



abdulaly@kacst.edu.sa :

## ABSTRACT

*Nitrate exists in groundwaters naturally and/or due to human activities. Waters with high concentration of nitrate must be treated to prevent adverse health effects. Water samples were collected from 18 drinking water treatment plants in Riyadh, Gasseem and Hail regions for the purpose of evaluating the performance of those plants in nitrate removal. Results indicate that the concentration of nitrate in groundwater ranges between 2.9 and 84.8 mg/L and in the plants product water ranges between 1.2 and 45.2 mg/L, with removal rate of up to 69.2%. High nitrate removal occurs in plants with RO or ED processes. In general, RO process gave a better removal than ED process. It is recommended that continuous monitoring of plants performance be carried out particularly for those that are supplied with high nitrate groundwater.*

(NO<sub>3</sub>)

[Start, and Sawhny, 1980, Whelan, and Titamnis 1982]

[SASO, 1993] (      - /      ) NO<sub>3</sub>- /

(      )

(      )

[Nolan, and Stoner. 2000, Spalding and Exner. 1993, Foster, et al. 1986, Milburn, et al. 1990, Levallois, et al. 1998, Donoso, et al. 1999, Pekny, et al. 1989].

—  
—  
—  
—  
—  
—

( - - )

[Alabdulaaly et al, 2001]

( )

[APHA, AWWA, WEF, 1998]

. (Dionex Dx-300)

( )

:

( / )  
( / )

( / ) ( / , )  
( / , ) / ( / , )  
/

( )

. / - , ( / )

% ,

.( % , - )  
)

( )

% , - , ( / )

)

. % ,

(

.  
( )  
:  
% , , ( ) .  
-  
% ,  
[Hindin, et al.1968] . % -  
% , ( / ) .  
[ Sword, 1969 ; Takenaka, et al., 1975 ]  
) / - ,  
( -  
/  
( )

1. Alabdulaaly, A.I, Al-Rehali A., Al-Zarah, A. and Khan, M.A, (2001), "Occurrence of Nitrates and Its Removal from Drinking Water of the Central Region of Saudi Arabia", First Technical Report, Project ARP 15-15, King Abdulaziz City for Science and Technology.
2. Donoso, G., Cancino, J., and Magri, A., 1999, "Effects of Agricultural Activities on Water Pollution with Nitrates and Pesticides in the Central Valley of Chile", *Water Science and Technology*, 39 (3), pp 49-60.
3. Foster, S.S.D., Bridge, L.R., Geake, A.K., Lawrence, A.R., and Parker, J.M., 1986,. "The Groundwater Nitrate Problem: A Summary of Research on the Impact of Agricultural Land-Use Practices on Groundwater Quality Between 1976 and 1985", Hydrogeological Report 86/2, British Geological Survey.
4. Hindin, E, Dunstan, G.H., and Bennett, R.J., 1968, "Water Reclamation by Reverse Osmosis", Bulletin 310 Technical Ext. Service, Washington State University.
5. Levallois, P., Theriault, M., Rouffignat, J., Tessier, S., Landry, R., Ayotte, P., Girard, M., Gingras, S., Gauvin, D., and Chiasson, C., 1998, "Groundwater Contamination by Nitrates Associated with Intensive Potato Culture in Quebec", *The Science of the Total Environment*, 217, pp 91-101.
6. Milburn, P., Richards, J.E., Gartley, C., Pollock, T., O'Neil, H., and Baily, H., 1990, "Nitrate Leaching from Systematically Tiled Potato Fields in New Brunswick, Canada", *Journal of Environmental Quality*, 19, pp 448-454.
7. Nolan, B.T., and Stoner, J.D., 2000, "Nutrients in Groundwaters of the Conterminous United States, 1992-1995", *Environmental Science and Technology*, 34 (7), pp 1156-1165
8. Pekny, V., Skorepa, J., and Vrba, J., 1989, "Impact of Nitrogen Fertilizers on Groundwater Quality - Some Examples from Czechoslovakia", *Journal of Contaminant Hydrology*, 4, pp 51-67.
9. Saudi Arabian Standards Organization, 1993, "Bottled and Non-Bottled Drinking Water Standards". SSA# 701/1993.
10. Spalding, R.F., and Exner, M.E., 1993, "Occurrence of Nitrate in Groundwater-A Review", *Journal of Environmental Quality*, 22, pp 392-402.
11. Standard Methods for the Examination of Water and Wastewater (1998), 20<sup>th</sup> Ed., APHA, AWWA, WEF.
12. Start, J.L., and Sawhney, B.L., 1980, "Movement of Nitrogen and Carbon from a Septic System Drain Field". *Water, Air, and Soil Pollution*, 13, pp 113.
13. Sword, B.R., 1969, "Desalination of Irrigated Return Waters", American Geophys., Union Math Fall Meet Hydrology Section, California.
14. Takenaka, H.H., Chen, C.L., and Miele, R.P., 1975, "Deminalization of Wastewater by Electrodialysis", U.S. Environmental Protection Agency, Cincinnati, Ohio
15. Whelan, B.R., and Titamnis, Z.V., 1982, "Daily Chemical Variability of Domestic Septic Tank Effluent", *Water, Air, and Soil Pollution*, 17, pp 131.

( )

		/ (NO <sub>3</sub> )		
Foster, et. al., 1986		/ - / < -	-	
Milburn, et. al., 1995 .		/ - ,		
Levallois, et. al., 1998.		/ , < - , >		
Donoso, et. al., 1999 .		/ ,		
Pekney, et. al., 1989.		/ ( - ) * /	-	
		/ / * /	-	
Nolon and Stoner, 2000		/ * % / , * %		
Spalding and Exner, 1993	( )	% , / , ≤ * % , / , ≤ *		

( ) :

							/	
-	✓	-	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
-	✓	-	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	-	✓		,	
✓	✓	✓	✓	✓	✓		,	
-	✓	-	✓	✓	✓		,	
-	✓	*✓	✓	-	-		,	
-	✓	*✓	✓	-	✓		,	/
-	✓	-	✓	-	✓		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	-		,	
✓	✓	✓	✓	✓	✓		,	
✓	✓	✓	✓	✓	✓		,	

\*





( )

%	/		
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	/
-		'	
'	'	'	
'	'	'	
'	'	'	
'	'	'	

/