

Chemical Physical Analysis of River Water Quality in Padang Panjang City

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ABSTRACT

Rivers are bodies of water that are elongated on the earth's surface that are naturally formed, ranging from small ones upstream to large downstream ones. In Padang Panjang City, 10 rivers flow, 6 rivers in West Padang Panjang District, and 4 rivers in East Padang Panjang District. Data from the analysis of river water quality in Padang Panjang City was obtained from secondary data, namely data from river water quality tests conducted by the Padang Panjang City Environment Service in March 2021 and from various other official sources such as journals and articles. The value of water quality in Padang Panjang City, in general, meets the Quality Standards based on PP No. 82/2001, but there are several sources whose values are below the established Quality Standards. The use of surface water for various activities according to water quality standards using physical, chemical, and biological parameters can be grouped into several parts, including human consumption, water recreation, fisheries, industry, and agriculture.

Keywords: Water, Chemical Physical, Quality, River, Padang Panjang.



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INTRODUCTION

Rivers are bodies of water that are elongated on the earth's surface that are naturally formed, ranging from small ones upstream to large downstream ones. The function of the river is to accommodate rainwater that falls on the earth's surface and flows along with the material in it to lower places and continues to flow into the sea (Leopold, 1997). Rivers as a body of water are strongly influenced by many factors, both natural factors, and human activities. The input of waste or garbage from human activities around the river body can directly or indirectly affect the physical and chemical conditions of river water, which in turn can affect the life of the biota in and around the river (Akhtar et al., 2021).

A river is a body of water that flows in one direction. The river water is cold and clear and contains little sediment and food. The flow of water and waves constantly provide oxygen to the water. The water temperature varies with altitude and latitude. Communities in rivers are different from lakes. Fast-flowing river water does not support the existence of the plankton community to remain silent because it will be carried away by the current. Instead, photosynthesis occurs from the attached algae and rooted plants so that they can support the food chain (Cheremisnoff, 2019). The composition of the animal community also differs between rivers, tributaries, and downstream. In the tributaries are often found,

freshwater Man (Hermon et al., 2021). Blackburn (1983) downstream are often found catfish and carp. Several large rivers are inhabited by various turtles and snakes. Especially rivers in the tropics, inhabited by *crocodiles* and *dolphins*. River organisms can survive not being carried away by the current due to evolutionary adaptations. For example, a thin dorsoventral body can be attached to stones. Several types of insects that live on the downstream sides inhabit small habitats that are free from whirlpools.

Padang Panjang City is one of the cities with the smallest area in the province of West Sumatra, Indonesia. The city has the nickname the City of the Veranda of Mecca and is also known as Egypt van Andalas. The administrative area of Padang Panjang City is surrounded by the administrative area of Tanah Datar Regency (Nurisyah et al., 2021). In mid-2021, the population of Padang Panjang City is 59,998 people. Topographically, the city is located on an undulating plateau, where about 20.17% of the total area is a relatively sloping area (slope below 15%), while the rest is a sloping, steep and hilly area, and landslides often occur due to the soil structure, unstable and heavy rainfall. However, the sloping area of the city is fertile andosol-type soil which is very good for agriculture.

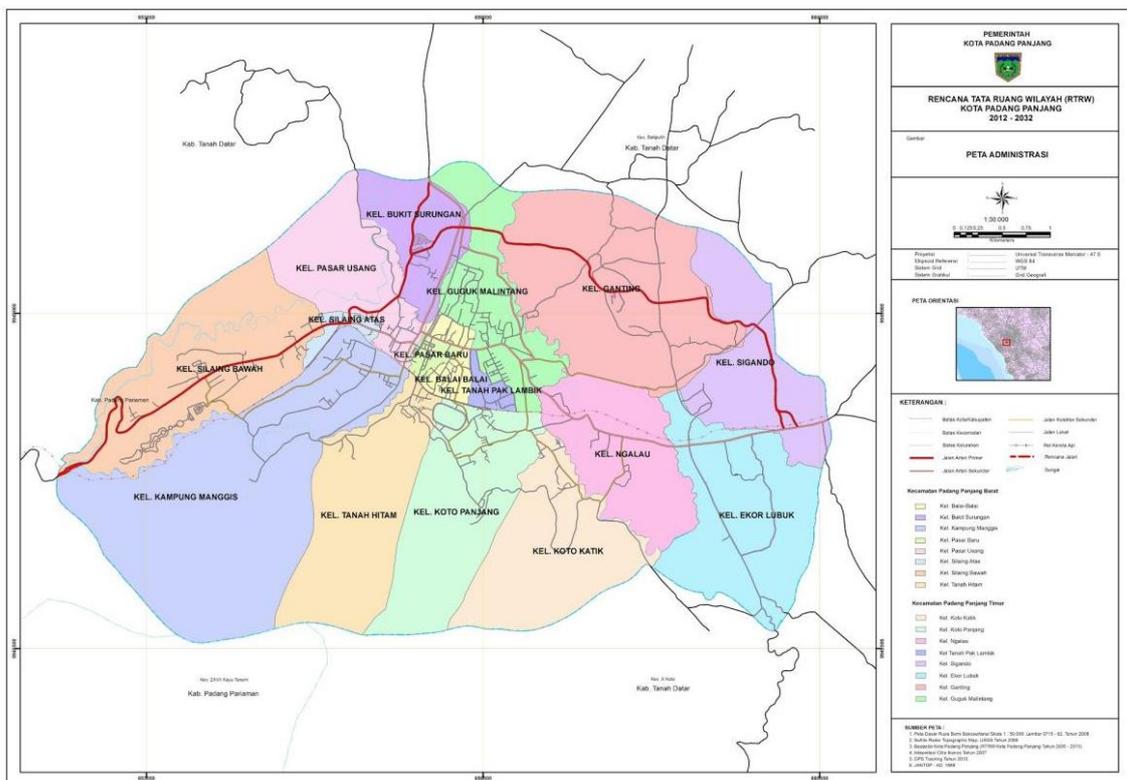


Figure 1. Administration Map of Padang Panjang City

Padang Panjang City is traversed by many small and large watersheds (DAS). West Padang Panjang District is traversed by 6 watersheds and East Padang Panjang District is traversed by 4 watersheds. A watershed can also be defined as a collection of many smaller sub-watersheds. In addition, the watershed is also a row of mountains, hills, or division boundaries at the top which can drain water to the sloping bottom (Triono, 2010).

Rivers are likened to the veins in the human body, while the water that flows in these veins is like blood. Without veins, blood can't deliver various nutrients needed by all parts of the human body. Likewise, without a river or if the river is polluted then humans, in addition to having difficulty getting proper water, will also be expensive. DeSanto et al (1978) suggest that about 70% of the human body is water and every day humans need

about 1.5 liters of water to survive, and terrestrial ecosystems directly depend on water as a factor that determines the structure and function of all biomes on earth. Meanwhile, Odum (1988) suggests that because water is very important and is the largest part of protoplasm, it can be said that all life is "aquatic". Rivers, where water flows and carries various needs of human life and various other creatures that it passes, are part of the freshwater ecosystem. Although the area of the river and the amount of water flowing in it is very small compared to the area and amount of water in the sea, the river has an important role directly for human life and the creatures around it.

The rivers in Padang Panjang City are widely used by people living around the river to fulfill their daily needs. In addition, it is also used as a dumping ground for garbage and domestic wastewater, either directly or indirectly. The use of rivers by the community can cause river water pollution. According to Law No. 23/1997 concerning Environmental Management, environmental pollution is the entry or inclusion of living things, substances, energy, and or other components into the environment by human activities so that the quality drops to a certain level which causes the environment to be unable to function according to its designation. Furthermore, Kristanto (2002) states that water pollution is a deviation of the properties of water from the normal state not from its purity. The water in the universe is never pure, but that does not mean that all water is polluted. For example, water in the mountains and remote areas with clean and pollution-free air still contains dissolved materials such as oxygen, nitrogen, and suspended organic matter. dissolved. Chemical characteristics contained in water determine the nature of water in terms of the level of poisoning and the danger it causes. The more polluting materials in the water, the less water use will be limited. Chemical characteristics consist of organic and inorganic materials and in general, the properties of water are influenced by these two substances, such as the value of pH, BOD, COD, and heavy metals. Based on what has been stated previously, it is necessary to carry out a physical and chemical analysis of the quality of river water in Padang Panjang City.

FINDING (LITERATURE REVIEWS)

Based on data obtained from the BAPPEDA of Padang Panjang City, it is known that 10 rivers are flowing in Padang Panjang City, namely 6 rivers in West Padang Panjang Sub-district, and 4 rivers in East Padang Panjang Sub-district, for more details can be seen in Table 1 below.

Table 1. The name of the rivers in Padang Panjang City

Sub-district	River Names (In Indonesia)	Length (km)
West Padang Panjang	1. Sungai Talang	5.82
	2. Sungai Sibunian	3.96
	3. Batang Air Sikakeh	4.21
	4. Hilir Sungai Burai	0.89
	5. Air Mangiang	0.65
	6. Batang Air Sitabak	1.55
East Padang Panjang	1. White Water Bar	3.38
	2. Retak Air Kulit Kayu	4.02
	3. Sungai Andok River	1.15
	4. Sungai Sikalambai River	3.1

The river is an open flow with geometric dimensions, namely cross-section, longitudinal profile, and slope of the valley that changes over time, depending on the discharge, bed material, and cliffs. Water in nature is very rarely found in a pure state, although rainwater that was originally pure, has undergone reactions with gases in the air on its way to the earth, then contaminated during its journey above the earth's surface and underground. Water quality states the level of suitability of water for certain uses in meeting their needs, ranging from meeting direct needs, namely drinking water, toilets, irrigation water, animal husbandry, fisheries, recreation, and transportation (Suripin, 2001).

The quality of river water in Padang Panjang City, based on the results of the water quality test carried out by the Environmental Service of Padang Panjang City in period 1, namely in March 2021, can be seen in Table 2 below.

Table 2. Data on River Water Quality in Padang Panjang City

No	River Name	Location	Watch Point	DO (mg/L)	BOD (mg/L)	COD (mg/L)	NO ₂ (mg/L)	NO ₃ (mg/L)	Chlorine (mg/L)	TP (mg/L)
1	Batang Sibunian	Ex. Ganting	Upstream	6.32	1.55	18.6	0.002	2.4	0.05	0.024
			Range	6.04	2.32	23.5	0.004	1.1	0.27	0.029
			Downstream	7.45	2.5	24	0.009	8.2	0.11	0.026
2	Batang Sikakeh	Ex. Sigando	Upstream	6.93	1.91	14.7	0.006	2.7	0.06	0.031
			Range	6.44	1.89	15.6	0.009	1.6	0.08	0.05
			Downstream	6.44	2.5	14.5	0.003	7.8	0.13	0.026
3	Sungai Talang	Ex. Bukit Surungan	Upstream	6.52	2.5	11.5	0.002	1.8	0.1	0.028
			Range	7.65	1.65	14.5	0.004	1.3	0.14	0.024
			Downstream	8.25	2.68	21.6	0.007	2	0.17	0.026
4	Batang Sitabak	Ex. Koto Panjang	Upstream	4.79	2.68	27	0.085	2.6	0.05	0.066
			Range	5.23	3.18	26.6	0.151	1.6	0.15	0.073
			Downstream	7.45	4.89	19.9	0.078	1.8	0.13	0.034
5	Batang Bakarek-karek	Ex. Bukit Surungan	Upstream	6.93	1.77	19.9	0.003	0.9	0.14	0.021
			Range	7.33	5.78	21.8	0.03	1	0.16	0.043
			Downstream	7.33	5.42	16.1	0.071	1.6	0.14	0.047
6	Parik Rumpang	Ex. Bukit Surungan	Upstream	7.85	3.1	19.7	0.051	1.7	0.11	0.043
			Range	6.72	4.93	30.2	0.057	1.7	0.18	0.092
			Downstream	6.64	0.22	18	0.05	1.8	0.13	0.047
7	Sungai Andok	Ex. Silaing Bawah	Downstream	8.34	2.6	13.3	0.018	1.3	0.13	0.019

Source: Data from the Padang Panjang City Environment Service in 2021.

Table 3. PP Quality Standards No. 82/2001

Parameter	Unit	Class				Information
		I	II	III	IV	
Temperature	°C	deviation 3	deviation 3	deviation 3	deviation 3	Deviation and temperature from scientific state
TSS	mg/L	50	50	400	400	For conventional drinking water management, TSS < equal to 5000 mg/L
pH	-	6 - 9	6 - 9	6 - 9	5 - 9	-
BOD	mg/L	2	3	6	12	-
COD	mg/L	10	25	50	100	-
DO	mg/L	6	4	3	0	Minimum limit number

From the data from the measurement of river water quality that has been carried out by the Environmental Service of Padang Panjang City when compared with the PP Quality Standards No. 82/2001, it can be seen that the lowest average DO value of river water is 4.79 mg/L in the upstream part of the river. Talang in Kampung Koto Panjang, while the highest DO value is 8.25 mg/L in the lower reaches of the Talang river in the Koto Katiak Sub-district, while the minimum limit value based on Quality Standards is 6. In general, the DO value of rivers in Padang Panjang City meets the Water Quality Standards according to PP No. 82/2001. For the BOD value, the results of the measurement of the Environmental Service of Padang Panjang City on river water quality is 0.22 in the downstream part of Kampung Parik Rumpang in the Kampung Manggis and the highest is 5.78 in the Bakarek-karek range in Kampung Pasar Usang. Based on the Quality Standards, the permissible value is 2 - 12 mg/L. This means that the quality of river water

in Padang Panjang City in terms of BOD, on average meets the Quality Standards, although there are several sources whose BOD values are below the quality standard values. For other water quality values, it can be seen in Table 2.

In general, the quality of river water in Padang Panjang City meets the Quality Standards based on PP No. 82/2001, but there are several sources whose values are below the established Quality Standards. According to its designation Riyadi (1984), the quality of surface water and groundwater can be grouped into four groups, namely: 1) Class A/water requiring no treatment is water that comes from groundwater that is free from possible contamination. Water can be used as drinking water directly without being processed first, but it is required to be cooked first; 2) Class B/water requiring simple chlorination or its equivalent, is water that can be used as raw water to be processed as drinking water and for household purposes; 3) Class C/water requiring complete, rapid sand filtration treatment or its equivalent, is water that can be used for fishery and livestock purposes; and 4) Class D/water requiring auxiliary treatment in addition to complete filtration and post-chlorination is water used for agriculture and can be used for urban businesses, industry, and hydroelectric power. Furthermore, Hammer & Mac Kichan (1981); Asdak (2002) suggested that the use of surface water for various activities according to water quality standards using physical, chemical, and biological parameters can be grouped into several parts including human consumption, water recreation, aquaculture, industry, and agriculture.

CONCLUSION

In Padang Panjang City, 10 rivers flow, 6 rivers in West Padang Panjang Sub-district, and 4 rivers in East Padang Panjang Sub-district. The value of water quality in Padang Panjang City, in general, meets the Quality Standards based on PP No. 82/2001, but there are several sources whose values are below the established Quality Standards. The use of surface water for various activities according to water quality standards using physical, chemical, and biological parameters can be grouped into several parts, including human consumption, water recreation, and aquaculture. fisheries, industry, and agriculture.

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