A WATER TREATMENT PROCESS OF KARBALA WELLS

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ABSTRACT

This paper focused on vertical water wells commonly used to supply water for domestic, municipal and agricultural uses in Karbala province. A fifty four water well located in different places at Karbala governorate is studied. chemical analysis were analyzed statistically in SPSS,ver.24, the descriptive statistics results are introduced in LewaPlus water treatment design package to get the design for a reverse osmosis system, another units was added to be useful for application. LewaPlus gives details for the suggested design, specifies pump, motor power consumption as well as system power consumption. The estimated system capacity is about 96 $\frac{m^3}{day}$ with a recovery of 80%.

INTRODUCTION

Water pollution can be classified into four sections: biological contamination, chemical contamination, physical contamination, radioactive contamination [1]. Water can be contaminated by pathogens, a disease causing organisms like 'bacteria, amoebas and viruses, as well as the eggs and larvae of parasitic worms', from human activities such as industrial wastes, pesticides, and fertilizers and the naturally existed minerals from the environment, such as arsenic, common salt and fluorides. Some non-harmful contaminants may influence the taste, smell, color or temperature of water, and make it unsuitable to the community (2).

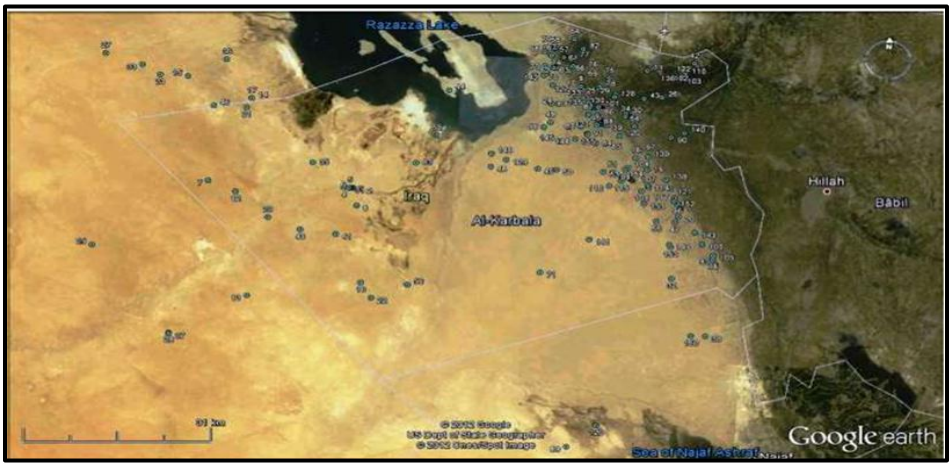

Figure 1: Illustrate the distribution of water wells in Karbala province.

Data Collection

Karbala city located about100 km southwest of Baghdad. It covers an area of 5034 km^2 and the population exceeds 1.5 million. The main groundwater aquifer within the area is is composed of poorly sorted sand and sand stone with gravel (7). In the current study, the data of chemical contaminants concentrations for 91 wells

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were taken from The Iraqi General Corporation of Groundwater; the mentioned wells are constructed in unconfined aquifer regions which belong to the Karbala province boundary. The distribution of wells in Karbala province is illustrated in figure (1). Contour maps are studied in details for contaminants by ('Al-Saadi') (6). Water Treatment Process Process block diagram is illustrated in figure (2), the first stage is to remove solid materials like sand gravel and mud in an electrically self-cleaning filter which is illustrated in figure (3), (8). The filter should work with a wide range of filtration requirements 705 -15 Microns. A chlorine is injected at the intake to kill alleges and bacteria and to protect equipment's from iron bacteria. The water after filtration unit is ready to use in agricultural applications. Removing of sediments, is important to protect the following reverse se osmoses unit from clogging. The final unit is to install a UV cell, to make the water suitable for drinking.

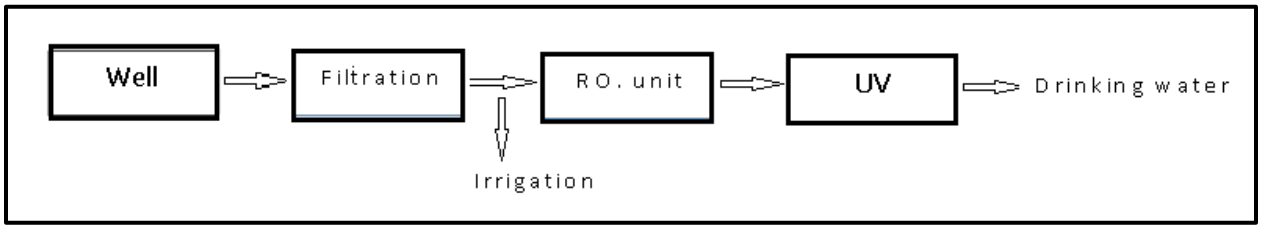

Fig. 2: A block diagram for the suggested process.

Filtration Process

The water enters through the filter inlet pipe and flows through the screen. The "filter cake" accumulates on the screen increasing the pressure difference to develop between the Filter inlet and outlet. A pair of Pressure Transducers read the differential (usually set at 8 psi) and signals a programmable logic controller to start the cleaning operation.

Fig. 3: The Typhoon Automatic, Self-Cleaning Water Filter Morrill Industries.

Raw Water Feed Stream

The statistical data of water specification is illustrated in table (1)

Table 1: descriptive statistics for water analysis in 54 well at Karbala province

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	units
pH	54	7.11	7.81	7.3193	.19223	$ds.m^{-1}$
EC	54	2320	45300	4690.00	5732.659	$ds.m^{-1}$
TDS	54	1460.0	32210.0	3451.037	4083.6862	Mg/l
Ca Ion	54	70.00	924.00	246.8889	156.81568	Mg/l
Mg Ion	54	36.00	586.00	137.4259	96.77042	Mg/l
Na+	53	119.00	1390.00	432.0566	216.86245	Mg/l
K	54	1.00	745.00	59.0259	107.67561	Mg/l
CL	54	.00	2931.00	609.1111	447.39218	Mg/l
CO3	47	0	512	10.89	74.683	Mg/l
HCO3	54	59	1350	378.17	233.228	Mg/l
SO4	54	2	7775	1182.95	1310.647	Mg/l
NO3	53	1.00	23.00	4.6057	3.87514	Mg/l
Valid N (listwise)	45					

N= number of samples.

The Biological investigations detect the presence of Coliform bacteria, which indicate the sanitary quality of water for human (5).

Reverse Osmosis System

The system based on design basis of 5 $\frac{m^3}{hr}$ production rate using Lanex Lewa plus software Design results

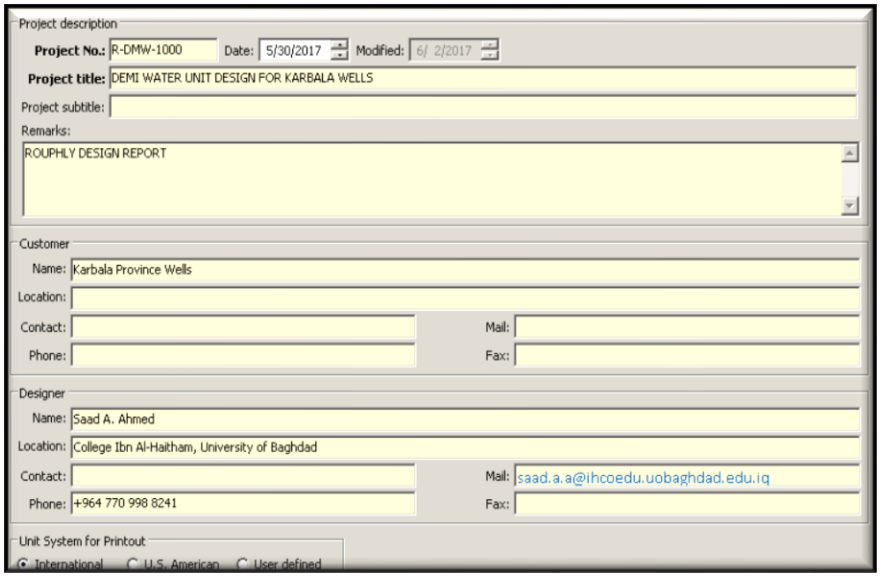

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Figure 4: Project Description.

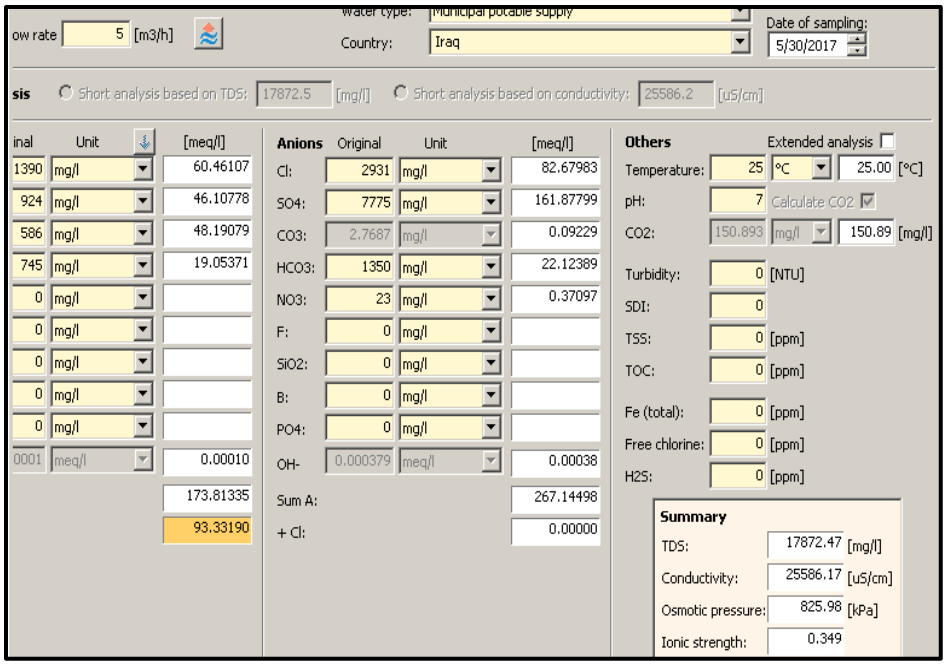

Fig. 5: Water Analysis.

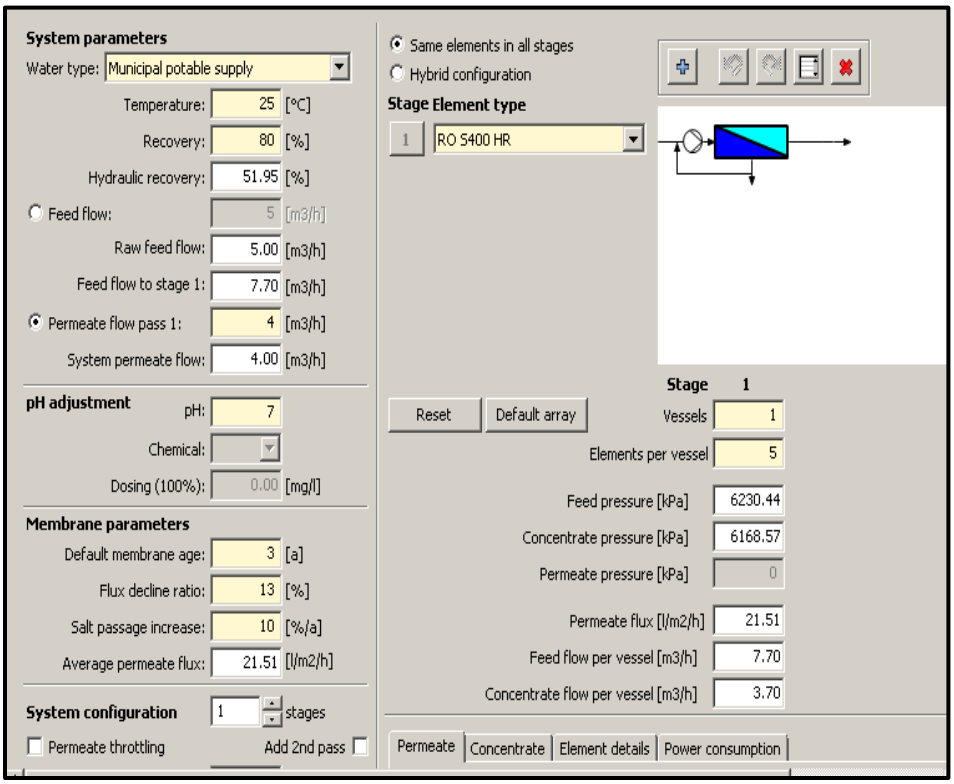

Fig. 6: system parameters.

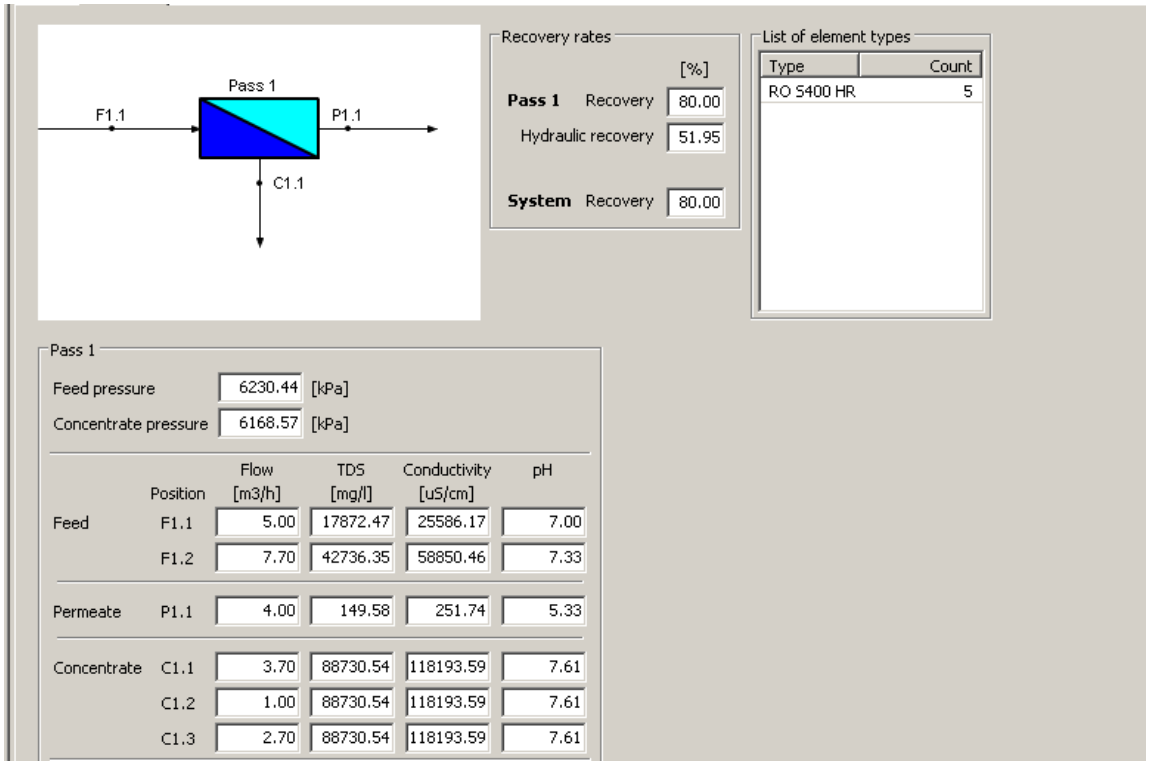

Fig. 7: Overview Of System Design

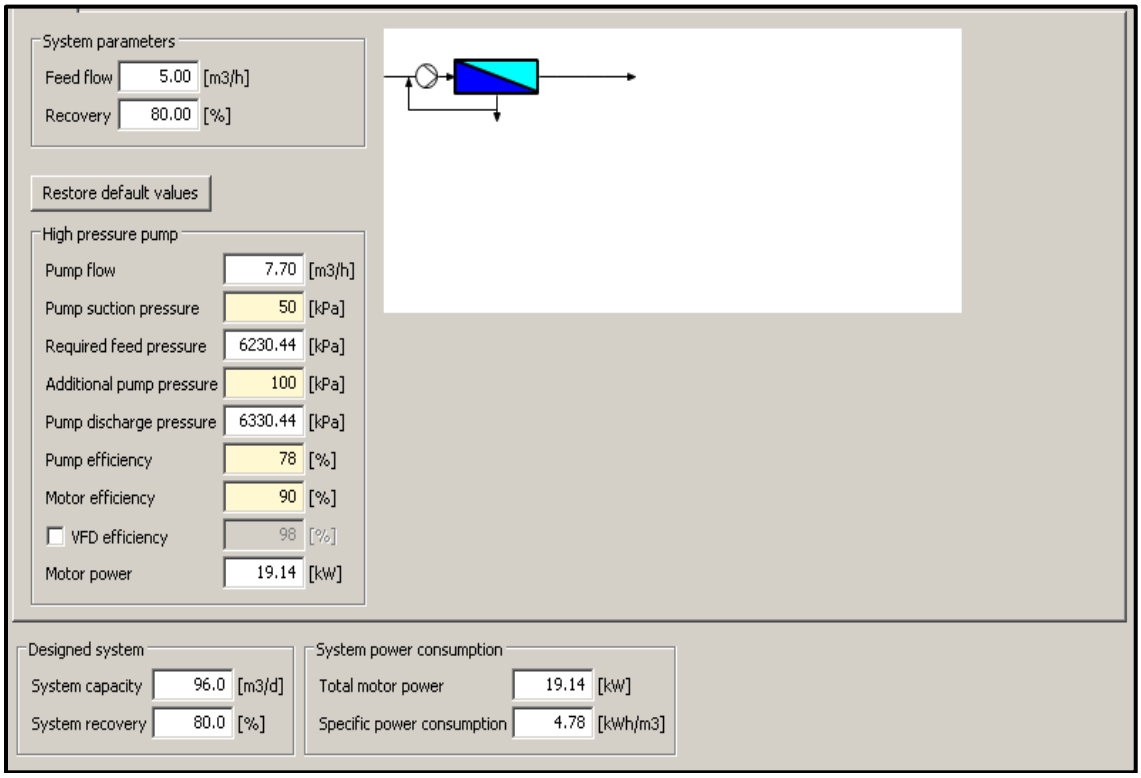

Fig. 8: Pump specification.

Ultraviolet Radiation Treatment

Water disinfection with high-energy UV radiation is an environmentally-friendly method such no chemicals used, neither chlorine nor ozone. Special UV cells destroy microorganisms such as bacteria, viruses and parasites and help decompose chemicals harmful to health (9).

Ultraviolet energy is an electromagnetic invisible radiation spectrum between visible light and x-rays, Special low-pressure mercury vapor lamps produce UV at 254 nm, the optimal wavelength for disinfection and ozone destruction, the UV rays penetrates the outer cell membrane, passes through the cell body and crash the DNA preventing reproduction. UV disinfection does not remove materials from water. It is important to to put the UV unit after the RO. Unit, whereas certain contaminants can reduce the transmission of UV light through the water, UV dose not reaches the bacteria. These contaminants include turbidity, iron, and humic and fulvic acid, common to surface water supplies. Suspended particles are a problem because microorganisms buried within particles are shielded from the UV light and pass through the unit unaffected. UV disinfection is most effective for treating high-clarity purified reverse osmosis water , water specification should meet the values listed in table (2). Another important design parameter is the water stream flowrate the flow is too high, water will pass through without enough UV exposure (4).
In order to use UV Units, water should satisfies the specification in table (2).

Table 2: illustrate Recommended Maximum Concentration Levels for Water to be Treated By UV

Test	Unit mg/l
Turbidity	5 NTU
Suspended Solids	10 mg/l
Color	None
Iron	0.3 mg/l
Manganese	l 0.05 mg/l
pH	l 6.5 – 9.5
Hardness	< 6 grains

Conclusion

R.O. System is an effective water treatment if it is filtered, the water is suitable for drinking in case of adding ultraviolet unit for disinfection, but chlorine unit is important because UV dose not completely kill all types of bacteria and viruses. The R.O. output stream decreases conductivity to about 250 µS, TDS is decreased from to about 150 ppm.

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عملية معالجة مياه من اَبار محافظة كربلاء المقدسة

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الملخص

يركز البحث على دراسة مياه الآبار واستخدامها للمنزل او الزراعة او أمور أخرى من خلال أخذ اربع وخمسين عينة من مياه اَبار محافظة كربلاءالمقدسة وإجراء الدراسة عليها وإجراء التحليل الكيميائي ثم الإحصائي عليها لمعرفة نسبة الأملاح والملوثات فيها وبالتالي تحديد ان كان بالإمكان استخدامها للشرب والحفظ وتحديد نوع الفلتر المطلوب استخدامه لتنقية تلك المياه وجعلها صالحة للشرب وكذلك نوع المضخة التي تستخدم لذلك الغرض، وتم اقتراح تصميم معين للمضخة التي تفي بالغرض.

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