Misr J. Ag . Eng., 21 (3): 585 - 592

DEGRADATION OF WATER RESOURCES IN GHARBIA GOVEORNRATE

Esway Kasem Mahmoud[1] and Ahmed Mohamed Aggag [2]

ABSTRACT

Degradation of water resources is one of the environmental damages. In this study, the groundwater samples were taken from 13 sites and 5 sites for irrigation water samples to determine pH, salinity, ammonium and nitrate, and heavy metals. The data were compared with the WHO guidelines for irrigation and drinking water. The pH, total dissolved solids(TDS), NH_4-N,and NO_3-N for irrigation water, drainage water and groundwater were in the range of acceptable levels for irrigation guidelines. While, TDS in groundwater exceeds the limits for the drinking water. With exception of cadmium and manganese, heavy metals concentrations in irrigation and drainage water were lower than the irrigation standards. Cadmium, lead, and manganese levels in the groundwater were exceeds the limits for the drinking water. The groundwater must be treated, before it can be recommended as a source for drinking water.

I NTRODUCTION

Groundwater may be contaminated by either point sources or diffuse sources . Typically in rural farmyards where there are water wells , there is always the possibility run off and other agricultural contaminats intering the groundwater . The spreading of fertilizers and pesticides on land are potential diffuse sources of point pollution (Kiely , 1998) . One of the greatest problems that accurs in rural and marginal urban areas is the lack of water supply systems and sewage systems . This leads conditions that hamper the proper development of the population , particularly in terms of health . Degradation of water resources occurs as a result of the need to eliminate organic wastes in any manner. Almost all rural areas in Egypt are already facing critical environmental degradation. This is the result of the overload on the existing on-site disposal units (mostly septic tanks), the improper waste disposal high groundwater rivers and streams contamination and a long list of service management deficiencies (Fadel,2002). Elsabae and Meneissy (2002) studied groundwatar quality in the 45 wells in North Sinai . The date indicated that the pH variation was in the acceptable range of 7–8.

[1]Soil and Water Sciences Department, College of Agriculture, Tanta University,Tanta, Egypt.
[2]Soil and Water Sciences Department, College of Agriculture, Alexandria University, Damanhour, Egypt.

However, levels of the NO_3, NO_2, the heavy metals (Cd^{+2}, Pb^{+2}, Mn^{+2} and Cu^{+2}), and organochlorine insecticides content were, higher in the ground wells in the vicinity of the slaughter house and food canning factory the groundwater in the 45 wells can be accepted for irrigation or domestic use and they don't comply with international guidelines for the drinking water .
The main pollution sources in the Mid Nile Delta include agricultural (fertilizer and pesticides) and urban (municipal dumps and septic tanks)and industrial activities .There are many industries such as fertilizers (Talkha and Kafr – El-zaiyat), oil& saop (Tanta – Kafr El-zaiyat and El- Mehalla El-kobra) sugar beet (Belkas, El-Hamoul), refining petroleum, oil and flax, Pepsi at Tanta and soda, slant , pesticides, Chemicals, Financier Industrial Egypt at Kafr El-Zaiyat occupying the study area . All this factories discharge their waste effluents to the canals and drains that are running from south to north discharging in Burullus lagoon or the Mediterranean sea(Hamida;2002). The objective of the study is to obtain a clear idea about the water resources degradation in the Gharbia governrate

MATERIALS AND METHODS

Samples of ground water were collected from 13 sites as shown in Table(2). Irrigation water samples collected from 5 sites; El korshia, Mit Hibeish, Sigar, Zefta and Kohafa just after collection of the samples for chemical analysis.

pH and Total dissolved solids

The pH was determined by pH controller model 5997 .Electrial Conductivity (EC),in decisiemens per meter (ds/m) was measured by CDM 83 conductivity meter. The 'total dissolved solids' (TDS) in the form of soluble salts was approximated:

TDS mg/l = EC [ds\m] x 640

Ammonium and Nitrate

Ammonium –N was determined quantitatively from the NH_3-N liberated by steam distillation with a small amount of MgO ,whereas [ammonium+nitrate]-N was determined by the same method on adding finally divided Devarda alloy immediately before distillation [Mulvaney, 1996].A Buchi N_2 distillation unit model 320 was used .

Heavy metals

Water samples were filtered if necessary and preserved by acidifying with concentrated nitric acid to pH<2. Flame atomic absorption spectrometry [standard 3111]was employed for measuring iron ,zinc ,manganese ,cadmium ,and lead .A Perkin Elmer AA model 2380 was used.

Results and Discussion

With the increase of population in the Gharbia governrate with agricultural and industrial development has increased pollution of surface and

groundwater .The main sources of pollution are salinity nutrients and heavy metal.

Salinity and pH

Total dissolved solids[TDS] concentrations are good indicator for salt concentration .TDS of irrigation canals, drainage drains, groundwater have values of 236.8 , 364.8 and 326.4. to 825.6 , 30214.4 and 1075.3 mg/l, respectively Table(3). The increase in the TDS of drainage drains was through flushing of salts from soils and aquifers and increases the evaporative enrichment. Industrial and domestic wastes may contribute significantly to the drainage drains mineral content. The increasing TDS in Mit Hibeish and Sigar canals was due to receiving drainage and domestic water form round area .The pH of irrigation canals , drainage drains and ground water ranged from 6.24 – 11.26 .Elsabae and Meneissy(2002) found that the average pH values of groundwater wells in the north Sinai were in the range of 7.0-8.0 which coincides with the present data. Generally , the values of pH and TDS of the irrigation canals and groundwater were in the range of acceptable levels of irrigation guidelines (WHO, 1993) While , TDS groundwater exceeds the limits for drinking water.

Nitrate and Ammonium

Nitrat and ammonim of the ground water from the different sites are reported in Table (3) for comparison with irrigation canals and drainage drains in Gharbia governate .The groundwater wells NH_4 and NO_3–N concentrations have values of 2.24 and 1.96 to 19.60 and 22.40 ppm ,respetively.Nitrate concentrations are less than 22.40 ppm the allowable limit (45mg/l).As the normal concentration in uncontamainated water is low (less than 5 mg/l) ,nitrate can be a good indicator of conctaminatiom by fertilzers and waste organic matter (Kiely , 1998).

Levels of heavy metals in irrigation and drainage waters

Levels of the five heavy metals (Fe , Zn, Mn, Cd, and Pb) were measured in the irrigation water samples at the five locations: El Korshia, Mit Hibeish, Sigear, Zefta and kohofa compared to drainage waters at 44 sites Table(3). Iron , Zinc , Manganese , Cadmium and Lead ranges from 0.24, 0.01 , 0.28, 0.14 and 1.21 to 0.45,0.55 , 2.03 ,0.26 and 1.68 ppm in the irrigation canals , respectively . with the exception of cadmium and manganese, heavy metals concentration in irrigation and drainage and irrigation canals were lower than the irrigation and standards (WHO,1993). The drain and irrigation are polluted by Cd and Mn. Thereby, the drain and irrigation canals must be treated before using in irrigation water.

Combating the drain and irrigation water pollution

In the Gharbia governrate, drains and irrigation canals are suffering acute effects froms pollutants through point and nonpoint sources .The formulation of a national strategy for water quality improvement is becoming increasingly necessary. Such strategy would be based on abatement of

untreated domestic and industrial water discharges, reduction of the released loads of primary pollutions and increase of the assimilative capacity of the drains and irrigation canals. The domestic and industrial wastewater as shown in Fig.(1) are must be treated before drain in the drainage system or mixing it with irrigation water before using .

Levels of heavy metals in groundwater

Levels of five heavy metals: iron ,zinc ,manganese ,cadmium and lead were measured in the groundwater samples at 13 sites in the Gharbia governrate are shown Table (3).Cadmium, manganese, lead, iron and zinc ranged from 0.13, 0.74, 1.06, 0.06 and 0.01 to 0.27, 3.00, 1.64, 0.73 and 0.3 ppm ,respectively .the higher lead and manganese in the Kohafa and Kafer Essem [in Tanta town] ,which affected by the seepage from the waste of many industries such as refining petroleum , soda &salt and oil &flax (use lead and manganese naphthene in the manafacturing of boiling flax oil). Cadmium, lead and manganese levels were exceeds the limits for the drinking water guidelines (WHO,1993) the average cadmium, lead and manganese of the groundwater increased from 0.026 ,0.017,and 0.25 Yousef(1996)to 0.210,1.318 and 1.15 (2004).These means that ,the ground water was heavily polluted by these elements from agricultural (fertilizer and pesticides) ,urban (municipal, dumps and septic tank) and industrial activtes .Effluent from the wastes cause deoxygenation in the ground which results in dissolation of Fe ,Cd, and Mn from the soil ,subsoil and bedrock into groundwater (kiely ,1998).

Combating the groundwater pollution

The used low-cost technology for the domestic and industrial wastewater treated before discharge their waste effluents to Environmental. The waste Effluents from the Tanta Combustion as well as El Mahalla Combustion must be treated before drain in the drainage system. Applying best management practices (BMP) for fertilizers use to protected groundwater from fertilizers.

SUMMARY

The present study is to help the decision makers to set the priorities for the domestic and industrial wastewater treatment by low-cost technology to protect water resources.

REFERENCES

El Sabae, A. and Meneissy, H.(2002): Assessment of water quality and monitoring of pollutant levels in groundwater wells at North Sinai. Alex. J. Agric. Res. 47(2):191-199.

Fadel, A.(2000). The Egyptian experience with low cost technologies for domestic wastewater collection and treatment. Email afadel@egyptnetwork.com.

Hamida, M.(2002): Geochemical investigation of soil and water on polluted areas in Mid-Nile Delta for environmental assessment. Ph.D. Thesis, Fac. Agric., Mansoura Univ., Egypt.

Kiely, G. (1998): Environmental engineering. New York: McGraw-Hill Book company.

Standard Methods(STM), American Public Health Association (APHA).1995. Standard methods for the examination of water and wastewater, 19th ed. American Public Health Association, Washington, DC.

WHO(1993). Guidelines for drinking water quality. 2nd Edition. Vol. One Recommendations W.H.O. Geneva.

Yousef, A. and Mohamed, N.E.(2002).:Desertification in Egypt.In. Conf. For Develop. and the Envi. in The Arab World, March, 26-28.

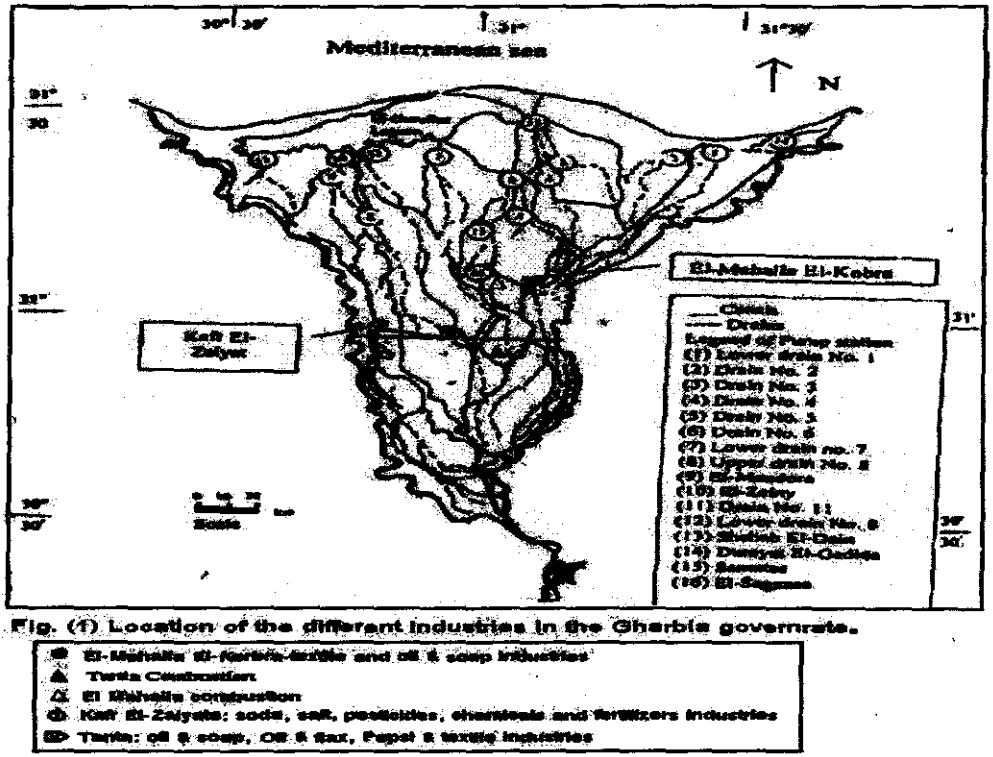

Fig. (1) Location of the different industries in the Gharbia governrate.

T able (1) : chemical characteristics of the irrigation water From Gharbia Governrate.

Site	pH	TDS	NH_4	NO_3	Fe	Zn	Mn	Cd	Pb
		ppm							
El kornshia	7.15	268.8	1.68	2.52	0.45	0.01	0.28	0.2	1.68
Mit Hibeish	7.53	825.6	2.80	8.40	0.30	0.01	0.24	0.15	1.43
Sigar	7.31	825.6	2.52	7.28	0.25	0.14	2.03	0.17	1.21
Zefta	7.57	236.8	4.76	2.24	0.41	0.01	0.35	0.14	1.30
Kohofa	6.24	236.8	4.20	4.202.52	0.32	0.01	0.47	0.26	1.52

Table (2): Ground water analysis collected from Gharbia governrate

Site	pH	TDS	NH_4	NO_3	Fe	Zn	Mn	Cd	Pb
		ppm							
Sigar	7.30	819.2	8.96	12.6	0.45	0.01	3.06	0.27	1.15
Kohofa	6.77	742.4	19.6	22.40	0.68	0.30	0.84	0.25	1.91
El Korshia	7.27	371.2	2.80	4.76	0.58	0.19	0.90	0.18	1.30
Koteer	7.57	595.2	5.04	6.16	0.51	0.14	1.05	0.13	1.09
El Mehalla El- Kobra	7.48	556.8	5.32	2.52	0.62	0.02	0.75	0.13	1.19
El Manshia	7.56	1075.3	3.92	3.36	0.59	0.18	0.77	0.25	1.18
Mehalla Marhom	7.55	524.8	7.00	1.96	0.60	0.19	1.24	0.17	1.32
Kafr El-Ziyat	7.43	326.4	7.00	1.96	0.55	0.17	1.20	0.25	1.32
Zefta	7.29	390.4	4.20	8.96	0.51	0.01	0.74	0.17	1.26
Mit Ghezal	7.24	326.4	3.08	9.24	0.73	0.02	1.49	0.22	1.06
Samanoued	7.30	403.2	3.08	9.52	0.35	0.11	0.71	0.22	1.42
Samalt	7.78	582.4	5.60	9.80	0.60	0.15	0.84	0.26	1.30
Kafr Essem	7.66	449.2	2.24	3.36	0.06	0.12	1.49	0.24	1.64

Table (3) Quality characteristics of irrigation and drainage waters and groundwater compared with criteria for irrigation and drinking waters.

	Irrigation water	Drainage water(a)	groundwater	Water Criteria	
				Irrigation[b]	Drinking[c]
PH	6.24-7.57	6.72-11.26	6.77-7.78	6.5-8.4	
TDS, ppm	236.8-825.6	364.8-30214.4	326.4-1075.3	2000	
NH_4-N, ppm	1.68-4.76		2.24-19.60		
NO_3-N, ppm	2.24-8.40		1.96-22.40		
Fe, ppm	0.24-0.45		0.06-0.73	5.0	
Zn, ppm	0.01-0.55	0.056-0.910	0.01-0.30	2.0	
Mn, ppm	0.28-2.03	0.015-0.826	0.74-3.00	0.2	0.5
Cd, ppm	0.14-0.26	0.005-0.303	0.13-0.27	0.01	0.003
Pb, ppm	1.21-1.68	0.057-2.389	1.06-1.64	5.0	0.01

a. range of values for 44 drainage water samples in the Mide Nile Delta(Hamida, 2002)
b. US (CSU) 1993 c. WHO,1993

الملخص العربى

تدهور مصادر المياه فى محافظة الغربية

د. عيسوى قاسم محمود ١ د. احمد عجاج ٢

يعتبر تدهور مصادر المياه واحد من أهم المخاطر البيئية التى تواجه العالم وقد تم اخذ عينات من هذه الدراسة من١٣ موقع مياه جوفية و٥ مواقع لمياه الرى وذلك لتقدير درجة الحموضة ph والملوحة والامونيا والنترات والعناصر الثقيلة. وقورنت النتائج المتحصل عليها مع الحدود المسموح بها لمياه الرى والشرب وذلك طبقا لارشادات منظمة الصحة العالمية.

تبين من النتائج أن تركيز كلا من درجة الحموضة ph والمواد الذائبة الكلية Tds والامونيا والنترات لميه الرى والصرف وكذلك المياه الجوفية فكانت فى الحدود المسموح بها لاستخدمها فى الرى .بينما تعدى تركيز المواد الصلبة الكلية فى المياه الجوفية الحدود المسموح بها لاستخدمها كمياه شرب. اما بالنسبة لتركيز العناصر الثقيلة فى مياه الرى والصرف فكانت اقل من المسموح بها فيما عدا الكادميوم والمنجنيز بينما تعدى تركيز كلا من الكادميوم والرصاص والمنجنيز فى المياة الجوفية الحدود المسموح بها لاستخدامها فى مياة الشرب ولذلك لابد من معالجة المياة الجوفية قبل أن يوص باستخدامها كمصدر لمياة الشرب

١ قسم الاراضى والميه كلية الزراعة جامعة طنطا بطنطا
٢ قسم الاراضى والمياه كلية الزراعة بدمنهور جامعة الاسكندرية