Available online at www.elixirpublishers.com (Elixir International Journal)

Civil Engineering

Elixir Civil Engg. 82 (2015) 32086-32093

ISSN: 2229-712X

Evaluating the Performance of Water Treatment Plant (Case Study: Al-Rumaitha Treatment Plant, Al-Muthanna, Iraq)

Huda Mohammed Selman[1], Ahmed Amir Abdul Wahid[2] and Ghassan Mohammed Selman[2]

[1]Department of Civil Engineering, College of Engineering, Al-Muthanna University, Al-Muthanna, Iraq.

[2]Department of Environmental Engineering, College of Engineering, Babylon University, Babylon, Iraq.

ARTICLE INFO

Article history:

Received: 12 March 2015;

Received in revised form:

19 April 2015;

Accepted: 30 April 2015;

Keywords

Treatment

Plant, Turbidity,

Al-rumaitha,

Evaluation.

ABSTRACT

The trend of urbanization in Iraq is exerting stress on civic authorities to provide basic requirement such as safe drinking water, sanitation and infrastructure. The rapid growth of population has exerted the portable water demand, which requires exploration of raw water sources, developing treatment and distribution systems. There is a need to study the water treatment plants for their operational status and to explore the best feasible mechanism to ensure proper drinking water production with least possible rejects and its management. A case study has been conducted to evaluate the process of treatment and to find out the problems of drinking water treatment process in Al-Rumaitha drinking water treatment plant(RWTP) lies in the city of Rumaitha in Muthanna province,Iraq. In general, conventional treatment is provided having a sequence of alum addition, coagulation, sedimentation, filtration and disinfection by chlorination. Water treatment plants are playing an important role in purifying and supplying the pure water to the people. This plant consists of two projects, The design capacity of the old project (88000 m^3 / day) and for the new project (820 m^3 / hr) while not know the actual capacity of the plant due to lack of flow gauges. In this study, the removal efficient of turbidity will be addressed as well as three factors are, total dissolved solids , pH and values of chlorine added at February,2015 of old and new project for raw and treated water, then compared within Iraqi limits to note the problems of the plant and how to avoid them in the easiest and cheapest methods. It was found that the average value of the removal efficiency of the turbidity were about 51.5% of old project and 53.8% of new project which is relatively low due to the absence of the permanent maintenance and the continuous clean out for the sedimentation basin. The average value of T.D.S concentration of treated water were 910.8 ppm of old project and 911.5 ppm of new project . The free chloride (CL_2)of old project was 2.1 ppm and of new project was 2.6 ppm. While we don't note that the strong influence of the change in temperature on the factors which studied in this project. The pH value is almost constant values for the water of the Euphrates River. In addition to the study of these factors there are notes on the treatment plant should study and develop plans for processing and control. It is upon these observations lack of flocculation basin, limiting the efficiency of the sedimentation basins despite large size disrupt dissolve alum basins as alum is added to it manually, leading to differing concentrations of alum solution. From time to time and other problems presented piping at the station, as is since the establishment.

Introduction

Next to the air, the other important requirement for human life to exists is water. Water is available in various forms such as rivers, lake, streams etc. The earliest civilizations organized on the banks of major river systems and required water for drinking, bathing, cooking etc. But with the advancement of civilization the utility of water enormously increased and now such a stage has come that without well organized public water supply scheme, it is impossible to run the present civic life and the develop the towns. The importance of water from only a quantity viewpoint was recognized from the earliest days and the importance of quality come to be recognized gradually in the later days. The main objective of water treatment is to purify the polluted water and make it fit for the human consumption, through the removal and killing of organism's sickness (pathogenic organisms) and remove the taste, smell, unpalatable turbidity discharge, some of the excess of dissolved metals and a range of items. However, the desired chemical and harmful [1, 2, and 3].The earliest recorded knowledge of water quality and its treatment are found in Sanskrit literature "Sushuri Sanhita" compiled about 2000 B.C. It deals with storage of drinking water in copper vessels, exposure to sunlight, filtering through charcoal, sand etc. The correlation between water quality and incidence of diseases was first established in 1849 by Dr. John snow when cholera appeared in London during the summer and 14,600 deaths were reported. But Dr. snow unable to convince the authorities and public with the evidence of available data. The water borne diseases like typhoid, dysentery, cholera etc the concept of water borne diseases was well accepted by 1900. Another striking example was reported from Uttarpradesh by W.H.O (World Health Organisation) in 1963, there the death rate by chorera decreased by 74.1%, Thyphoid fever by 63.6% , by dysentery 23.1% and diarria by 63.6%. All these were achieved by drinking water treatment [4]. Potable water for

Tele:

E-mail addresses: hudamohammad20@gmail.com

human consumption contains permitted concentration of impurities, particulates, chemical compounds and minerals dissolved water treatment [5]. Moreover, it contains the number of bacteria in source water and like colon bacteria (E-coli), also included the parameters of the highest amounts of radiation in the presence of water [5 and 6]. The raw water quality available in Iraq varies significantly, resulting in modifications to the conventional water treatment scheme consisting of screen, chemical coagulation, sedimentation, filtration and disinfection. The backwash water and sludge generation from water treatment plants are of environment concern in terms of disposal. Therefore, optimization of chemical dosing and filter runs carries importance to reduce the rejects from the water treatment plants. Also there is a need to study the water treatment plants for their operational status and to explore the best feasible mechanism to ensure proper drinking water production with least possible rejects and its management.

Objective of Study

The main objective of this study was to evaluate the performance of Al-Rumaitha water treatment plant. Turbidity and T.D.S were selected as a main parameters which are very important tools in the evaluation of performance.

Literature Review:

Michele Grenier, XCG Consultants Ltd.*. Performance evaluations were conducted at two surface water treatment plants based on the Guidance Manual for the Optimization of Ontario Water Treatment Plants Using the Composite Correction Program (CCP) Approach (Ontario Ministry of Environment, March 1998). The CCP approach was developed by the US Environmental Protection Agency and adapted for the MOE. The CCP approach consists of two main components, the Comprehensive Performance Evaluation (CPE) phase and the Comprehensive Technical Assistance (CTA) phase. The CPE is an evaluation approach that aims to estimate the capabilities of the existing facility. The objective of the CPE phase is to identify if significant improvements in the plant's performance can be achieved without major capital improvements. The CTA is a performance improvement phase that addresses the issues identified during the CPE and implements the optimization of the existing facilities to achieve desired performance. This paper describes the CPE phase conducted at two Ontario water treatment plants [7].

M. A. ElDib and Mahmoud A. Azeem Elbayoumy (2003) This research outlines the finding of investigation of the treatment plant in Dakahlia (Meet Fares). The evaluation conducted in this research was carried out by reviewing the engineering design to assure matching of standards and codes. Also, biological, chemical and bacteriological analysis were conducted to investigate water quality. The conclusions drawn from this research outlines the importance of accurate engineering design and need for continuous monitoring and analysis of each unit performance [8].

C.B.A. Ogutu and F.A.O. Otieno(2003). In this study, sampling of water was done at the inlet and outlet of each of the process units of the Moi University drinking water treatment plant (Kenya) regularly for six months and turbidity tests done to asses their performance in terms of turbidity removal. Other physical parameters like pH, Residual chlorine and suspended solids were also measured and their relationship with turbidity developed. Results revealed that the optimum coagulant dosage for this plant should be 2mg/l at pH of 6.8 for optimal turbidity removal; this however, varies from plant to plant. WHO recommendations for turbidity of filtered water to be disinfected with chlorine should be less than 1NTU. Higher turbidities measured in this study revealed the presence of cracks and mud balls in the sand media of the filter units causing inefficiencies in filtration as well as lower filtration rates. WHO also recommends turbidities of less than 5NTU for drinking water and higher turbidities ranging 5-7NTU measured in this study indicates possibility of faults in the treatment plant and distribution system. Corrective measures should therefore be pursued [9].

Materials and Methods

Description of the Project:

Al-Rumitha water supply project is the important project in Al-Muthanna province. This Treatment Plant consists of two projects: The old project was constructed in 1982 to produce 88000 m3/day and to produce 40000 m3/day due to meet the increasing water demand in all Al-Muthanna province. Figure1 shows the site of Al-Rumitha water treatment plant

Fig 1. The site of Al-Rumitha water treatment plant (RWTP) [10].

The purification process:

Figure 2 shows the general layout of the RWTP, which consists of collection works, treatment and storage facilities. The following gives a brief description of all WTP units components facilities.

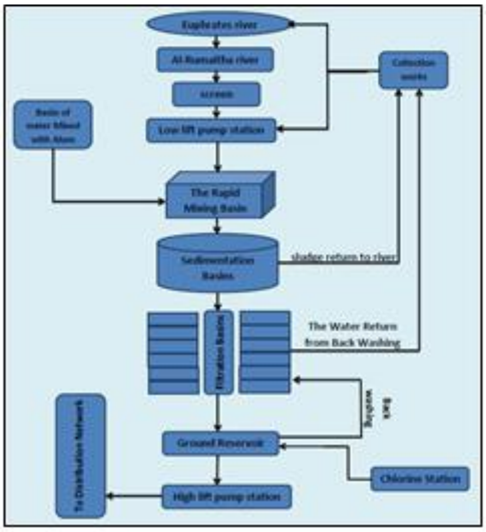

Fig 2. Sketch the line of Al-Rumitha Water Treatment Plant (RWTP)

Intake and Intake Conduit:

It is located on the Euphrates River in depth of 12 meters, a rubber protector to prevent the entry of floating material and algae. The intake conduit that pull water from source has 90 cm in diameter. The pump contains 5 plugs on the pump uploaded the water, six of them working and the forth-pump is as Standby.

The total energy of each pump is 820 m3/ h, the pressure of the head of the water wis 15 m, and the type of the pump is (KSP RDL 400-440A). These pumps are meant to raise the water from the river to the Rapid mixing basin. There is an organized system near the lift station in order organize the amount of water drawn from river.

Fig 3. River Intake and Main pipe of RWTP

Screens

Screens are fixed in the intake works or at the entrance of treatment plant so as to remove the floating matters as leaves, dead animals etc.

Fig 4. Bar Screen of RWTP

Rapid Mixing

The rapid mixing stage is the first treatment step for water after receives it from river. Chemical additive as aluminum is added to the raw water materials in a manner and then distribute the water to the sedimentation basins. Dimensions of the pelvis (6 ×5.6×4) m and the actual capacity of the basin is 118 m3 and the reaction time is 180 seconds. In this position alum solution and pre-chlorination are applied across(1 in) diameter pipe. The aluminum sulphate solution is delivered, via two splitter boxes each of which serves four clarifiers. Inside the coagulation tank there is a mixer in order to achieve the required flocculation. Sludge which is discharged from the concentrators and the central chamber of each clarifier, flows under gravity to the sludge pumping station. Its discharge = 1150 liter/hr. The alum which add as powder in the past was used 150 bags of alum but now 20 bags are consumed in one day as a result of change in weather and water case according to(turbidity test & ph test).the mechanism of alum add according to ministry standards was limited with (5 gm\m3) . There are 3 alum container the water is pulled from it to flash mixer (it mixes alum impure water) in coagulation basin. Each alum molecule will break four particles of clay in the sedimentation tank .The water which mixed rapidly will collected through a small opening before entering the settling ponds and then go to the raw water tower in the center of sedimentation basins ,and after the sedimentation completion the water goes to the opening as (v-notch)shape to the filter basins during time period (one hour).

Fig 5. Rapid Mixing and room of alum add in RWTP

Sedimentation:

After mixing the water is transferred from flash mixing to sedimentation basins immediately. There are four sedimentation basins ,with 45m diameter for each one. Each basin contain clay scrapers which has 50 cm in height to remove precipitates materials .The clay have accumulated by the scrapers through an orifice is located below sedimentation basin known as (clay orifice). The clay is pushed through clay orifice to the river by using pipe of 20 cm dia.

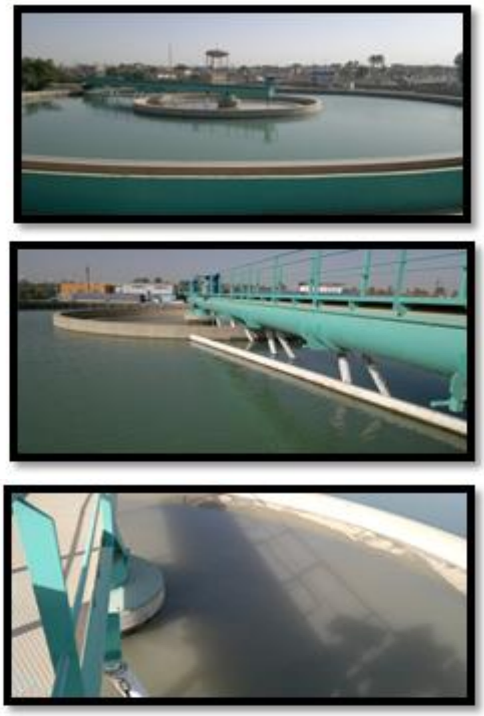

Fig 6. Sedimentation basin with scraper in RWTP

Filtration

The process of passing the water through beds of sand or other granular materials is known as filtration. For removing bacteria, color, taste, odors and producing clear water, filters are used by sand filtration 95 to 98% suspended impurities are removed The number of Filtration basins are 22 basin each one have dimensions (9.5 m × 5 m). Filters media consist from graded sand and gravel. Filtration rate about 160 liter/hr. filters are cleaning manual (there is a small space on the side to allow to the worker to walk and clean).The water outside of the filters are pure but not sterilized .Washing of filters is occur in three times per day Because of the high turbidity of the river, the water uses for washing the filters are the water which in the underground reservoir (by using six pumps) ,the water which contained mud and result from filters washing go back to the river. Filters washing accurse by opening the filter which neighboring to the filter which needed to wash and then close the washing filter. The water that is produced from washing have returned to source (river).

Fig 7. Filtration basin and Back washing in RWTP

The process of killing the infective bacteria from the water and making it safe to the user is called disinfection. There are pipes in filters of dia.= 4 cm which take the non disinfected water from the ground tank of filter to the ground reservoir then chlorine is mechanically added as disinfection matter. Chlorine is put with rate of (3-3.5) Boeing so that 0.5 ppm of Chlorine is reach to consumer. After the disinfection is completed the water is become drinkable and is divided as following:

- Al-Samawah city: 6 pumps, discharge = 675 m^3/hr and head losses = 90 m,
- AL-Rumaithah city: 2 pumps, discharge = 300 m^3/hr and head losses = (70-80) m,
- AL-Hilal city: 2 pumps, discharge = 200 m^3/hr and head losses = (80-90) m,

AL-Khudhr city: 2 pumps, discharge = 400 m^3/hr and head losses = (70-80) m

Fig 8. Ground reservoir and Chlorine Container of RWTP

Data Collection

Two different types of water samples have been taken for the analysis at different stages of treatment: raw water and supply water. All the water samples were taken at February 2015. The aim of the daily laboratory test is to ensure that potable water confirming to IS . Physical tests conducted to determine the quality of water, to ensure that treatment of water is properly done during each phase or stage of treatment and to examine whether the treated water confirms to standards. Turbidity , T.D.S. and chloride added are used in this analysis. The data were collected from daily laboratory water quality analysis reports covering the period from 1-2-2015 to 26-2-2015 for two projects of RWTP .

Types of tests:

The tests was working daily, approximately during February month 2015. These tests include:

1. **Turbidity:** It is caused due to presence of suspended and colloidal matter in the water. The character and amount of turbidity depends upon the type of soil over which the water has moved ground waters are less turbid than the surface water. Turbidity is a measure of resistance of water to the passage of light through it. Turbidity is expressed as NTU (Nephelometric Turbidity Units) or PPM (parts per million) or Milligrams per liter (mg/l). Turbidity is measured by 1) Turbidity rod or Tape 2) Jacksons Turbid meter 3) Bali's Turbid meter. In this study it measured by first method The Sample to be tested is poured into a test tube and placed in the meter and units of turbidity is read directly on the scale by a needle or by digital display. Drinking water should not have turbidity more than 10 N.T.U. This test is useful in determining the detention time in settling for raw water and to dosage of coagulants.
2. **Temperature:** Temperature of water is measured by means of ordinary thermometers. The temperature of surface water is generally at atmospheric temperature, while that of ground water may be more or less than atmospheric temperature. The most desirable temperature for public supply between 4.4°C to 10°C. The temperature above 35°C are unfit for public supply, because it is not palatable.
3. **PH Value of Water** PH value denotes the concentration of hydrogen ions in the water and it is a measure of acidity or alkalinity of a substance.

$$PH = -\log_{10}[H^+] \text{ or } 1/\log_{10}[H^+]$$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Acidity ← Neutral→ Alkalinity

Depending upon the nature of dissolved salts and minerals, the PH value ranges from 0 to 14. For pure water, PH value is 7 and 0 to 7 acidic and 7 to 14 alkaline range. For public water supply PH value may be 6.5 to 8.5. The lower value may cause tubercolation and corrosion, where as high value may produce incrustation, sediment deposits and other bad effects. PH value of water is generally determined by PH papers or by using PH meter. In this study it was measured by second method PH can read directly on scale or by digital display using PH meter.

4. **TDS: TDS shows general water Quality.**
5. **Chlorine Added:** A partial material which used in chlorine examination was Powder Pop Dispenser PPD.

Results and discussion

Turbidity: It is indicated from Table2 and 3. It is obvious to note that the turbidity of the that water entered the plant had peaked in 24/2/2015 of old project and new project during the study period on with a value 22 NTU and 18 NTU respectively. The lowered turbidity in 8/2/2015 of old project and in 19/2/2015 of new project with a total value 9.1 NTU and 7.3 NTU respectively. The overall rate of raw water turbidity involved 13.4 NTU and 12.6 NTU of old project and new project respectively .The turbidity of treated water has peaked in 4/2/2015 of old of old project and in 24/2/2015 of new project with a value of 14 NTU and 10.1 NTU respectively , lowered in 16/2/2015 with a value of 4.5 NTU of old project and 4.2 NTU of new project . Whereas the overall rate of turbidity of treated water were 6.3 NTU of old project and 5.4 NTU of new project. The removal efficiency of turbidity reached its optimum magnitude of old project in 24/2/2015 with about 72.7 % and of new project was 71.3% in 5/2/2015 , while it lowed in 4/2/2015 with about 10.8% of old project and in 26/2/2015 with about 26% of new project .The turbidity increased in rainy seasons. The removal efficiency of turbidity in RWTP was 52.5 %. The relationship between turbidity and the date of test is reported in fig.9 and 10. The comparison between removal efficiency of old and new project would showed in fig.11

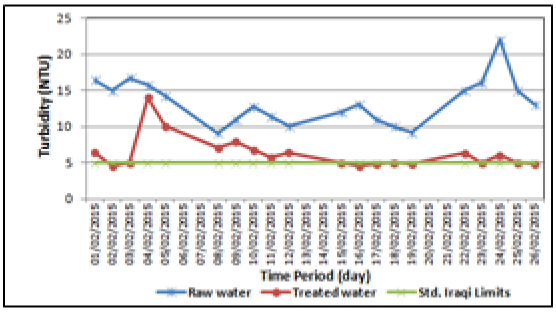

Fig 9. Relation Between Turbidity and day of Test of Old Project

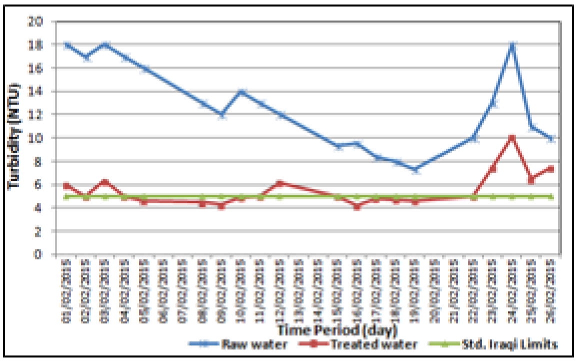

Fig 10. Relation Between Turbidity and day of Test of New Project

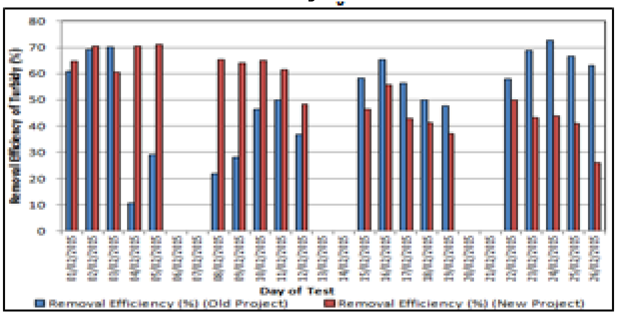

Fig 11. Removal Efficiency of Turbidity in Old and New Project

T.D.S: Total dissolved solids of old and new project in RWTP are shown in fig. 12,13 and 14, while the data of T.D.S. is depicted in Table 4 and 5. It can be clearly seen that the corresponding values of T.D.S of raw water was higher in the new project, 991 ppm . Maximum average concentration of T.D.S was 988 ppm in the old project .The Iraqi standards of total dissolved solids could be applicable to it (500 ppm).T.D.S value unacceptable of IS in all days of study.

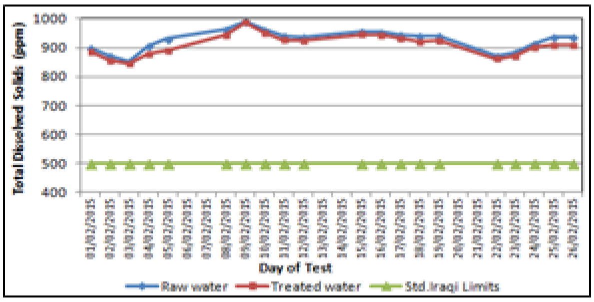

Fig 12. Relation Between T.D.S and day of Test of Old Project

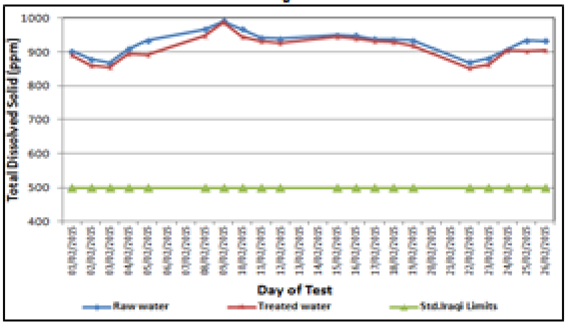

Fig 10. Relation Between Turbidity and day of Test of New Project

pH Value: Results for PH are illustrated in Fig.11. It is shown the relationship of the values of pH, ranged between (7.5-8.5), which are among the determinants of global and do not have a significant impact on other water features. The data clearly indicates that all pH value of treated water was found acceptable the Iraqi limits of (7.0-8.5). Table 6 indicates to the data of pH value.

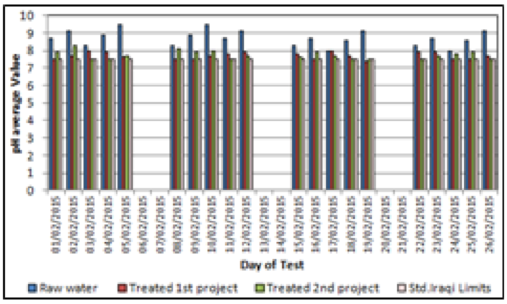

Fig 11. Comparison Between pH value with IS.

Add chloride: The dose of chloride was within the specifications of Iraqi standards ranging between (0.5 - 4) mg/l. It is evidenced that the chlorine dose increased in rainy season as it already illustrated in Fig.12. This is because of the high value of turbidity which leads to rise number of contaminants. The data of added chloride of old and new project in RWTP are shown in Table 7.

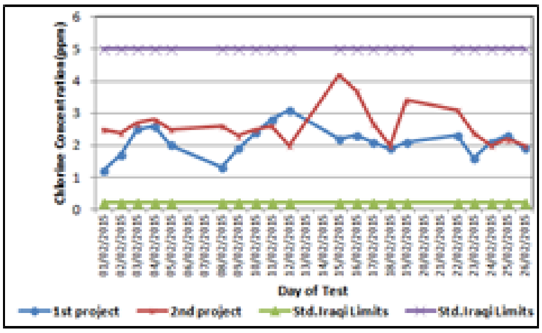

Fig 12. Change Free (CL_2) within date of test

Table 1. Iraqi Specifications(IS) of Drinking Water No. (17/4/1974)

Parameter	Desirable-Tolerable	If no alternative source available, limit extended up to
Turbidity (NTU unit)	5	25
Color (Hazen scale)	5	50
Taste and Odor	Un-objectionable	Un-objectionable
PH	7.0-8.5	6.5-9.2
Electrical conductivity (µS/cm)	----	2000
Acidity mg/l (as $caco_3$)	0.0	----
Alkalinity mg/l (as $caco_3$)	125	200
Calcium mg/l (as Ca)	75	200
Magnesium mg/l (as Mg)	50	150
Chlorides mg/l (as Cl)	200	600
Total Hardness mg/l (as $CaCO_3$)	100	500
Iron mg/l (as Fe)	0.1	1.0
Sulphates mg/l (as SO_4)	200	400
Total Dissolved Solid (TDS) mg/l	500	1500
Fluorides mg/l (as F)	0.6-1.2	1.5
Added chloride mg/l	0.5-4	----
Nitrates mg/l (as NO_3)	----	40
M.P.N. of total coli form 37 Č	----	9.2

Table 3.Turbidity and Removal Efficiency of Old Project.

Day	Date	Turbidity(NTU)		Removal Efficiency (%)(Old Project)
		Raw water	Treated water	
Sunday	1/2/2015	16.4	6.4	61.0
Monday	2/2/2015	15	4.6	69.3
Tuesday	3/2/2015	16.7	5.0	70.1
Wednesday	4/2/2015	15.7	14	10.8
Thursday	5/2/2015	14.2	10.1	28.9
Sunday	8/2/2015	9.1	7.1	22.0
Monday	9/2/2015	11	7.9	28.2
Tuesday	10/2/2015	12.7	6.8	46.5
Wednesday	11/2/2015	11.4	5.7	50.0
Thursday	12/2/2015	10.1	6.4	36.6
Sunday	15/2/2015	12.0	5.0	58.3
Monday	16/2/2015	13.0	4.5	65.4
Tuesday	17/2/2015	11.0	4.8	56.4
Wednesday	18/2/2015	10.0	5.0	50.0
Thursday	19/2/2015	9.2	4.8	47.8
Sunday	22/2/2015	15	6.3	58.0
Monday	23/2/2015	16.0	5.0	68.8
Tuesday	24/2/2015	22.0	6.0	72.7
Wednesday	25/2/2015	15.0	5.0	66.7
Thursday	26/2/2015	13.0	4.8	63.1

Table 4. Turbidity and Removal Efficiency of New Project

Day	Date	Turbidity(NTU)		Removal Efficiency (%) (New Project)
		Raw water	Treated water	
Sunday	1/2/2015	18.0	6.0	66.7
Monday	2/2/2015	17.0	5.0	70.6
Tuesday	3/2/2015	18.0	6.3	65.0
Wednesday	4/2/2015	17.0	5.0	70.6
Thursday	5/2/2015	16.0	4.6	71.3
Sunday	8/2/2015	13.0	4.5	65.4
Monday	9/2/2015	12.0	4.3	64.2
Tuesday	10/2/2015	14.0	4.9	65.0
Wednesday	11/2/2015	13.0	5.0	61.5
Thursday	12/2/2015	12.0	6.2	48.3
Sunday	15/2/2015	9.3	5.0	46.2
Monday	16/2/2015	9.5	4.2	55.8
Tuesday	17/2/2015	8.4	4.8	42.9
Wednesday	18/2/2015	8.0	4.7	41.3
Thursday	19/2/2015	7.3	4.6	37.0
Sunday	22/2/2015	10	5.0	50.0
Monday	23/2/2015	13	7.4	43.1
Tuesday	24/2/2015	18	10.1	43.9
Wednesday	25/2/2015	11	6.5	40.9
Thursday	26/2/2015	10	7.4	26.0

Table 4. Total Dissolved Solids and Removal Efficiency of Old Project.

Day	Date	T.D.S (ppm)	
		Raw	Treated
Sunday	1/2/2015	899	887
Monday	2/2/2015	873	856
Tuesday	3/2/2015	852	846
Wednesday	4/2/2015	907	880
Thursday	5/2/2015	931	889
Sunday	8/2/2015	964	943
Monday	9/2/2015	989	988
Tuesday	10/2/2015	962	952
Wednesday	11/2/2015	942	927
Thursday	12/2/2015	938	925
Sunday	15/2/2015	955	946
Monday	16/2/2015	954	945
Tuesday	17/2/2015	945	934
Wednesday	18/2/2015	942	921
Thursday	19/2/2015	940	925
Sunday	22/2/2015	873	862
Monday	23/2/2015	885	870
Tuesday	24/2/2015	913	901
Wednesday	25/2/2015	937	908
Thursday	26/2/2015	936	910

Table 5. Total Dissolved Solids and Removal Efficiency of New Project.

Day	Date	T.D.S(ppm)	
		Raw water	Treated water
Sunday	1/2/2015	902	981
Monday	2/2/2015	878	860
Tuesday	3/2/2015	868	855
Wednesday	4/2/2015	909	894
Thursday	5/2/2015	934	892
Sunday	8/2/2015	968	948
Monday	9/2/2015	991	987
Tuesday	10/2/2015	968	946
Wednesday	11/2/2015	943	931
Thursday	12/2/2015	940	927
Sunday	15/2/2015	950	946
Monday	16/2/2015	949	941
Tuesday	17/2/2015	938	932
Wednesday	18/2/2015	937	930
Thursday	19/2/2015	935	920
Sunday	22/2/2015	869	853
Monday	23/2/2015	881	863
Tuesday	24/2/2015	908	905
Wednesday	25/2/2015	934	903
Thursday	26/2/2015	933	905

Table 6. PH value of Raw Water ,Treated Water of Old and New Project in RWTP

Day	Date	PH		
		Raw water	Treated Water of Old project	Treated Water of New project
Sunday	1/2/2015	8.7	7.5	7.9
Monday	2/2/2015	9.1	7.7	8.3
Tuesday	3/2/2015	8.3	8.0	7.5
Wednesday	4/2/2015	8.9	7.9	7.5
Thursday	5/2/2015	9.5	7.6	7.7
Sunday	8/2/2015	8.3	7.5	8.1
Monday	9/2/2015	8.9	7.5	7.9
Tuesday	10/2/2015	9.5	7.7	8.0
Wednesday	11/2/2015	8.7	7.8	7.5
Thursday	12/2/2015	9.1	7.9	7.7
Sunday	15/2/2015	8.3	7.8	7.6
Monday	16/2/2015	8.7	7.5	7.9
Tuesday	17/2/2015	8.0	8.0	7.7
Wednesday	18/2/2015	8.6	7.7	7.5
Thursday	19/2/2015	9.1	7.4	7.5
Sunday	22/2/2015	8.3	7.9	7.5
Monday	23/2/2015	8.7	7.9	7.7
Tuesday	24/2/2015	8.0	7.5	7.8
Wednesday	25/2/2015	8.6	7.5	7.9
Thursday	26/2/2015	9.1	7.7	7.5

Table 7. Added Chloride of Old and New Project in RWTP

Day	Date	Added Chlorine (ppm)	
		Treated Water of Old project	Treated Water of New project
Sunday	1/2/2015	1.2	2.5
Monday	2/2/2015	1.7	2.4
Tuesday	3/2/2015	2.5	2.7
Wednesday	4/2/2015	2.6	2.8
Thursday	5/2/2015	2.0	2.5
Sunday	8/2/2015	1.3	2.6
Monday	9/2/2015	1.9	2.3
Tuesday	10/2/2015	2.4	2.5
Wednesday	11/2/2015	2.8	2.6
Thursday	12/2/2015	3.1	2.0
Sunday	15/2/2015	2.2	4.2
Monday	16/2/2015	2.3	3.7
Tuesday	17/2/2015	2.1	2.7
Wednesday	18/2/2015	1.9	2.0
Thursday	19/2/2015	2.1	3.4
Sunday	22/2/2015	2.3	3.1
Monday	23/2/2015	1.6	2.4
Tuesday	24/2/2015	2.1	2.0
Wednesday	25/2/2015	2.3	2.2
Thursday	26/2/2015	1.9	2.0

Conclusions

The conclusions that can be drawn from these engineering and laboratory investigations can be summarized as follows:

1. The average of turbidity removal was relatively acceptable, so that to raise the efficiency of removal could be by reducing flow velocity , increasing the amount of alum added and construction flocculation basin.
2. Almost pH value of Euphrates river constant with a simple differences that resulting from the changes in the river conditions and the type of suspended solids in it , but it is less rate than the usual in the times of high level of turbidity but remain within the permissible limits.
3. Adequate engineering design is essential for successful operating plant. Simple design considerations for retention time, velocity, surface loading rate and dosage must be followed.
4. Continuous maintenance and analysis will lead to precise evaluation of plant performance and definition of any required modifications.
5. T.D.S. is not within allowable limits and that meanly due to a defect in the filtration basins because of high level of turbidity which resulting from inadequate work of sedimentation basins.
6. Rapid sand filters sand should be according to standards.
7. The water temperature varies with the air temperature without affecting the other water properties.
8. The amount of added chlorine relatively high but it is within the limits.

Recommendations

1. Provide a slow mixing basins to improve the work of the sedimentation tank.
2. Systematic maintenance of the different treatment units.
3. Put the closing valve in the distribution network to avoid shutting down the plant completely when there is some problem with the net.
4. Supply a gauge of the discharge measurement to know the amount of water drawn from the river ,to see how much the plant production and how much losses of the water inside the station.
5. Operating water treatment plant according to the scientific conventional method and operation manual in terms of dosing chemicals, de-slugging and backwashing process is highly recommended.
6. Continuing monitoring different units to get high water quality.

References

[1] Al-Obaidi, A.H.; 2005. Aluminum concentrations in Baghdad water supplies; Master thesis, University of Technology. Iraq.
[2] Al-Qaisi, R.J.K.; 2005. Residual chlorine concentrations in Baghdad water supplies. Master thesis, University of Technology. Iraq.
[3] American Water Works Association; AWWA Statement of Policy; 1989;" *Drinking Water Quality*"; J. AWWA;81:5:90.
[4] State Institute Of Vocational Education Director Of Intermediate Education Govt. Of Andhra Pradesh, *For The Course Of Water Supply And Sanitary Engineering*, 2005.
[5] APHA; AWWA; and WPCF; 1985;"Standard Method for the Examination of Water and Wastewater"; 16th; American Public Health Association; Washing; USA.
[6] Black, A.P.; and Willems, D.G.; 1961;"Electrophoretic studies of coagulation for removal of organic color"; J. AWWA; 53:589.
[7] Amirtharajah, A.; and Wetstein, D.P.; 1980;"Initial Degradation of Effluent Quality during Filtration"; J. AWWA; 72:9:518.
[8] Seventh International Water Technology Conference IWTC7 Egypt 1-3 April 2003 "Evaluation of a water treatment plant performance -case study" M. A. ElDib and Mahmoud A. Azeem Elbayoumy.
[9] Assessing The Performance Of Drinking Water Treatment Plant Using Turbidity As The Main Parameter (Case Study: Moi University-Kenya) C.B.A. Ogutu and F.A.O. Otieno.
[10] http://www.ezilon.com/maps/asia/iraq-maps.html