

The study area are situated between 31°28 53 and 31° 04 22 N latitude and 31°20 07 and 31°03 25 E longitude. Drain 4, drain3, drain5andGharbiya are main drainage canals present in this area (illustrated in Fig.1), they receive drainage water from drainage system and also, receive industrial and sanitary water. They serve about 360,000 Fed.

**Samples:**

Samples of water and sediment drains were collected during July, August and Sept.2012and was carried out according to, APHA (1992). Samples were collected from sixteen fixed sites on four drains illustrated (Fig 1). The collected samples were refrigerated in ice box and transferred to the laboratory for analysis. Water samples used for bacteria counts were collected in sterilized and closed bottles all collected samples were examined within 6 hours after collection for count of bacteria according to APHA (1992).

**Count of fecal coliform bacteria:**

According to APHA (1992), the most probable number technique was carried out for presumptive and confirmed tests of fecal coliform bacteria in water samples. Lauryl tryptose broth medium (incubated at 37 °C for 48 hours) was used for presumptive test of total coliform. The positive tubes which showed acid and gas were used to inoculate brilliant green lactose bile broth medium (BGB), as a confirmed test. The production of acid and gas was recorded as positive confirmed test for total coliform. Fecal coliform estimation was carried out by inoculation in the EC broth tubes from positive BGB broth medium tubes, then incubated at 44.5 °C for 24 hours .The positive tubes containing gas production were used to detect counts per 100 ml sample (MPN index / 100ml).

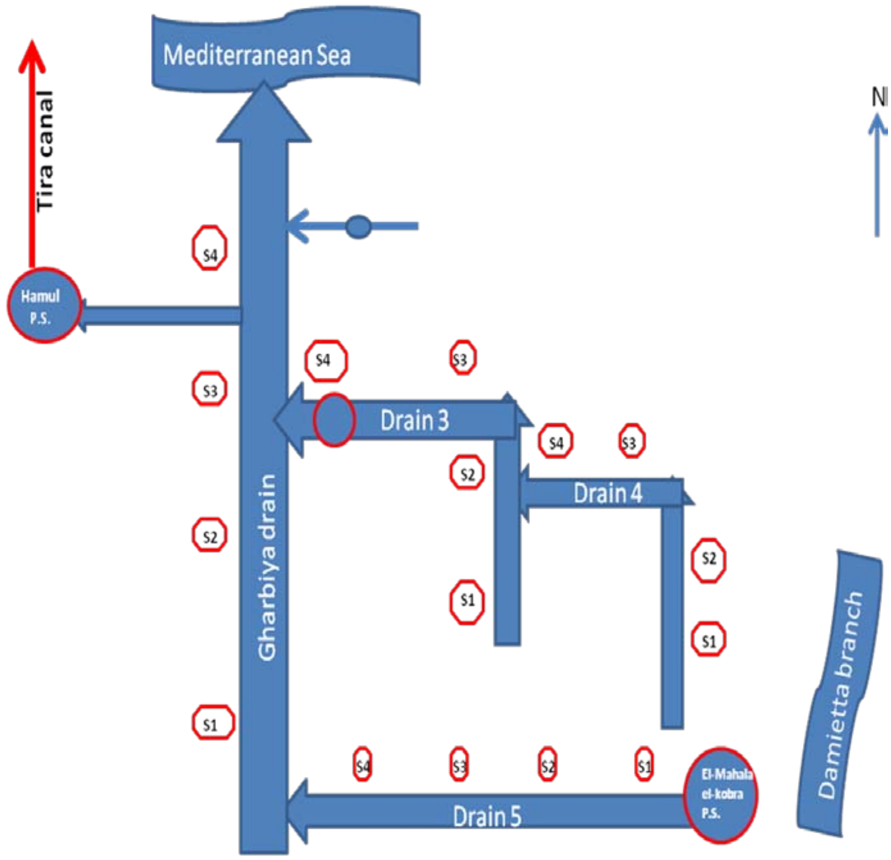


Fig1:Gharbiya drain System  Sites

**Biological oxygen demand ($BOD_5$)analysis:**

$BOD_5$ {incubation period (5-days)}, in water samples, was determined according to standard methods for examination of water and waste water APHA (1992).

**Pb ,Cd and Cu analysis:**

Soluble Pb, Cd and Cu were determined using the standard method described by American Public Health Association (APHA, 1971). The collected water samples were filtered and evacuated under vacuum in a water path until analysis. The residues were soaked with 10ml of Aquai regia then digested and analyzed using Atomic Adsorption Spectrophotometer Perkin Elmer 3300.

Nitrate analysis:

Nitrate in water samples were analyzed using Kjeldahl method (Cottenie *et al.,* 1982)

# RESULTS AND DISCUSSION

**Fecal coliform bacteria**:

Data in (Table1 and Fig.2) showed that, counts of fecal coliform bacteria (MPN/100ml) at all drains in the studied area violate the permissible limits of international standard recommended by FAO (1992) (1000 MPN/100ml for crops consumption by human), while, the counts of coliform bacteria in all drains (except drain5 during July) in the studied area were less than the standard limits for Fodder crops recommended by FAO (1992) (5000 MPN/100ml). Therefore, this drains water can be used in irrigation of Fodder crops only. The high counts of coliform bacteria in studied area may be due to these drains received domestic wastes from human activities.

The mean values of fecal coliform were varied from 1800 to 3000, 2450 to 4250, 2900 to 6075 and 2225 to 2900 MPN/100 ml at drain 4, drain3, drain5 and Gharbyia drain, respectively.

Safaa *et. al ,*(2012)recorded total coliform bacteria counts4600-389x$10^5$ C.F.U/100ml at drains in the Nile Delta. Zaghloul and Elwan (2011)found that the fecal coliform counts was varied from 10.4x$10^4$ to 4.2x$10^6$C.F.U/100ml in Gharbiya drain water.

**Biological Oxygen demand (**BOD5**):**

BOD5 concentration in four drains (Table1) showed that, its value ranged between 26.98 to 27.03 mg/l at drain4. BOD concentration ranged from 25.39 to31.47 mg/l at drain3. At drain5 and Gharbiya drain, the concentration of BOD5 ranged between 50.33 to 63.98 mg/l and between50.11 to 53.53mg/l, respectively. It is worth mentioning that all $BOD_5$values violate the standard limits recommended by FAO, 1992(10 mg/l).BOD of the present study are high and this may be due to domestic and sewage effluents which discharged in these drains, without any pre-treatment. Safaa *et. al,* (2012) recorded BOD was varied from7to120mg/l at drains in the Nile Delta .Zaghloul and Elwan (2011) found that BOD5 concentrations in Gharbiya drain water was ranged between23.8 and 63.23 mg/l and its values violate the standard limits recommended by law 48/1982 (10 mg/l).Abd-El-Hamed (2009) monitored a range of BOD in some Egyptian drains between 637.6 and 806.62mg/l. Also, El-Mowelhi *et. al.*, (1995) study water quality of the drainage network of the western Delta and they reported that the values of BOD ranged from 134-1291 mg/l. Water of these drains must take more interest for good treatment before used in irrigation

**Nitrate concentration:**

Nitrogen in drainage waters are mainly in the form of nitrate, but may also in the form of ammonium because ammonium is rapidly oxidized into nitrates(Duxbury and Peverly,1978).Nitrate concentrations of water samples collected from studied drains (Table,1) varied in a relatively wide range., the values of $NO^-_3$ were from 30.35 to 82.98mg/l in all drains. The considerable variation in $NO^-_3$ concentration in drainage water may be ascribed to several factors including soil properties, amount of irrigation water and temperature of the air and evaporation rates, drainage system and forms of applied fertilizers, uptake by plants and clay minerals (Dinnes *et. al.,* 2002). Nitrate concentrations (Table, 2) in Drain No.3 were lower than other drains because, this drain was far from pollution center (industrial and sanitary in El-Gharbia and Kafr El-Sheikh Governorates .Safaa *et. al.* ,(2012).recorded$NO_3$ concentrations in drains at the Nile Delta ranged between 40.6 and 106.8mg/l. Antar *et. al.,* (2012) found that nitrate concentrations leaving surface drains in North Delta, Egypt exceed the U. S. Environmental Protection Agency (1991).

The horizontal subsurface drainage system, in addition to controlling water table and leaching out harmful dissolved salt form the drained soil profile, may also cause losses of various forms of nitrogen through the drainage effluent. Such nitrogen losses, besides may leach and pollute both ground water and surface water, are also likely to cause environmental degradation that will be detrimental to aquatic life, plants, animals and human (Singh *et al,* 2002).

**Table (1):Count of Fecal Coliform bacteria as well as BOD5, and $NO^-_3$ concentration in drains water during summer2012**

| Count / Sites | | fecal Coliform bacteria MPN/100ml | | | $BOD_5$ mg/l | | | $NO^-_3$ mg/l | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | July | August | Sept. | July | August | Sept. | July | August | Sept. |
| Drain.4 | S1 | $2.6x10^3$ | $1.8x10^3$ | $2.4x10^3$ | 22.33 | 23.45 | 18.89 | 44.2 | 56.3 | 45.6 |
| | S2 | $1.4x10^3$ | $2.3x10^3$ | $1.7x10^3$ | 18.25 | 16.88 | 17.66 | 22.3 | 62.3 | 35.6 |
| | S3 | $2.1x10^3$ | $4.3x10^3$ | $2.3x10^3$ | 33.32 | 35.23 | 35.44 | 36.3 | 40.6 | 58.9 |
| | S4 | $1.1x10^3$ | $3.6x10^3$ | $1.4x10^3$ | 34.22 | 33.12 | 35.92 | 18.6 | 20.5 | 84.6 |
| Mean | | 1800 | 3000 | 1950 | 27.03 | 27.17 | 26.98 | 30.35 | 44.93 | 56.18 |
| Drain.3 | S1 | $9.2x10^3$ | $1.1x10^3$ | $2.4x10^3$ | 14.33 | 28.66 | 21.33 | 32.3 | 66.9 | 70.2 |
| | S2 | $4.3x10^3$ | $2.1x10^3$ | $1.7x10^3$ | 18.99 | 34.23 | 18.66 | 36.2 | 70.6 | 56.3 |
| | S3 | $1.8x10^3$ | $1.4x10^3$ | $1.4x10^3$ | 33.56 | 38.66 | 31.22 | 45.2 | 25.3 | 44.5 |
| | S4 | $1.7x10^3$ | $5.4x10^3$ | $4.3x10^3$ | 34.66 | 24.33 | 30.33 | 56.9 | 26.3 | 45.6 |
| Mean | | 4250 | 2500 | 2450 | 25.39 | 31.47 | 25.39 | 42.56 | 47.28 | 54.15 |
| Drain.5 | S1 | $1.4x10^4$ | $2.4x10^3$ | $2.3x10^3$ | 68.23 | 60.32 | 56.41 | 35.6 | 16.5 | 35.6 |
| | S2 | $4.3x10^3$ | $2.1x10^3$ | $3.6x10^3$ | 58.68 | 66.43 | 58.14 | 42.3 | 45.6 | 56.3 |
| | S3 | $3.6x10^3$ | $7.4x10^3$ | $1.4x10^3$ | 68.58 | 62.34 | 49.33 | 56.8 | 23.6 | 12.3 |
| | S4 | $2.4x10^3$ | $1.1x10^4$ | $4.3x10^3$ | 60.41 | 64.55 | 37.44 | 75.6 | 80.3 | 42.3 |
| Mean | | 6075 | 3250 | 2900 | 63.98 | 74.05 | 50.33 | 52.58 | 41.5 | 36.63 |
| Gharbiyyah drain. | S1 | $2.3x10^3$ | $2.4x10^3$ | $1.1x10^3$ | 35.34 | 34.22 | 31.77 | 86.9 | 45.6 | 24.3 |
| | S2 | $1.4x10^3$ | $2.3x10^3$ | $3.6x10^3$ | 34.78 | 28.99 | 60.23 | 98.7 | 66.9 | 16.3 |
| | S3 | $4.3x10^3$ | $1.7x10^3$ | $2.4x10^3$ | 71.12 | 68.45 | 52.65 | 56.6 | 78.4 | 18.91 |
| | S4 | $3.6x10^3$ | $3.6x10^3$ | $1.8x10^3$ | 72.87 | 68.79 | 68.95 | 89.7 | 90.2 | 75.6 |
| Mean | | 2900 | 2500 | 2225 | 53.53 | 50.11 | 53.4 | 82.98 | 70.28 | 33.78 |

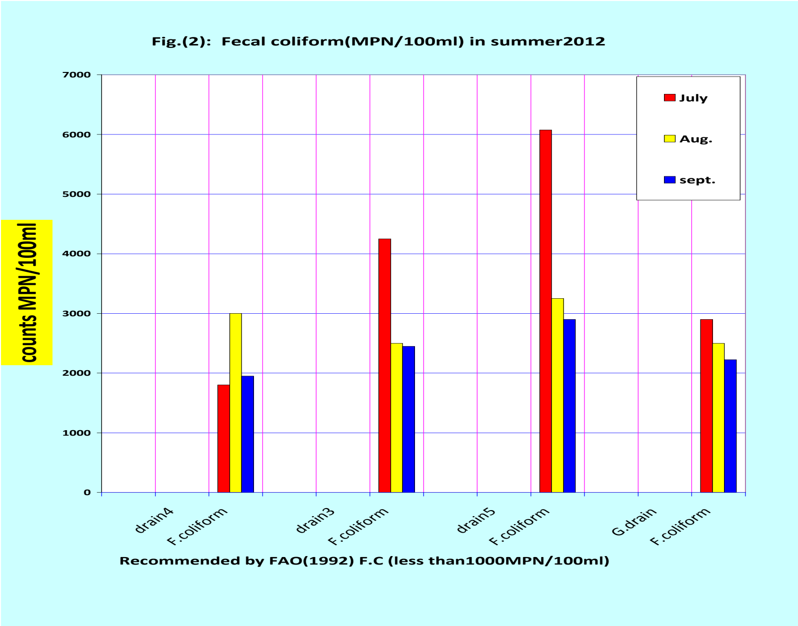


Fig.(2): Fecal coliform(MPN/100ml) in summer2012

**Heavy metals concentration:**

Pb, Cd and Cu concentrations (Table2, fig.3) in drains water at Kafr El-Sheikh district varied from one site to another and from water to sediments samples. The concentrations of Pb, Cd and Cu in sediments were higher than in water for all drains. The Pb, Cd and Cu concentrations in water were varied from 11.0to19.0, 2.8 to5.3, and 31.5 to75.5 /L, while, in sediments were varied from 24.3 to 61.0,5.3 to 9.8, and 86.0 to 146.0 /L respectively. The highest concentration of the Pb, Cd and Cu in both water and sediments in all drains (except Cu in water samples), might be due to industrial activities in El-Gharbiya and Kafr El-Sheikh Governorates. The concentration of Pb, and Cd in all water and sediments samples violate the maximum permissible levels recommended by FAO (1992) (10 and 3 /L) in water for Pb and Cd, while in sediments 20 and 0.3 /g, respectively. The concentration of Cu in all water samples were lower than the maximum permissible levels recommended by FAO (1992) (200 /L) in water for Pb and Cd. Safaa *et. al.,*(2012)reported that, the concentration of Cd, Cu and Pb in drainage water at Delta varied from 1.0to6.0,24.0to174.0 and7.0to24.0 /L, respectively. Therefore, the use of this wastewater without good treatment make these toxic elements accumulated in soil by time.

**Table (2): Pb, Cd and Cu concentrations in water and sediment drains during summer 2012**

| Drains | Sites | Summer 2012 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pb | | | | | | Cd | | | | | | Cu | | | | | |
| | | water /L | | | sediment /g | | | water /L | | | sediment /g | | | water /L | | | sediment /g | | |
| | | July | Aug. | Sept. | July | Aug. | Sept. | July | Aug. | Sept. | July | Aug. | Sept. | July | Aug. | Sept. | July | Aug. | Sept. |
| Drain.4 | S1 | 11 | 12 | 15 | 25 | 56 | 36 | 2 | 3 | 4 | 5 | 9 | 11 | 33 | 26 | 36 | 112 | 89 | 114 |
| | S2 | 8 | 32 | 11 | 32 | 35 | 45 | 3 | 5 | 3 | 8 | 11 | 9 | 65 | 68 | 12 | 156 | 115 | 125 |
| | S3 | 16 | 15 | 10 | 26 | 24 | 36 | 4 | 4 | 6 | 6 | 7 | 8 | 40 | 63 | 46 | 89 | 143 | 136 |
| | S4 | 13 | 17 | 16 | 14 | 37 | 33 | 2 | 2 | 2 | 7 | 6 | 10 | 26 | 56 | 35 | 144 | 116 | 147 |
| Mean | | 12 | 19 | 13 | 24.5 | 38 | 37.5 | 2.8 | 3.5 | 3.8 | 6.5 | 8.3 | 9.5 | 41 | 53.3 | 32.3 | 125 | 115 | 131 |
| Drain.3 | S1 | 9 | 12 | 11 | 34 | 42 | 62 | 2 | 6 | 6 | 9 | 9 | 12 | 82 | 42 | 41 | 96 | 158 | 156 |
| | S2 | 16 | 18 | 9 | 26 | 35 | 45 | 4 | 2 | 3 | 5 | 10 | 6 | 24 | 68 | 35 | 153 | 96 | 112 |
| | S3 | 17 | 13 | 25 | 36 | 40 | 36 | 5 | 3 | 5 | 6 | 8 | 8 | 68 | 89 | 62 | 159 | 158 | 169 |
| | S4 | 13 | 9 | 12 | 25 | 37 | 23 | 7 | 4 | 7 | 7 | 11 | 9 | 43 | 76 | 12 | 69 | 163 | 147 |
| Mean | | 14.5 | 13 | 14 | 30.5 | 38.5 | 41.5 | 4.5 | 3.8 | 5.3 | 6.8 | 9.5 | 8.8 | 54.3 | 68.8 | 37.5 | 119 | 144 | 146 |
| Drain.5 | S1 | 11 | 13 | 11 | 32 | 37 | 65 | 3 | 7 | 2 | 5 | 6 | 10 | 56 | 68 | 21 | 87 | 145 | 89 |
| | S2 | 15 | 15 | 6 | 42 | 45 | 52 | 5 | 5 | 6 | 4 | 9 | 8 | 34 | 87 | 45 | 86 | 123 | 117 |
| | S3 | 6 | 9 | 33 | 51 | 36 | 44 | 3 | 3 | 3 | 3 | 11 | 9 | 87 | 58 | 26 | 93 | 156 | 69 |
| | S4 | 19 | 7 | 24 | 47 | 30 | 36 | 2 | 6 | 8 | 9 | 8 | 13 | 16 | 89 | 38 | 156 | 158 | 159 |
| Mean | | 12.8 | 11 | 18.5 | 43 | 37 | 49.3 | 3.3 | 5.3 | 4.8 | 5.3 | 8.5 | 10.0 | 48.3 | 75.5 | 32.5 | 106 | 146 | 86 |
| El- | S1 | 14 | 16 | 14 | 35 | 36 | 56 | 2 | 4 | 3 | 7 | 10 | 5 | 36 | 96 | 24 | 113 | 123 | 123 |
| | S2 | 25 | 12 | 19 | 29 | 29 | 62 | 4 | 7 | 5 | 5 | 12 | 7 | 87 | 36 | 31 | 158 | 118 | 118 |
| | S3 | 16 | 9 | 26 | 48 | 38 | 76 | 3 | 3 | 2 | 8 | 9 | 12 | 59 | 68 | 15 | 163 | 145 | 145 |
| | S4 | 13 | 11 | 11 | 53 | 31 | 50 | 5 | 5 | 6 | 10 | 8 | 9 | 89 | 42 | 56 | 119 | 178 | 178 |
| Mean | | 17 | 12 | 17.5 | 41.3 | 33.5 | 61.0 | 3.5 | 4.8 | 4.5 | 7.5 | 9.8 | 8.3 | 67.8 | 60.5 | 31.5 | 138 | 140 | 141 |

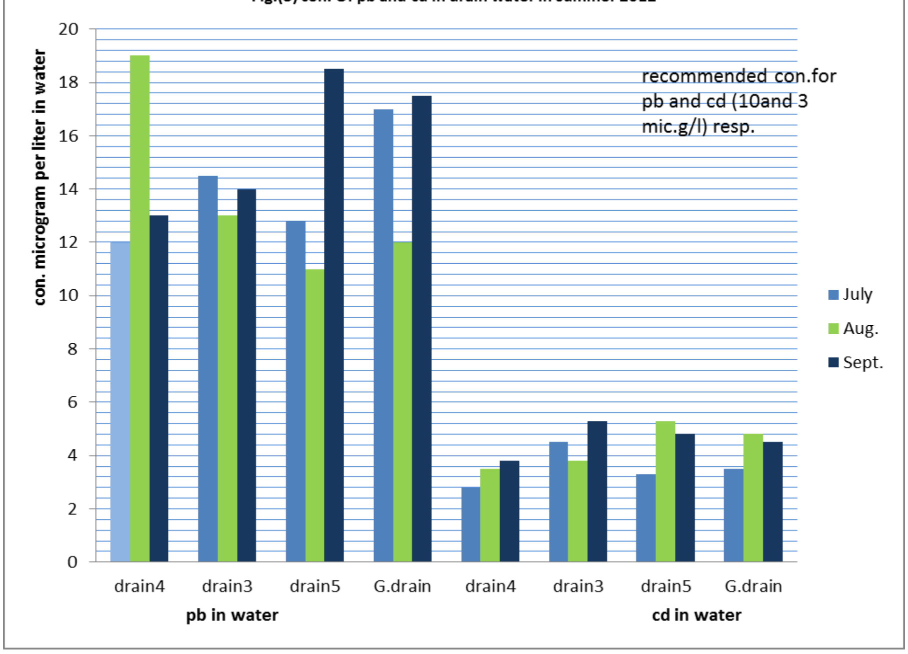

Fig.(3) con. Of pb and cd in drain water in summer 2012

**EC and SAR:**

The EC (dS/m) and SAR of the drainage water might be affected by some factors such as land use, crop pattern, soil management, drains location and drainage efficiency. Data in Table (3) revealed that EC and SAR mean values of the studied drainage water samples ranged from 1.83 to 2.74 dS/m and 7.51 to 10.21, respectively .The EC and SAR in the studied drains water were mostly considered slight to moderate according to international guideline concentrations mentioned by FAO/RNEA (1993) which are EC (0.7 to 3 dS/m) and SAR (3 to 9%). The increase in EC and SAR in the drainage water of this studied area are mainly ascribed to the inflow and contamination with the saline water, through the sea water intrusion. According to U.S. Salinity Laboratory (1954), the studied samples of Gharbyia drain, drain 4 and drain 5 are in class $C_3S_1$, while drain 3 is in class $C_4S_2$. Class $C_3S_1$ water is high saline and low sodium content. Such water can be used with restricted drainage even with adequate drainage, special management for salinity control may be required, and salt tolerant plants must be selected. Therefore, such water is considered slightly dangerous for irrigation purposes. $C_4S_2$ indicate that the water is very high saline with medium sodium content. This water is not suitable for irrigation for soils under ordinary conditions but may be used occasionally under very special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess, to provide considerable leaching and highly salt tolerant crops should be selected .Sodium was present in appreciable sodium hazard in fine textured soils having high cation exchange capacity, specially under low leaching conditions, unless gypsum present in the soil. Such water may be used on course textured or organic soil with good permeability.

**Table3:EC and SAR of water drain samples during summer 2012**.

| Site | | Sampling date | | | | | |
|---|---|---|---|---|---|---|---|
| | | July | | August | | September | |
| | | E.C dS/m | SAR | E.C dS/m | SAR | E.C dS/m | SAR |
| Drain No.3 | $S_1$ | 2.65 | 9.25 | 2.36 | 9.65 | 2.73 | 10.12 |
| | $S_2$ | 2.44 | 8.78 | 2.33 | 9.44 | 2.98 | 11.41 |
| | $S_3$ | 2.72 | 10.11 | 2.47 | 8.66 | 2.55 | 9.42 |
| | $S_4$ | 2.82 | 10.22 | 2.86 | 8.69 | 2.69 | 9.89 |
| Mean | | 2.67 | 9.59 | 2.51 | 9.11 | 2.74 | 10.21 |
| Drain No.4 | $S_1$ | 2.45 | 8.92 | 2.33 | 7.89 | 1.87 | 7.68 |
| | $S_2$ | 2.12 | 8.24 | 1.98 | 8.54 | 1.68 | 7.98 |
| | $S_3$ | 2.30 | 8.31 | 1.87 | 7.86 | 1.89 | 7.33 |
| | $S_4$ | 2.35 | 8.24 | 2.24 | 8.66 | 2.31 | 8.24 |
| Mean | | 2.31 | 8.43 | 2.11 | 8.24 | 1.94 | 7.81 |
| Drain No.5 | $S_1$ | 1.89 | 7.86 | 2.13 | 8.22 | 1.78 | 6.88 |
| | $S_2$ | 1.78 | 7.65 | 2.41 | 7.88 | 2.22 | 7.54 |
| | $S_3$ | 2.22 | 7.58 | 1.99 | 9.41 | 1.98 | 8.11 |
| | $S_4$ | 2.33 | 7.46 | 2.11 | 7.66 | 1.87 | 7.68 |
| Mean | | 2.06 | 7.64 | 2.16 | 8.29 | 1.96 | 7.55 |
| Al-Gharbiya drain. | $S_1$ | 1.96 | 7.33 | 2.11 | 8.12 | 1.93 | 9.11 |
| | $S_2$ | 1.92 | 7.62 | 1.95 | 7.77 | 1.85 | 7.88 |
| | $S_3$ | 1.89 | 7.86 | 1.91 | 8.19 | 1.82 | 8.36 |
| | $S_4$ | 1.86 | 7.22 | 2.01 | 9.03 | 1.73 | 6.97 |
| Mean | | 1.91 | 7.51 | 2.00 | 8.28 | 1.83 | 8.08 |

## CONCLUSION

The water of studied drains at Kafr El-Sheikh district contains huge number of coliform bacteria, as well as, high amounts of Pb and Cd .Therefore, these waters are dangerous, when used for irrigation food crops eaten raw, but, it can be used for irrigation fodder crops.

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## دراسة على بعض الملوثات البيولوجية والكيمائية في مياه الصرف بمنطقة كفر الشيخ

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نظرا لنقص مياة الرى فى منطقة كفر الشيخ خاصة فى موسم الصيف تستخدم مياة الصرف الزراعى فى الرى (حيث تستقبل مصارف هذه المنطقة مياه الصرف الصحي والصناعي أيضا). لذا تهدف هذه الدراسة الى رصد بعض الملوثات البيولوجية والكيماوية في مياة الصرف الزراعى بمصرف 4 ومصرف 3 ومصرف 5 و مصرف الغربية الرئيسى بمنطقة كفر الشيخ. وتوضح النتائج أن اعداد بكتريا القولون البرازية فى المياة محل الدراسة كانت من 1800 الى 6075 (MPN/100ml) وهو أعلى من المسموح به حسب منظمة الاغذية والزراعة مما يدل على وجود مياة صرف صحى مع مياة الصرف الزراعى. كما تراوحت تركيزات BOD من 25.39إلى 74.05 جزء في المليون لعينات مياه المصارف المدروسة مما يدلل على وجود ملوثات عضوية بكميات كبيرة.

كما أشارت النتائج الى زيادة فى تركيزات الرصاص و الكادميوم فى مياه الصرف محل الدراسة حيث تراوحت تركيزات الرصاص مابين 11-19 ميكروجرام/لتر و الكادميوم ما بين 2.8—5.3 ميكروجرام/لتر وهذه التركيزات بمياه الصرف الزراعى أعلى من أقصى معدل مسموح به تبعا لمنظمة الأغذية والزراعة. كما كان متوسط قيم الملوحة في عينات مياه الصرف قيد البحث تتراوح بين 1.83إلي 2.74 ds/m والصودية من 7.51 إلي 10.21 . و هي تقع في القسمين ($C_3$ $S_1$ ; $C_4$ $S_2$)تبعا لتقسيم معمل الملوحة الأمريكي 1954 لصلاحية المياه للري. لذا يوصى باستخدام هذه المياه فى رى محاصيل العلف فقط.

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