Monitoring supplied domestic water quality at Thu Dau Mot water supply enterprise

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ABSTRACT

The current status assessment research of water use and quality of supplied domestic water in Thu Dau Mot city, Binh Duong province, as well as the clean water use situation of the local people. Sampling and assessment of the quality of supplied water at Thu Dau Mot Water supply enterprise. The water treatment process here is strictly conducted to ensure stability, constant pressure, inlet and outlet water flow.

The analysis results of physical and chemical parameters of water quality at Thu Dau Mot Water supply enterprise show parameters within the allowable limits of water standards for domestic use QCVN 02: 2009/BYT and domestic water QCVN 01: 2009/BYT. However, during the water treatment process in the rainy season, it is time consuming and costly for the use of many chemicals in the treatment process, as high turbidity and high color temperature, low TDS, low pH, low chloride, high SS, Fe and Mn content changes in the wet season higher than in the dry season. After sampling for analysis and treatment, the output water meets the clean water standard to meet the needs of the people in Thu Dau Mot City and surrounding areas.

Keywords: water quality, physical and chemical parameters, water standards, clean water

1. Introduction

Water plays a very important role in maintaining life, as the most basic element in the developing process of human bodies, plants, animals and aquatic species, ... as well as industrial and agricultural activities. Based on the nature of water sources and arising sources, water can be divided into many types: surface water, groundwater, stormwater, mineral water, ... Water in nature often does not meet human requirements, so it needs to be treated before being used.

In recent years, Thu Dau Mot City has been under the pressure of a mechanical increase in the population, as the increase in industrial production, commerce and services, leading to increasing levels of serious environmental pollution, especially water source pollution. Therefore, the research and application of water treatment technologies contribute to the clean water supply for the people of the city and surrounding areas has been and has always been concerned by the authorities of Binh Duong Province.

2. Research Methods

2.1. Research subjects

Research by sampling raw water of Saigon River in Thu Dau Mot Water supply enterprise area based on TCVN 6663-6: 2008 (ISO 5667-6: 2005) and supplied water samples according to TCVN 5995: 1995 (ISO 5667-5: 1991). Sampling frequency is 5 times/day according to the time frames 7:30, 9:30, 11g, 14g and 16g.

Analysis of domestic parameters including sensory criteria (temperature, smell, taste and strange taste), basic parameters (pH, turbidity, color, TDS, residual chlorine), advanced index (chloride, acidity, alkalinity, total hardness, calcium hardness), nutritional criteria (nitrite, ammonium, phosphate, sulfate), metal index (Al, Cu, Fe, Nitrate, Manganese, Zn).

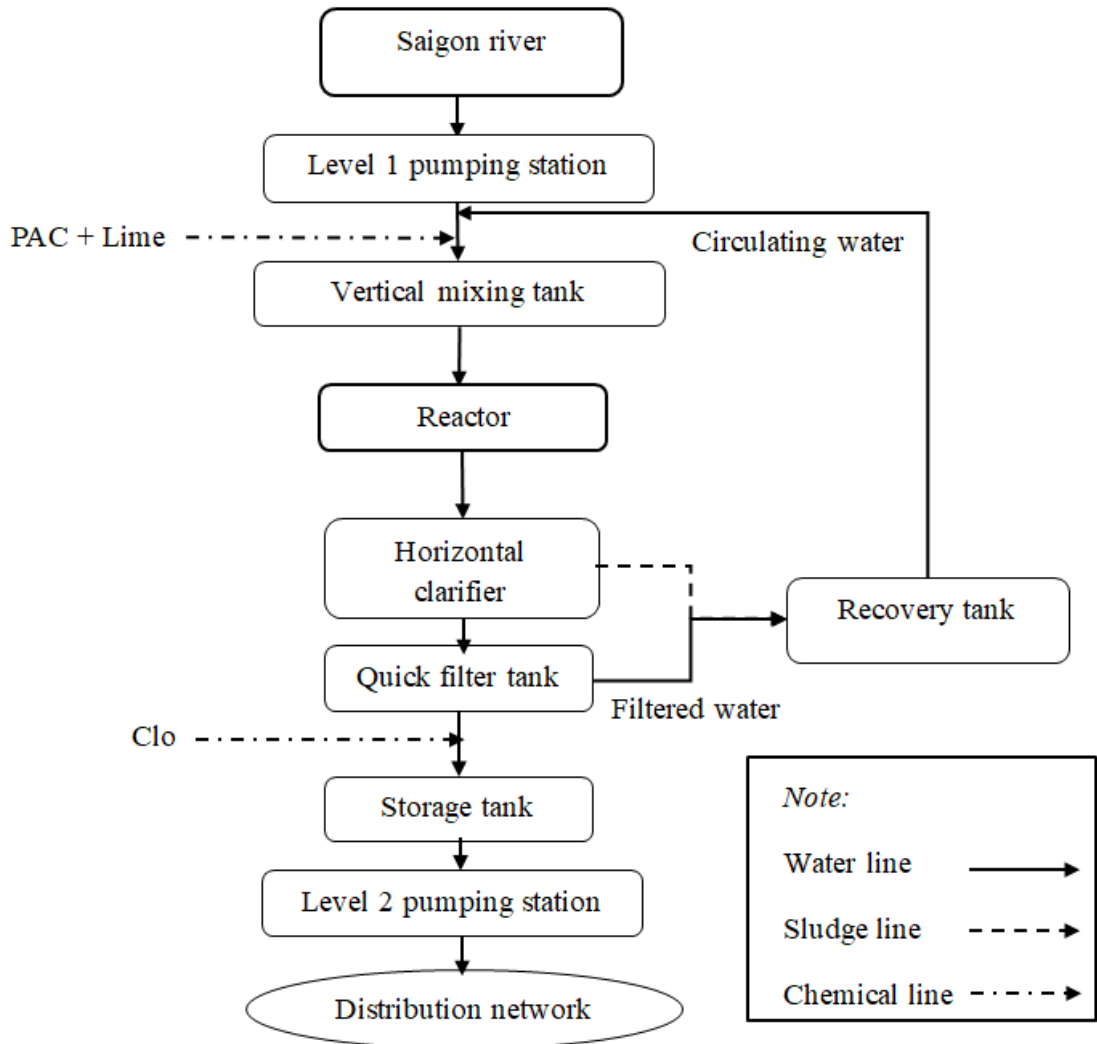### 2.2. Process of water treatment technology at the plant

Chart 3.1. *Chart of supplied water treatment technology for TDM water supply enterprise*

2.3. Testing facilities and equipment

2.3.1. Sampling raw water and water after being treated

TABLE 1. Methods of sampling raw water and water after being treated

Sampling locations	Sampling time	Sampling frequency	Method
Raw water tank	7g30 9g30 11g 14g 16g	5 times/day	A clean plastic or glass bottle must be labeled with all details such as: Name of water source, sampling time (hour, date/month/year), sampling location, full name and signature of sampling.
Water faucet holds after being treated	7g30 9g30 11g	5 times/day	

	14g		
	16g		

(Source: surveyor)

2.3.2. Sampling, analyzing water quality

2.3.2.1. Sensory criteria

Identifying temperature: Dip the electrode in the water sample to be measured. Turn on the thermometer and the temperature of the water sample to be measured appears on the monitor.

Identifying smell: How to determine water smell: Collect 100ml of water and put into a 250ml bottle, cover, shake the sample vigorously then open the lid and use your nose to determine water smell.

Identifying taste and strange taste: Put a little water to be tested in your mouth, little by little, do not swallow but keep in your mouth for 3 to 5 seconds to identify taste and strange taste.

2.3.2.2. Some basic criteria

Identifying pH: Use the standard solutions to check pH meter such as: Standard solution pH $_{standard}$ = 4, pH $_{standard}$ = 7. Wash the electrode with distilled water, dip it in the water sample to be measured. Turn on the device, pH of the water sample to be measured will appear on the screen of the meter.

Identifying turbidity: Rinse Cuvet thoroughly with distilled water, rinse with water to be measured. Put the water sample to be measured into the Cuvet. Use tissue to dry the outside, leaving no fingerprints or other marks to avoid errors. Put the Cuvet containing the sample in the Hach 2100N Turbidimeter (turbidity detector), press the Enter button and receive the result.

Identifying color: Put 1.5 ml of distilled water into a glass bottle then put in the Turbidimeter. Press zero to return the result. Then reject and add 1.5 ml of water sample, press ENTER to get the result.

Identifying Total Water Dissolved Solids (TDS): Turn on the Turbidimeter and dip the Turbidimeter in the water sample, then get the results.

Identifying total residual chlorine (Orthotolidine method): Add Orthotolidine to a water sample in the ratio 1/9 and shake well (0.5 ml of reagent in 9.5 ml of water sample). Put 1 ml of distilled water (blank) into a glass cup and put in Hach, press Zero to get zero results, then add 1ml of sample into the glass cup into the Turbidimeter, press Read to get the result.

2.3.2.3. Some advanced criteria

Identifying Acidity: Put 25 ml of water sample into an erlen flask (if the raw water has to filter out turbidity), add 2-3 drops of Phenolphthalein indicator. Then metricize 0.02N NaOH solution. The solution changes from colorless to light purple. Record V volume just metricized.

Identifying alkalinity: Take 25 ml of water sample, place 3 indicator drops of Bromcresol Green in flask, metricized phenoltalein alkaline, and titrate with 0.02N H_2SO_4 Acid. The solution changes from green to orange. Record the volume of Acid used in titration.

Identifying hardness:

(1) *Total hardness:* Put 25ml of sample in an erlen flask, and filter raw water. Then add 1 - 2 ml of Ammonium Slurry solution (1 ml for tank water and 2 ml for raw water) and add 1 tablespoon of EBT then shake well. Metricize with 0.01N EDTA solution. The color will change from acrid red to cyan. Record the metricized resulting volume of EDTA.

(2) *Calcium hardness:* Put 25ml of sample in an erlen flask, and filter raw water. Then add 3 to 5 drops of 12N KOH (3 drops for treated water, 5 drops for raw water) and add a little Murexide and shake well. Metricize with 0.01N EDTA solution. The color will turn from pink to lilac purple. Record the metricized resulting volume of EDTA.

Identifying chloride (Morh method): Put 25 ml of sample into an erlen flask, add 3 to 5 drops of NaOH + 3 drops of K_2CrO_4 (water turns light yellow), and metricize with 0.0141N $AgNO_3$ standard solution that turns into orange from pale yellow. For identifying clearly, take a blank sample for comparison.

2.3.2.4. Nutritional criteria

Identifying Phosphate (PO_4^{3-}): Take 50 ml of the sample and 50 ml of distilled water (blank) add 2 ethers. Then add 2 ml of Ammonium molybdate, shake well + 5 drops of $SnCl_2$ and shake well. Wait for 10 minutes to measure, press Read above to receive measurement results.

Identifying Ammonium in water ($NH4^+$) (direct Nesslerization method): Take 50 ml of the sample and 50 ml of distilled water (blank) add 2 ethers. Then add 2 ml of Nessler and 1 drop of EDTA and shake well. Wait for 10 minutes to measure, press Read above to receive measurement results.

Identifying Sulfate (SO_4^{2-}) (Measuring method of turbidity): If the sample is turbid, filter the quantitative filter paper that has been wet with water, and reject the first 20 ml of filtrate. Take 25 ml of the sample and 25 ml of distilled water (blank) add 2 ethers. Then add 1 ml of $MgCl_2$ and a little of $BaCl_2$ and shake until it is dissolved. Wait for 4 minutes to measure, press Read above to receive the measurement result.

IdentifyingNitrite (NO₂⁻) (Naphthylamine method): If the sample has high turbidity, it must be filtered by a centrifuge. Add 1 ml of EDTA solution + 1 ml of Sulfanilic Acid to 50 ml of distilled water sample (blank sample) and 50 ml of pure filtered sample, then shake, let stand for 3 minutes. Add 1ml of Naphthylamine + 1ml of Sodium Acetate filler to 2 samples, wait for 10 minutes to measure, press Read above to receive the measurement results.

Identifying nitrate content (NO₃⁻) (Method 8039): If the sample is turbid, it should be filtered by a centrifuge. Lower pH = 6 - 9 by NaOH. Add 10 ml of water sample to ethylene as blank and add 10 ml of water sample to another ethylene then add 1 pack of 5 Nitrate Nitratever, shake vigorously (still residue becomes suspended), the amber color will appear and wait for 5 minutes.

2.3.2.5. Metal criteria. If the sample is turbid, it should be filtered by a centrifuge.

Identifying aluminum content (Al): Lower pH to about 3.5 - 4.5 by adding NaOH. Add 1 pack of Ascorbic Acid to 50 ml of water sample + 1 pack of AluVer 3 reagent, shake unitl it is dissolved. Put 10 ml of the chemically added sample to another ethylene and add 1 pack of Bleaching 3 to shake (as blank). Wait for 10-15 minutes measurement.

Identifying Iron (Fe) content (Method 8008): Lower pH to about 3-5 by adding NaOH. Divide 20 ml of the sample into 2 equal flasks into 10 ml as the blank and 10 ml as the real sample to take the test. The erlen flask contains 10 ml of water as the blank without adding chemicals. Put 1 pack of FerroVer Iron reagent in an erlen flask containing 10 ml of the real sample, shake and wait for 3 minutes.

Identifying Manganese (Mn) content: Lower pH of 10 ml of the filtered real sample to 4-5 with NaOH. Add 10 ml of distilled water into an erlen flask (as blank) and 10 ml of water in another erlen flask as real sample. Add 1 pack of Ascorbic Acid to each flask, mix + 12 drops of Alkaline Cyanide reagent, gently invert + 12 drops of PAN 0.1% indicator, gently invert to avoid foaming. Orange color will appear if Manganese is present in the sample. Wait for 2 minutes to measure.

Identifying (Cu) content: Put 20 ml of the water sample into an erlen flask and Lower pH to about 4-5 by adding NaOH. Divide 20 ml of the sample into 2 equal erlen flasks into 10 ml as the blank and 10 ml as the real sample to take the test. The erlen flask contains 10 ml of water as the blank without adding chemicals. Put 1 pack of CuVer 1 Copper reagent into an erlen flask containing 10 ml of the real sample, shake and allow to wait for 2 minutes. Press Hach Programs on the meter.

Identifying Zinc content (Zn): Put 20 ml of the water sample into an erlen flask and Lower pH to about 4-5 by adding NaOH. Then add 1 sachet of Zincover[R] 5 to the flask, shake vigorously until it is dissolved, then put 10 ml into another erlen flask and drip

0.5 ml of Cycohexanone to wait for 2 minutes. The erlen flask contains the remaining 10 ml of the sample as blank. Press Hach Programs on the meter.

2.3.3. Jartest test

2.3.3.1. Test 1: Determine optimal pH

Steps to take the test:

Step 1: Add 1 liter of raw water to each cup, then place the Jartest's paddle.

Step 2: Put the same PAC in the cup, depending on the turbidity of the water.

Step 3: Add to each cup a different amount of lime so that pH reaction reaches the predetermined pH value.

Step 4: Lower paddle, start the device and mix quickly for 1 minute at 120 rpm.

Step 5: After 1 minute, Lower stirring speed to 60 rpm for 15 minutes. This is the reaction process.

Step 6: During the stirring reaction, observe the cotton residue, compare the size of the cotton residue formed, the cotton residue forming speed, the ability to flocculate in water.

Step 7: After 15 minutes, turn off the device and pull up the paddle and measure pH reaction.

Step 8: Wait for 10 minutes, observing the settling speed of each cup.

Step 9: Measure the turbidity and color temperature of each cup with the meter. Choose a cup with the lowest turbidity and coloration and a suitable pH range.

2.3.3.2. Test 2: Identifying the optimal PAC

Steps to take the test:

Step 1: Add 1 liter of raw water into each cup, then place it in Jartest's paddle.

Step 2: Add a different amount of PAC into each cup and increase gradually.

Step 3: Add lime evenly with the appropriate dosage to achieve the optimum pH value.

Step 4: Lower the paddle down, start the device and mix quickly for 1 minute at 120 rpm.

Step 5: After 1 minute, Lower stirring speed to 60 rpm for 15 minutes. This is the reaction process.

Step 6: During the stirring reaction, observe the cotton residue, compare the size of the cotton residue formed, the cotton residue forming speed, the ability to flocculate in water.

Step 7: After 15 minutes, turn off the paddlewheel and measure pH reaction.

Step 8: Wait for 10 minutes, observing the settling speed of each cup.

Step 9: Measure the turbidity and color temperature of each cup with the meter. Choose the cup with the lowest turbidity and coloration.

3. Discussion results.

The raw water used for the test is taken from Saigon River, the section flows through Thu Dau Mot city near Thu Dau Mot water treatment plant.

3.1. Raw water test results analyzed by TDM water supply plant

− Sample name: Water sample from Saigon River - Level 1 Thu Dau Mot pump station

− Sampling date: May 09th, 2020

− Sampling location: Level 1 pumping station - Thu Dau Mot Water supply enterprise

− Address: My Hao Hamlet, Chanh My Ward, Thu Dau Mot City, Binh Duong Province

− Analysis date: May 09th, 2020

− Sample status: Sample is taken at the time of high tide, containing an average of 2 liters, turbidity, yellow color, with sediment.

TABLE 2. Test result table of raw water analyzed by TDM water supply enterprise

No.	CRITERIA	UNIT	TEST METHOD	QCVN 08-MT:2015/BTNMT (column A2)	RESULT
1	pH*	-	TCVN 6492:2011	$6,0 – 8,5$	6,62
2	Dissolved oxygen content (DO)	mg/L	TCVN 7325:2004	≥ 5	2,98
3	Chemical oxygen content (COD)	mg/L	SMEWW 5220-C:2017	≤ 15	16
4	Biochemical oxygen content (BOD_5)	mg/L	TCVN 6001 – 2:2008	≤ 6	0,31
5	Ammonium content (NH_4^+)*	mg/L	HACH Method 8038	$\leq 0,3$	0,3
6	Nitrite content (NO_2^-)*	mg/L	TCVN 6178 – 1996	$\leq 0,05$	0,04
7	Nitrate content (NO_3^-)	mg/L	SMEWW 4500-B:2017	≤ 5	0,12
8	Phosphat content (PO_4^{3-})	mg/L	SMEWW 4500-D:2017	$\leq 0,2$	0,05
9	Total iron content (Fe_{tc})*	mg/L	HACH Method 8008	≤ 1	0,19
10	Clorua content (Cl^-)*	mg/L	SMEWW 4500-B:2017	≤ 350	19
11	Copper content (Cu)	mg/L	HACH Method 8506 + 8026	$\leq 0,2$	0,01
12	Zinc content (Zn)	mg/L	HACH Method 8009	$\leq 1,0$	0,02
13	Suspended solids (SS)	mg/L	HACH Method 8006	≤ 30	105

14	Manganese content (Mn)*	mg/L	HACH Method 8149	$\leq 0,2$	0,12
15	Sunphate content (SO_4^{2-})	mg/L	SMEWW 4500-E:2017	KQĐ	47,4
16	Aluminum content (Al)*	mg/L	HACH Method 8012	KQĐ	0,04
17	Total hardness	mg/L $CaCO_3$	SMEWW 2340-C:2017	KQĐ	110
18	Total dissolved solids (TDS)	mg/L	Sensor probes	KQĐ	102
19	Turbidity*	NTU	TCVN 6184:2008	KQĐ	80,6
20	Color temperature	Pt-Co	TCVN 6185:2008	KQĐ	474
21	Florua content (F)*	mg/L	HACH Method 8029	$\leq 1,5$	KPH
22	Xianua content	mg/L	HACH Method 8027	$\leq 0,05$	0,008
23	Cr^{6+}	mg/L	HACH Method 8023	$\leq 0,02$	0,009
24	Niken content	mg/L	HACH Method 8150	$\leq 0,1$	0,009
25	Total oil, grease	mg/L	ASTM D7066 - 04	$\leq 0,5$	KPH
26	Total Coliform	MPN/100 ml	TCVN 6187-2:1996	≤ 5000	300
27	E. coli	MPN/100 ml	TCVN 6187-2:1996	≤ 50	240

(Source: TDM water supply enterprise -2020)

* Comment: Water samples with DO, COD, SS, E. coli parameters are not conforming QCVN 08-MT: 2015/BTNMT (Column A2)

* Note:

+ QCVN 08-MT: 2015/BTNMT: National technical regulation on surface water quality.

+ KPH: Not detected; KQD: Not specified

+ Analysis results are only valid on the test sample at the time of testing

+ Sample storage time of 3 days from the date of giving the results

+ (*): Criteria recognized by VILAS

3. 2. Raw water test results analyzed by the author.

− Sample name: Water sample from Saigon River - Thu Dau Mot level 1 pump station

− Sampling date: November 29th, 2020

− Analysis date: November 29th, 2020

− Sampling location: Level 1 pumping station - Thu Dau Mot Water supply enterprise

− Address: My Hao Hamlet, Chanh My Ward, Thu Dau Mot City, Binh Duong Province.

Sample status: Sample is taken at the time of low tide, containing an average of 2 liters, turbidity, yellow color, with sediment.

Table 2. Test result table of raw water analyzed by author

No.	CRITERIA	UNIT	TEST METHOD	QCVN 08-MT:2015/BT NMT (column A2)	RESULT
1	pH*	-	TCVN 6492:2011	$6,0 - 8,5$	6,96
2	Dissolved oxygen content (DO)	mg/L	TCVN 7325:2004	≥ 5	2,11
3	Chemical oxygen content (COD)	mg/L	SMEWW 5220-C:2017	≤ 15	24
4	Biochemical oxygen content (BOD_5)	mg/L	TCVN 6001 – 2:2008	≤ 6	0,71
5	Ammonium content (NH_4^+)*	mg/L	HACH Method 8038	$\leq 0,3$	1,2
6	Nitrite content (NO_{2-})*	mg/L	TCVN 6178 – 1996	$\leq 0,05$	0,02
7	Nitrate content (NO_3^-)	mg/L	SMEWW 4500-B:2017	≤ 5	0,55
8	Phosphat content (PO_4^{3-})	mg/L	SMEWW 4500-D:2017	$\leq 0,2$	0,04
9	Total iron content (Fe_{tc})*	mg/L	HACH Method 8008	≤ 1	0,39
10	Clorua content (Cl^-)*	mg/L	SMEWW 4500-B:2017	≤ 350	227
11	Copper content (Cu)	mg/L	HACH Method 8506 + 8026	$\leq 0,2$	0,03
12	Zinc content (Zn)	mg/L	HACH Method 8009	$\leq 1,0$	0,02
13	Suspended solids (SS)	mg/L	HACH Method 8006	≤ 30	93
14	Manganese content (Mn)*	mg/L	HACH Method 8149	$\leq 0,2$	0,15
15	Sunphate content (SO_4^{2-})	mg/L	SMEWW 4500-E:2017	KQĐ	41,28
16	Aluminum content (Al)*	mg/L	HACH Method 8012	KQĐ	0,06
17	Total hardness	mg/L $CaCO_3$	SMEWW 2340-C:2017	KQĐ	25,3
18	Total dissolved solids (TDS)	mg/L	Sensor probes	KQĐ	505
19	Turbidity*	NTU	TCVN 6184:2008	KQĐ	80,3
20	Color temperature	Pt-Co	TCVN 6185:2008	KQĐ	374

21	Florua content (F)*	mg/L	HACH Method 8029	$\leq 1,5$	KPH
22	Xianua content	mg/L	HACH Method 8027	$\leq 0,05$	0,004
23	Cr^{6+}	mg/L	HACH Method 8023	$\leq 0,02$	0,004
24	Niken content	mg/L	HACH Method 8150	$\leq 0,1$	0,005
25	Total oil, grease	mg/L	ASTM D7066 - 04	$\leq 0,5$	KPH
26	Total Coliform	MPN/100ml	TCVN 6187-2:1996	≤ 5000	1.400
27	E. coli	MPN/100ml	TCVN 6187-2:1996	≤ 50	1.1000

(Source: author anlysis-2020)

* Comment: Water samples with DO, COD, NH_4^+, -N, SS, *E. coli* parameters are not conforming QCVN 08-MT: 2015/BTNMT (Column A2)

* Note:

+ QCVN 08-MT: 2015/BTNMT: National technical regulation on surface water quality.

+ KPH: Not detected. KQD: Not specified

Analysis results are only valid on the test sample at the time of testing

+ Sample storage time 3 days from the date of giving the results

+ (*): Criteria recognized by VILAS

3.3. Test result of treated water analyzed by TDM plant.

− Sample name: Treated water - Thu Dau Mot tank

− Address: My Hao Hamlet, Chanh My Ward, Thu Dau Mot City, Binh Duong Province.

− Sampling date: May 09th, 2020

− Analysis date: May 09th, 2020

− Sample status: Sample is collected in 2 1-liter bottles. The water sample is clear, colorless, no strange smell.

Table 3. Test result table of treated water analyzed by TDM water supply enterprise

No.	ANALYSIS CRITERIA	UNIT	TEST METHOD	QCVN 01:2009/BYT	TEST RESULT
1	pH*	-	TCVN 6492:2011	6,5 - 8,5	7,14
2	Flavor	-	Sensory	Tasteless, scentless	Tasteless, scentless
3	Total Dissolved Solids (TDS)	mg/L	Sensor probes	≤ 1000	313
4	Turbidity*	NTU	TCVN 6184:2008	≤ 2	0,28

65

5	Color	Pt-Co	TCVN 6185:2008	≤ 15	2
6	Total Hardness	mg/L $CaCO_3$	SMEWW 2340-C:2017	≤ 300	84
7	Chloride Content (Cl^-)*	mg/L	SMEWW 4500-B:2017	≤ 250	141,8
8	Residual Chlorine	mg/L	SMEWW 4500-00Cl:2017	0,3 – 0,5	0,5
9	Ammonium content (NH_4^+)*	mg/L	HACH Method 8038	≤ 3	0,06
10	Nitrite content (NO_2^-)*	mg/L	TCVN 6178-1996	≤ 3	KPH (LOD: 0,03 mg/L)
11	Nitrate content (NO_3^-)	mg/L	SMEWW 4500-B:2017	≤ 50	0,21
12	Sunphate content (SO_4^{2-})	mg/L	SMEWW 4500-E:2017	≤ 250	38,28
13	Total iron content (Fe_{tc})*	mg/L	HACH Method 8008	≤ 0,3	0,02
14	Aluminum content (Al)*	mg/L	HACH Method 8012	≤ 0,2	0,04
15	Copper content (Cu)	mg/L	HACH Method 8506 + 8026	≤ 1	0,01
16	Zinc content (Zn)	mg/L	HACH Method 8009	≤ 3	0,01
17	Manganese content (Mn)*	mg/L	HACH Method 8149	≤ 0,3	0,02
18	Pecmanganate index*	mgO_2/L	TCVN 6186:1996	≤ 2	0,77
19	Phosphate content (PO_4^{3-})	mg/L	SMEWW 4500-D:2017	KQĐ	0,01
20	*Total Coliform*	CFU/100mL	TCVN 6187-1:2019	0	0
21	*E. Coli*	CFU/100mL	TCVN 6187-1:2019	0	0

(Source: TDM water supply enterprise -2020)

* Comment: Water samples have suitable analytical parameters QCVN 01: 2009/BYT

* Note:

+ QCVN 01: 2009/BYT: National technical regulation on domestic water quality

Analysis results are only valid on the test sample at the time of testing

+ KPH: Not detected

+ KQD: Not specified

+ Sample storage time 3 days from the date of giving the results

+ (*): Criteria recognized by VILAS

3.4. Test results of water after being treated are analyzed by the author.

− Sample name: Treated water - Thu Dau Mot tank

− Address: My Hao Hamlet, Chanh My Ward, Thu Dau Mot City, Binh Duong Province

− Sampling date: November 29th, 2020

− Analysis date: November 29th, 2020

Sample status: Sample is collected in 2 1-liter bottles. The water sample is clear, colorless, no strange smell.

TABLE 4. Test result table of treated water analyzed by the author

No.	ANALYSIS CRITERIA	UNIT	TEST METHOD	QCVN 01:2009/BYT	TEST RESULT
1	pH*	-	TCVN 6492:2011	6,5 - 8,5	7,21
2	Flavor	-	Sensory	Tasteless, scentless	Tasteless, scentless
3	Total Dissolved Solids (TDS)	mg/L	Sensor probes	≤ 1000	120
4	Turbidity*	NTU	TCVN 6184:2008	≤ 2	0,28
5	Color	Pt-Co	TCVN 6185:2008	≤ 15	2
6	Total Hardness	mg/L $CaCO_3$	SMEWW 2340-C:2017	≤ 300	53,5
7	Chloride Content (Cl^-)*	mg/L	SMEWW 4500-B:2017	≤ 250	25
8	Residual Chlorine	mg/L	SMEWW 4500-00Cl:2017	0,3 – 0,5	0,42
9	Ammonium content (NH_4^+)*	mg/L	HACH Method 8038	≤ 3	0,17
10	Nitrite content (NO_2^-)*	mg/L	TCVN 6178-1996	≤ 3	KPH (LOD: 0,03 mg/L)
11	Nitrate content (NO_3^-)	mg/L	SMEWW 4500-B:2017	≤ 50	4,18
12	Sunphate content (SO_4^{2-})	mg/L	SMEWW 4500-E:2017	≤ 250	30,15
13	Total iron content (Fe_{tc})*	mg/L	HACH Method 8008	≤ 0,3	0,02
14	Aluminum content (Al)*	mg/L	HACH Method 8012	≤ 0,2	0,07
15	Copper content (Cu)	mg/L	HACH Method 8506 + 8026	≤ 1	0,01
16	Zinc content (Zn)	mg/L	HACH Method 8009	≤ 3	0,03
17	Manganese content (Mn)*	mg/L	HACH Method 8149	≤ 0,3	0,03
18	Pecmanganate index*	mgO_2/L	TCVN 6186:1996	≤ 2	0,64

19	Phosphate content (PO_4^{3-})	mg/L	SMEWW 4500-D:2017	KQĐ	0,01
20	*Total Coliform*	CFU/100mL	TCVN 6187-1:2019	0	0
21	*E. Coli*	CFU/100mL	TCVN 6187-1:2019	0	0

(Source: author anlysis-2020)

* Comment: Water samples have suitable analytical parameters QCVN 01: 2009/BYT

* Note:

+ QCVN 01: 2009/BYT: National technical regulation on domestic water quality

+ Analysis results are only valid on the test sample at the time of testing

+ KPH: Not detected; KQD: Not specified

+ Sample storage time 3 days from the date of giving the results
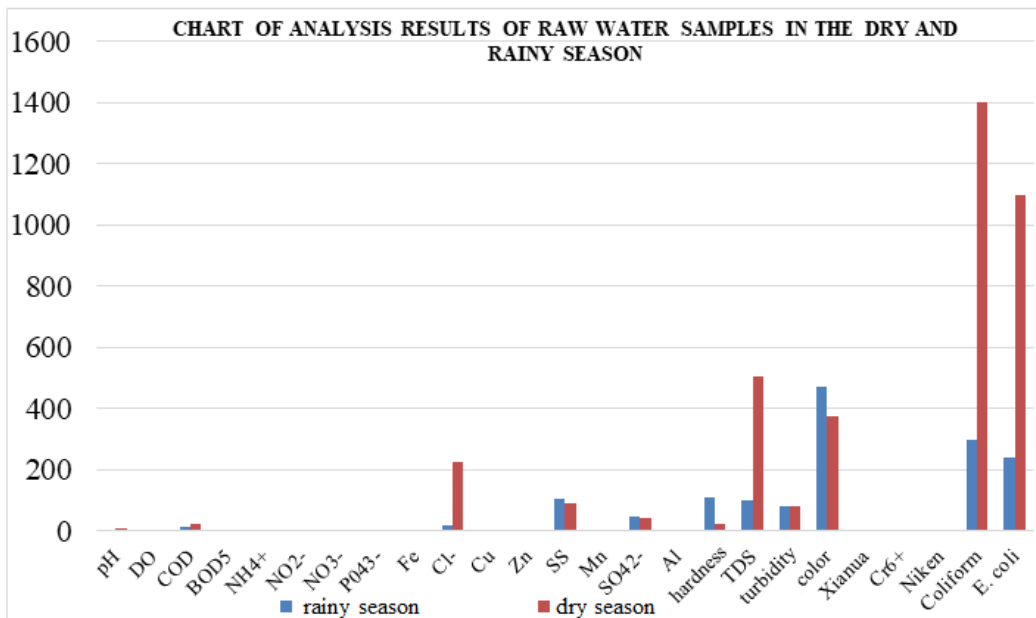
+ (*): Criteria recognized by VILAS

Figure 1. *Chart of raw water sample analysis results in the dry and rainy season*

* Comment: The chart shows that raw water samples treated in the rainy season will take more time and consume more chemical as high water turbidity, low TDS, low pH, high color, low chloride content, low SS (depending on high or low tide) in the rainy season,… compared to water sample treatment in the dry season.

4. Conclusion

Thu Dau Mot plant is treating water according to QCVN 01: 2009/BYT on output water quality. Currently, the water treatment plant has applied lamen plates in clarifiers to

increase sedimentation ability to achieve high efficiency. The tested water quality shows that it is within the allowable limits of QCVN 01: 2009/BYT National technical regulation on domestic water quantity.

Currently, the plant has developed the instructions for safe operating procedures and troubleshooting instructions when it is necessary. There is always a timely response plan to ensure the quality of the outlet water meets the standards of the Ministry of Health.

The plant regularly takes samples and checks the parameters in the samples in order to detect and notify the technical department of problems arising in the input water treatment process to promptly take the good resolution.

The operating process is carried out by engineers specialized in environment, electricity and automation with high expertise and enthusiasm in water treatment to provide domestic water to the people in the area.

The water treatment works are designed and built reasonably in the plant campus, ensuring efficient water treatment as well as the general landscape.

References

Nguyen Ngoc Dung (2009). Water treatment. Construction Publishing House.

Phan anh Duc, Nguyen Thi Mai Linh (2015). Environmental quality monitoring. Construction Publishing House.

Le Quoc Hung (2006). Methods and equipment for water environment monitoring. Publisher of Vietnam Academy of Science and Technology.

Bui Phuong Linh, Le Hoang Nghiem (2019). Methods of analyzing parameters of environmental monitoring. Ho Chi Minh City National University Publisher.

Nguyen Van Phuoc, Nguyen Thi Van Ha (2006). Environmental quality management. Construction Publishing House.

Nguyen Thi Thu Thuy (2000). Water treatment for domestic and industrial purposes. Science and Technology Publishing House.