

The Water Quality in PDAM Intake in South Kalimantan Province

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Submission date: 26-Apr-2023 08:51PM (UTC+0700)

Submission ID: 2076120535

File name: 2019_Fitriati_IOP_Conf._Ser._Earth_Environ._Sci._366_012028.pdf (633.03K)

Word count: 3119

Character count: 13525

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To cite this article: U Fitriati *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **366** 012028

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The Water Quality in PDAM Intake in South Kalimantan Province

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Abstract. The implementation of water resource management faces some variety of complex problems in line with the increasing number of populations, accompanied by rapid social and economic growth. On the other hand, population growth makes the increasing need of water for various purposes and on the other hand it also creates exploitation of water resource. Water need is increasing along with the population growth as well as the increasing people's living standard and economic growth. The high population growth rate will also be followed by urban water need hence a study of urban water quality is needed in the regency / city in South Kalimantan Province. The water turbidity in PDAM intake in rainy season is higher than in dry season. Water quality during dry season and rainy season can make good result after the water treatment in PDAM, compared to water sample from the intake tested mainly on turbidity and salinity component.

Keywords : water quality, PDAM intake, South Kalimantan Province

1. Introduction

Water resource holds an important role in supporting the lives of individuals, communities, social and economic development in one region and the ecosystem of its environment. Various economic activities such as the supply of raw water for households, agriculture, cities, industries and energy always require quantity and quality that is suitable for reliable and sustainable needs and services [1-3]. Water quality is not a market item, free market will not produce the optimal lake water quality level. The efficient government intervention requires an understanding of the benefits and costs of land use in water quality, but measuring this effect has been difficult, especially because of the lack of suitable data [4]. The rapid growth of the global population causes a big challenge to keep fresh water safe and to treat wastewater. Efficient, practical and fast water quality sensor in low-cost and simple location is needed to alarm the presence of poison early and obtain more relevant environmental data in real time [5].

2. Literature Review

Clean water and drinking water are distinguished by the following criteria. Clean water is water that meets the requirements for the supply of drinking water and drinking water is water that can be drunk without causing health problems [6].

The first clean water requirement is physically clear, odorless, colorless, tasteless and does not contain solid ingredients. The second is chemically does not contain chemicals in the amount that exceeds the threshold (physiological disturbance) and free of toxins. The third is biologically does not



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contain pathogenic organisms and does not contain other micro organisms (causes of disease disorders) [7].

Water quality is a very complex subject and it is reflected in the type of measurement and indicator of water used. The measurement will be more accurate if it is done directly in place because the water is in its original condition. For more complex measurements it requires water sample that needs to be maintained after, moved and analyzed elsewhere. This kind of measurements will cause two problems. The first is that the characteristic of water in the sample may not be the same as the source because there are chemical and biological changes over time. Water that has been separated from its environment will adjust to the new environment that is the bottle or packaging used in sampling so it requires that the material used for sampling must have a minimum reactivity level in order not to affect the quality of the water tested. The air space formed in the sample packaging can also influence it because there is a risk of air dissolving into the water sample. Maintaining sample quality can be done by cooling the sample so it will reduce the rate of chemical reaction and phase changes. Water quality from irrigation is not much different from the quality of water from rainwater [8].

3. Results and discussion

South Kalimantan is one of the provinces in Indonesia that is located in the Borneo Island, with the capital city of Banjarbaru. The Province of South Kalimantan has an area of 37.530.52 km² with the population of almost 3.7 million people. This province has 11 districts and 2 cities.

Sampling is conducted twice, in rainy season and in dry season. In addition water sampling is also carried out in one of the houses of the local resident who has installed the PDAM installation as a result of the comparison of the quality of water between unprocessed water and the water distributed. The parameter tested directly in the field is only physical parameter. The tool used is TDS meter which is used to measure temperature, electrolyte content, and the amount of solute, and a pH meter is used to measure the acidity of the water.

Except the direct parameter testing in the field, analysis of raw water quality parameters is also carried out in Hydraulics Laboratory, Lambung Mangkurat University using a U-50 HORIBA (multi water quality checker) device with a testing deadline a day after sampling in the field.

Table 1. Raw water quality testing data for intake PDAM in the field during rainy season

| No. | Regency/City | Temperature | Electric Conduction | Total Dissolved Solid | pH |
|-----|---------------------|-------------|---------------------|-----------------------|------|
| 1 | Balangan | 24,4 | 0,126 | 0,062 | 6,71 |
| 2 | Banjar | - | - | - | - |
| 3 | Barito Kuala | 29,5 | 0,44 | 0,21 | 4,46 |
| 4 | Hulu Sungai Selatan | 24,4 | 0,112 | 0,054 | 7,34 |
| 5 | Hulu Sungai Tengah | 25,8 | 0,126 | 0,067 | 7,87 |
| 6 | Hulu Sungai Utara | 27,2 | 0,135 | 0,068 | 6,7 |
| 7 | Kotabaru | 32,1 | 0,065 | 0,027 | 8,21 |
| 8 | Tabalong | 26,4 | 0,108 | 0,050 | 6,92 |
| 9 | Tanah Bumbu | 29 | 0,203 | 0,085 | 7,35 |
| 10 | Tanah Laut | 28,2 | 0,101 | 0,048 | 5,65 |
| 11 | Tapin | 25 | 0,112 | 0,067 | 6,77 |
| 12 | Banjarbaru | - | - | - | - |
| 13 | Banjarmasin | 29,5 | 0,133 | 0,066 | 6,08 |

Based on the 4 parameters tested in the field at 11 intake locations, temperatures ranged from 24.4 - 32.1 °C with the required temperature ± 3 °C from air temperature. Electric conductivity ranges from 0.1 to 0.4 mS / cm, it is quite small but raw water should not be allowed to have electrical conduction.

Dissolved solids are still below 1 g / L TDS, which ranges from 0.02 - 0.2 g / L TDS. While the required pH is around 5 - 9 is fulfilled at 11 intake locations, except at the intake in Barito Kuala, considering that the area is swamp area.

Table 2. Raw water quality testing data for PDAM intake in laboratory during rainy season

| No. | Regency/City | °C | Electric Cond. | Total Diss. Solid | pH | Turbidity | Salinity | Diss. Oxygen |
|-----|---------------------|------|----------------|-------------------|------|-----------|----------|--------------|
| 1 | Balangan | 27,4 | 0,133 | 0,087 | 6,39 | 11,7 | 0,1 | 9,73 |
| 2 | Banjar | - | - | - | - | - | - | - |
| 3 | Barito Kuala | 30,8 | 0,053 | 0,034 | 5,00 | 0 | 0,0 | 8,70 |
| 4 | Hulu Sungai Selatan | 27,5 | 0,116 | - | 6,55 | 0 | 0,1 | 9,47 |
| 5 | Hulu Sungai Tengah | 27,4 | 0,140 | 0,091 | 6,79 | 0 | 0,1 | 9,51 |
| 6 | Hulu Sungai Utara | 27,6 | 0,144 | 0,094 | 5,92 | 7,2 | 0,1 | 9,51 |
| 7 | Kotabaru | 30,5 | 0,074 | 0,048 | 6,34 | 0 | 0 | 11,17 |
| 8 | Tabalong | 27,8 | 0,126 | 0,082 | 5,61 | 38,4 | 0,1 | 9,31 |
| 9 | Tanah Bumbu | 29,3 | 0,210 | 0,136 | 6,20 | 15,0 | 0,1 | 9,52 |
| 10 | Tanah Laut | 31,3 | 0,121 | 0,078 | 5,71 | 40,4 | 0,1 | 9,37 |
| 11 | Tapin | 27,3 | 0,140 | 0,091 | 6,30 | 66,5 | 0,1 | 9,44 |
| 12 | Banjarbaru | - | - | - | - | - | - | - |
| 13 | Banjarmasin | 30,1 | 0,137 | 0,089 | 5,51 | 10,9 | 0,1 | 8,94 |

Table 3. Water quality testing data of PDAM customers in laboratory during rainy season

| No. | Regency/ City | °C | Electric Cond. | Total Diss. Solid | pH | Turbidity | Salinity | Diss. Oxygen |
|-----|---------------------|-------|----------------|-------------------|------|-----------|----------|--------------|
| 1 | Balangan | 27,44 | 0,129 | 0,084 | 6,28 | 0 | 0,1 | 9,6 |
| 2 | Banjar | - | - | - | - | - | - | - |
| 3 | Barito Kuala | 30,77 | 0,053 | 0,034 | 4,95 | 0 | 0 | 8,72 |
| 4 | Hulu Sungai Selatan | - | - | - | - | - | - | - |
| 5 | Hulu Sungai Tengah | 27,29 | 0,138 | 0,09 | 6,67 | 0 | 0,1 | 9,5 |
| 6 | Hulu Sungai Utara | 27,48 | 0,165 | 0,107 | 5,91 | 0,0 | 0,1 | 9,47 |
| 7 | Kotabaru | 30,24 | 0,100 | 0,065 | 6,26 | 0 | 0 | 8,92 |
| 8 | Tabalong | 27,79 | 0,137 | 0,089 | 5,75 | 0 | 0,1 | 9,36 |
| 9 | Tanah Bumbu | 29,18 | 0,113 | 0,074 | 5,64 | 0 | 0,1 | 10,02 |
| 10 | Tanah Laut | 29,70 | 0,159 | 0,103 | 6,34 | 0,3 | 0,1 | 9,21 |
| 11 | Tapin | 27,40 | 0,153 | 0,100 | 6,16 | 0 | 0,1 | 9,45 |
| 12 | Banjarbaru | - | - | - | - | - | - | - |
| 13 | Banjarmasin | 30,51 | 0,140 | 0,091 | 6,22 | 0,14 | 0,1 | 9,5 |

In the experiment sample conducted in laboratory, the result is not much different from the sample taken in the field. All samples do not meet the turbidity requirements of 5 NTU, except for the Barito

Kuala, HSS, HST and Kotabaru intake location. For salinity, almost all intakes still have a salinity effect with a small number. Dissolved oxygen is quite big, ranging from 8.7 - 11.17 mg / L DO.

From PDAM water sample that is tested in 11 regencies / cities in South Kalimantan Province in rainy season, the result shows that raw water becomes better, especially in turbidity and salinity experiment. Whereas the temperature component, electrical conductivity, the amount of dissolved solids and pH do not change much.

Sample test data that is carried out during the dry season ranging from July to August, the data obtained is as in Tables 4 - 6.

Table 4. Raw water quality testing data for PDAM intake in the field during dry season

| No. | Regency/City | °C | Electric Cond. | Total Dissolved Solid | pH |
|-----|---------------------|------|----------------|-----------------------|------|
| 1 | Balangan | 27,2 | 0,164 | 0,082 | 6,31 |
| 2 | Banjar | - | - | - | - |
| 3 | Barito Kuala | 29,1 | 0,37 | 0,19 | 6,53 |
| 4 | Hulu Sungai Selatan | 25,3 | 0,119 | 0,059 | 6,52 |
| 5 | Hulu Sungai Tengah | 25,0 | 0,139 | 0,07 | 6,68 |
| 6 | Hulu Sungai Utara | 29,2 | 0,155 | 0,077 | 6,44 |
| 7 | Kotabaru | 29,0 | 0,062 | 0,030 | 6,79 |
| 8 | Tabalong | 28,7 | 0,128 | 0,064 | 6,62 |
| 9 | Tanah Bumbu | 27,4 | 0,187 | 0,092 | 6,33 |
| 10 | Tanah Laut | 28,7 | 0,114 | 0,054 | 7,57 |
| 11 | Tapin | 26,6 | 0,169 | 0,080 | 6,00 |
| 12 | Banjarbaru | - | - | - | - |
| 13 | Banjarmasin | 31,1 | 0,179 | 0,6 | 4,37 |

Based on the 4 parameters tested in the field in 11 intake locations, temperature ranges from 25.0 - 31.1 °C, with the required temperature is ± 3 °C from air temperature. Electric conductivity ranges from 0.1 to 0.3 mS / cm, it is quite small but there should be no electrical conduction. The highest electrical conductivity is found at Barito Kuala intake. Dissolved solid is still below 1 g / L TDS, it ranges from 0.03 - 0.6 g / L TDS. Whereas the pH required is around 5 - 9 fulfilled at 10 intake locations, except for the intake in Banjarmasin, it is in 4.37.

In the sample experiment conducted in laboratory, the result obtained is not much different from the sample taken in the field. All samples fulfill the turbidity requirements <5 NTU, except for Tabalong, Tanah Bumbu, Tanah Laut and Tapin intake locations. For the salinity, almost all intakes still get the salinity with a small number. Dissolved oxygen is quite big, it ranges from of 5.54 - 17.03 mg / L DO.

Table 5. Raw water quality testing data for PDAM intake in the field during dry season

| No. | Regency/City | °C | Electric Cond. | Total Diss. Solid | pH | Turbidity | Salinity | Diss. Oxygen |
|-----|--------------|------|----------------|-------------------|------|-----------|----------|--------------|
| 1 | Balangan | 29,3 | 0,174 | 0,113 | 6,34 | 4,1 | 0,1 | 7,23 |
| 2 | Banjar | 27,2 | 0,133 | 0,086 | 6,25 | 0 | 0,1 | 8,93 |
| 3 | Barito Kuala | 28,6 | 0,043 | 0,028 | 7,32 | 0 | 0,0 | 17,03 |

| No. | Regency/City | °C | Electric Cond. | Total Diss. Solid | pH | Turbidity | Salinity | Diss. Oxygen |
|-----|---------------------|------|----------------|-------------------|------|-----------|----------|--------------|
| 4 | Hulu Sungai Selatan | 28,8 | 0,128 | 0,083 | 6,85 | 0,6 | 0,1 | 12,72 |
| 5 | Hulu Sungai Tengah | 29,5 | 0,152 | 0,099 | 6,03 | 0 | 0,1 | 6,81 |
| 6 | Hulu Sungai Utara | 28,1 | 0,162 | 0,105 | 6,01 | 3,0 | 0,1 | 9,39 |
| 7 | Kotabaru | 28,3 | 0,068 | 0,044 | 7,25 | 0 | 0,0 | 9,89 |
| 8 | Tabalong | 28,0 | 0,137 | 0,089 | 5,96 | 17,3 | 0,1 | 9,48 |
| 9 | Tanah Bumbu | 28,7 | 0,194 | 0,126 | 6,85 | 13,3 | 0,1 | 9,32 |
| 10 | Tanah Laut | 29,1 | 0,126 | 0,082 | 7,93 | 47,6 | 0,1 | 10,09 |
| 11 | Tapin | 29,4 | 0,162 | 0,110 | 5,81 | 30,8 | 0,1 | 5,54 |
| 12 | Banjarbaru | 27,2 | 0,133 | 0,086 | 6,25 | 0 | 0,1 | 8,93 |
| 13 | Banjarmasin | 29,3 | 0,235 | 0,153 | 5,87 | 0 | 0,1 | 10 |

Table 6. Water quality testing data of PDAM customers in laboratory during dry season

| No. | Regency/City | °C | Electric Cond. | Total Diss. Solid | pH | Turbidity | Salinity | Diss. Oxygen |
|-----|---------------------|------|----------------|-------------------|------|-----------|----------|--------------|
| 1 | Balangan | 29,2 | 0,178 | 0,115 | 6,04 | 0 | 0,1 | 7,46 |
| 2 | Banjar | - | - | - | - | - | - | - |
| 3 | Barito Kuala | 28,8 | 0,097 | 0,063 | 4,93 | 0 | 0 | 9,18 |
| 4 | Hulu Sungai Selatan | - | - | - | - | - | - | - |
| 5 | Hulu Sungai Tengah | 29,5 | 0,152 | 0,099 | 6,07 | 0 | 0,1 | 7,04 |
| 6 | Hulu Sungai Utara | 28,1 | 0,168 | 0,109 | 6,13 | 0 | 0,1 | 9,86 |
| 7 | Kotabaru | 28,1 | 0,110 | 0,071 | 6,68 | 0 | 0,1 | 9,29 |
| 8 | Tabalong | 28 | 0,132 | 0,077 | 6,1 | 0 | 0,1 | 9,09 |
| 9 | Tanah Bumbu | 28,7 | 0,204 | 0,133 | 6,80 | 0 | 0,1 | 9,97 |
| 10 | Tanah Laut | 29,2 | 0,145 | 0,094 | 7,60 | 0 | 0,1 | 9,50 |
| 11 | Tapin | 29,5 | 0,188 | 0,122 | 5,48 | 0 | 0,1 | 5,75 |
| 12 | Banjarbaru | - | - | - | - | - | - | - |
| 13 | Banjarmasin | 29,3 | 0,165 | 0,107 | 6,14 | 0 | 0,1 | 9,62 |

From PDAM water sample tested in 11 regencies / cities in South Kalimantan Province, the result shows that raw water becomes better, especially in turbidity and salinity.

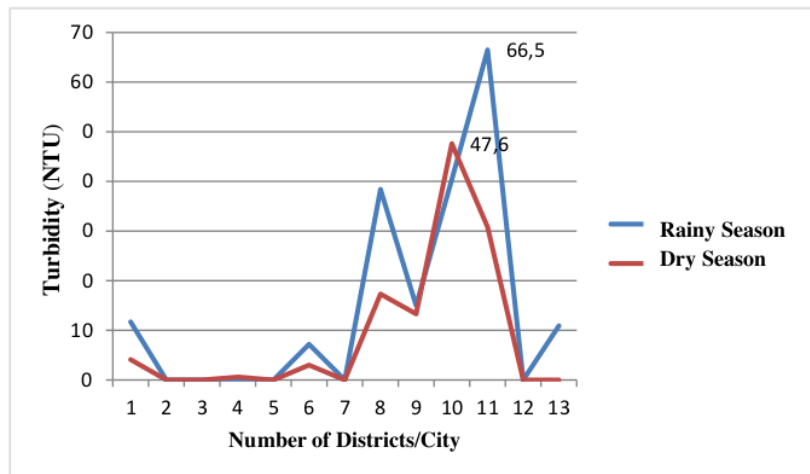


Figure 1. The water turbidity in PDAM intake in rainy

The water turbidity in PDAM intake in rainy season is higher than in dry season but the water turbidity that is delivered to customers is <5 NTU.

4. Conclusion

Water turbidity in PDAM intake in rainy season is higher than in dry season. The water quality during dry season and rainy season is quite good after having the water treatment in PDAM compared to water sample from the intake which is tested mainly in turbidity and salinity components.

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