Optimizing PDAM In Drinking Water Management Medan City

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Abstrak. Water resources are one of the important natural resources because it is the main thing for the consumption and sanitation of human, water as transportation facilities in the world, recreation facilities, and irrigation water needs. On the other, excess water resources - floods - can result in heavy damage and loss of human life. Water as a hydrosphere environment in the global scale, unevenly over the earth so its abundance somewhere varies with time and hydrological cycles. Finally, in the use of water resources, humans pollute much of the available water and degrade it. That it is no longer suitable for all types of utilization. In obtaining clean water that is feasible and safe for consumption (especially for drinking), there needs to be a processing from raw water to water drink. Water treatment can be started by using a simple system and can also with a complex processing, according to the level of necessary needs depending on the quality of raw water to be processed. The lower the water quality, the higher the required level of processing. Medan one of Metropolitan city in Indonesia. Medan city includes three big cities in Indonesia after Jakarta and Surabaya. This is very influential in acceleration of the development Medan and the province of North Sumatra in general. PDAM Tirtanadi which is one of the regional companies owned by North Sumatra. It is engaged in the provision of clean water and operated efficiently with the support of adequate technology for serves the needs of clean water in Medan city and surrounding areas.
keyword : PDAM, drinking water, drinking water treatment

1. Introduction

1.1 Standart Water Quality

Decree of the Minister of Health (Kepmenkes) RI No. 907 / Menkes / SK / VII / 2002 Concerning Terms and Supervisors of Drinking Water Quality states that drinking water is water that through the processing or without processing that meet health requirements and can be directly drunk. The types of drinking water include:

1. Water distributed through pipes for household purposes.
2. Water is distributed through a water tank.
3. Bottled water.
4. Water used for the production of food and beverages presented to the public.

The four types of drinking water must meet drinking water quality requirements that include physical, chemical, bacteriological and radioactive requirements.

2. Terms of Provision of Clean Water / Drinking Water

2.1 Quantitative Requirements

Quantitative terms mean the source of raw water used must be able to meet the large needs of clean water / drink service area and can be used without difficulty to get it.

2.2 Qualitative Requirements Physical Parameters

Physical parameters are characteristics of water that can be known with the senses of sight, smell and taste. Some physical parameters that affect the quality of clean water / drink are:

1. Suspended Solid. Suspended solid in water consists of organic particles or inorganic particles.
2. Temperature. The temperature of the water will affect the chemical reaction in water management, especially the very high temperature.
3. Color. The colored water is produced from the contact between water and organic ruins such as leaves.
4. Smell and taste. Flavors and odors are caused by decaying organic matter or volatile chemicals

Turbidity. The ingredients that cause this turbidity include: clay, mud, well-dispersed organic materials and other suspended small particles.

2.3 Chemical Parameters

Some chemical parameters that affect the quality of clean water / drinking are as follows:

1. pH value. PH is a term used to express the intensity of the acid or base state of a solution.
2. Alkalinity. The alkalinity of water is a measure of the capacity to neutralize the acids. (Alaerts, 1984)
3. Hardness. Hardness in water mostly comes from water contact with soil and rock formation. (Alaerts, 1984)
4. Calcium. Calcium is the second major element after the bicarbonate is present on the surface of the water. (Montgomery, 1985)
5. Magnesium. Magnesium is an essential mineral for humans with an acceptance rate of 3.6-4.2 mg / kg / day. (Montgomery, 1985)
6. Bicarbonate. The bicarbonate concentration is less than 10 mg / L in rainwater and less than 200 mg / L in surface water. (Montgomery, 1985)
7. Iron. Iron gives the color red and yellow. (Montgomery, 1985).
8. Manganese. The presence of Mn in water will cause odor and taste in water. At concentrations of 0.2-0.4 mg / L make the water taste and can accelerate the growth of microorganisms in the reservoir and distribution system. (Montgomery, 1985).
9. Chloride. Chloride can cause corrosive on steel and aluminum at concentrations of 50 mg / L. (Montgomery, 1985).
10. Nitrates. If high concentrations of nitrate can stimulate unlimited algae growth. (Alaerts, 1984)
11. Nitrite. Nitrite can be formed by the oxidation of ammonia (NH3) by bacteria Nitrosomonas under aerobic conditions (Alaerts, 1984).
12. Total Dissolved Solid (TDS). It is a measure of the total ions in the solution. Water containing more than 500 mg / l will cause saltiness. (AWWA, 1998)
13. Electric Conductivity (DHL). Is a parameter associated with TDS. DHL is a measure (in micromhos / cm) ionic activity of a solution. Generally, if TDS and DHL increase then water corrosivity also increases. (Montgomery, 1985).
14. Organic compounds. Organic compounds present in water come from the natural decomposition of plant and animal matter, from industry, housing or agriculture. (Montgomery, 1985).
15. Phospat. The main source of the use of anoraganic phosphate is from the use of detergents, household cleaning tools and agricultural fertilizers. (Alerts, 1984).

2.4 Biological Parameters

a. Bacteria. Bacteria are single-celled microorganisms measuring 0.1 - 10 μm (Montgomery, 1985).
b. Viruses. Viruses are parasitic that can be found in plants, plants, bacteria, fungi and algae (Montgomery, 1985).
c. Protozoa. Generally protozoa are pathogenic and potentially contaminate water (Montgomery, 1985 p. 44).
d. Parasitic Worms. Parasitic worms may contaminate water through human or human feces containing parasitic worms or through snails or insects as their host.

2.5 Terms Continuity

Terms of continuity means the source of clean water / drink must be able to provide sufficient water debit or fluctuation of a relatively flow continuously, both in the rainy season and during the dry season. This is related to the fulfillment of the needs service areas whose numbers are heavily dependent on the level of technological and socio-economic progress of the local community for domestic and non-domestic needs.

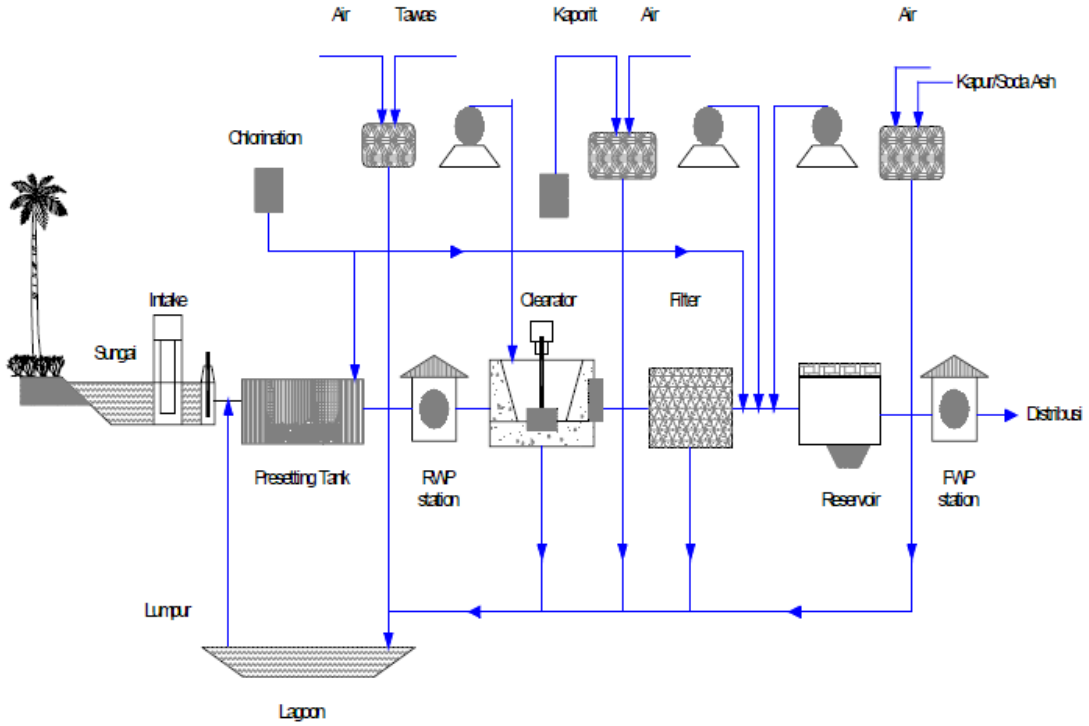
2.6 Water Treatment Unit

Water treatment is defined as a technical operation carried out on raw water to be clean water that meets quality requirements as clean water / drinking water by combining several processing processes. Water treatment to reduce the concentration of each pollutant in water so it is safe to use. Reynolds (1982) the operating units and process units used in water treatment are as follows:

a. Physical processing includes sedimentation, flotation and filtration.
b. Chemical treatment includes coagulation, flocculation, adsorption, ion exchange and chlorination.
c. Biological treatment includes aerobic digestion and anaerobic sigestion

3. Water Treatment PDAM Tirtanadi

The raw water comes from Belawan River's drowned. Water dam to the intake channel and into the Prasettling tank then affixed chlor. IPA Sunggal called Prasettling tank is with Raw Water Tank (RWT). Water From Raw water tanks flows gravitatively to a reservoir pool located on the sump of Raw Water Pump (RWP), before being pumped towards the clearator. Giving alum as a coagulant is injected into the water pipe to the clearator. In the clearator occurs flocculation and sedimentation process. Water from the clearator is streamed to filter the fine flocs and other solids through the filter. Placing chlor and lime soda flow in gravity to the reservoir. The process of drinking water can be seen in the following figure:



Existing operational activities use a combination of PLC (Programmable Logic Controller) as a unit performance controller and SCADA (Supervisory Control And Data Acquisition) as monitoring of process and performance of equipment by intensifying power consumption. All units in IPA Sunggal are equipped with control and monitoring system to make the operational process more effective. In this case the use of the automation system would free the operator from responsibility for performing repetitive routine tasks in a timely manner, while maximum efficiency and operational flexibility still exist by manually operating on other parts of the operation. The operator is responsible for monitoring the processing performance and flow settings through the installation units of the control center but for other operations manually, the control is carried out locally where the process can be observed directly.

3.1 Raw Water Quality

Sunggal Medan Water Treatment Plant utilizes Belawan River as a source of raw water. Belawan River includes surface water with turbidity that is temporary. Temporary turbidity levels are water that

generally flows over a covered surface of vegetation that is quite dense and steep so that when it rains, the water will become turbid due to spikes in sediment levels due to erosion. Compared with Government Regulation No.82 of 2001 on the criterion of water quality standard in class II, the quality of Belawan River is not suitable for the drinking water standard and still processing is needed. This is seen in the parameters of Iron, Manganese and Fecal Coliform. Iron (Fe) and manganese (Mn) can be eliminated through oxidation, gas transfer (aeration), chemical precipitation, and ion exchange. The process of iron oxidation (Fe) and manganese (Mn) can be done by using chlorine, chloroxyoxide, potassium permanganate (KmnO4) and ozone. Of the four options, the oxidation process should use potassium permanganate (KmnO4) as its oxidant. According to AWWA excess iron and manganese can be set aside by using filtration with various media. Sunggal IPA uses filtration with Rapid Sand Filter with quartz media and and gravel that has a wide range of diameters. Rapid sand filter process on Sunggal IPA can set aside Iron and Manganese. The high fecal coliform in Belawan River is caused by the amount of domestic wastewater of the community that empties into the Belawan River. This bacterium has aerobic properties, is a gram negative bacteria, does not form spores, has an oval shape and can hold fermentation with lactose within 48 hours at 35oC. The removal of fecal coliform can be done through the disinfection process by using chlorine, chlorindioxide, ozone, and UV rays. Montgomery, 1985 mentions that fecal coliform is one type of bacteria. If bacterial quality, including fecal coliform, exceeds the quality standard, it can be reduced by disinfecting. Disinfecting can reduce fecal coliform by 99%. Sunggal IPA in overcoming high quality fecal coliform with disinfectant. Disinfectants are made by adding chlorine to Raw Water Tank or Intermediate Chlorination and post chlorine before water to reservoir. Intermediate and post chlorination provision can set aside fecal coliform that exceeds the quality standard.

3.2 Quantity and Continuity of Raw Water

In quantity and continuity, the discharge provided by Belawan River of 2000 L / s has been able to meet the needs of Sunggal Water Treatment Plant (IPA) in clean water treatment throughout the year.

3.3 *Process Processing Installation Water Treatment*

Sunggal Water Treatment Plant is one of five IPA owned by PDAM Medan City, with water purification process consisting of intake, pre sedimentation, coagulation, combination of flocculation-clearinent, filtration, chlorination, lime, reservoir and lagoon. From Belawan River water characteristic, after complete processing it was able to produce water quality according to the Minister of Health Decree No. 907 / Menkes / SK / VII / 2002 on the Terms and Supervision of Drinking Water Quality.

4. Conclusion

a. Sunggal Water Treatment Plant (IPA) applies processing unit consisting of intake, pre sedimentation, coagulation, flocculation, sedimentation, filtration, disinfection, neutralization, reservoir and lagoon.
b. The quality of raw water of Sunggal Water Treatment Plant (IPA) has not fulfilled some standard parameters of drinking water supply based on PP. 82 of 2001 on water quality standard criteria in class II and still needed processing.
c. Drinking Water Treatment PDAM Tirtanadi using process from intake, pre sedimentation, coagulation, combination of flocculation-sedimentation (clearator), filtration, chlorinasi, lime, reservoir and lagoon.
d. The quality of drinking water of Water Treatment Plant (IPA) sunggal meets the standard of Kepmenkes No 907 / MENKES / SK / VII / 2002 regarding drinking water quality. 5. The quantity of raw water discharge that is tapped at 2000 l / s still satisfy the needs of the distribution debit.

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