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Discussion on Water Quality of Gaoping River and Fongshan River

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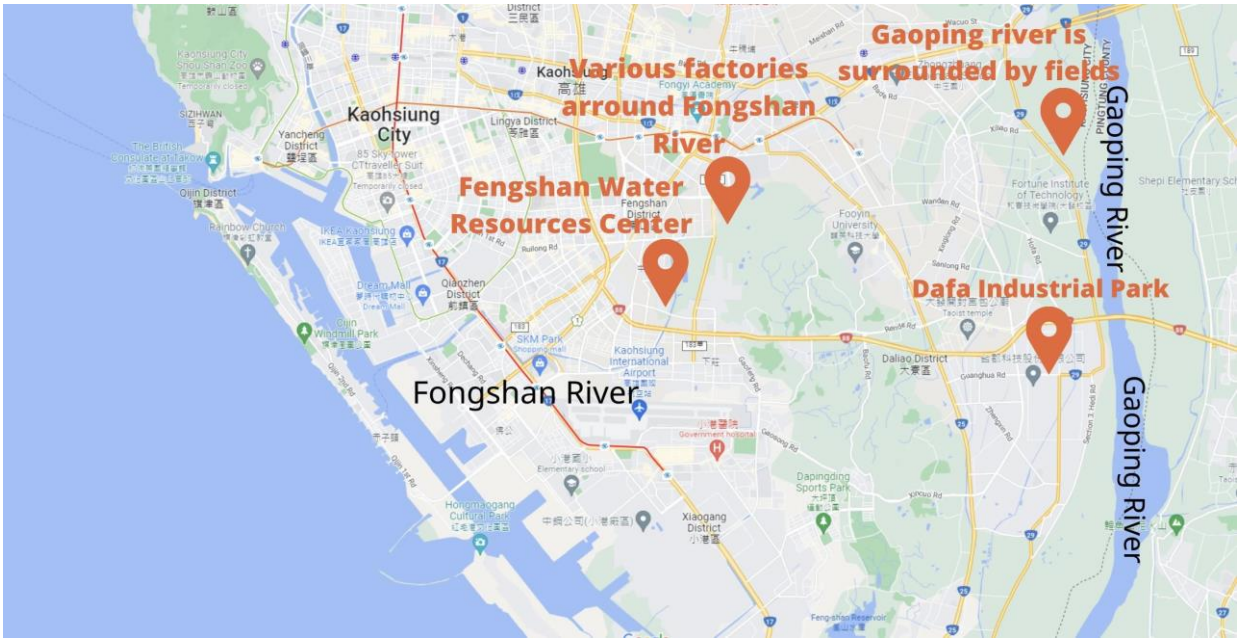
Abstract

This report compares the water quality of Fongshan River with that of Gaoping River in 2021, and it analyzes the correlation between the water temperature, rainfall, pH, dissolved oxygen (DO), chemical oxygen demand(COD), river pollution index (RPI), electrical conductivity and the industry around the two rivers. These statistics can directly or indirectly show whether the quality of water is good or bad. By analyzing the quality of water and the environment around the two rivers, we can reflect on whether industrial development and resource exploitation is reasonable.

Introduction

The two rivers, Fongshan River and Gaoping River, flow through the different areas in Kaohsiung. So we want to analyze whether the different environment of the river basin will affect the water quality of rivers. And before we analyze the statistics of river quality, we will introduce the different industry or business activities around the two rivers.



1. Gaoping River is surrounded by vast fields, and near the fields are many factories around, such as the Dafa Industrial Park. And the Gaoping River flows through the rural area so the population rate there is low.

2.Fongshan River flows through the urban area, such as Fongshan District or Cianjhen District, so the population rate there is high. And the upstream of Fongshan River is filled with factories, too. Along the river are several wetlands, and the Fengshan Water Resources Center established by the government to treat sewage.

Methods and Materials

We used the website of the Environmental Protection Bureau Kaohsiung City Government to inquire about the monthly data of Gaoping River and Fongshan River in 2021, and organized the data into a chart for discussion. The data of Gaoping River were taken by Gaoping Bridge Station, and the data of Fongshan River were taken by Qianzhen Bridge Station. Both stations are located downstream of the two rivers, to analyze the impact of washed-down material from upstream of the rivers.

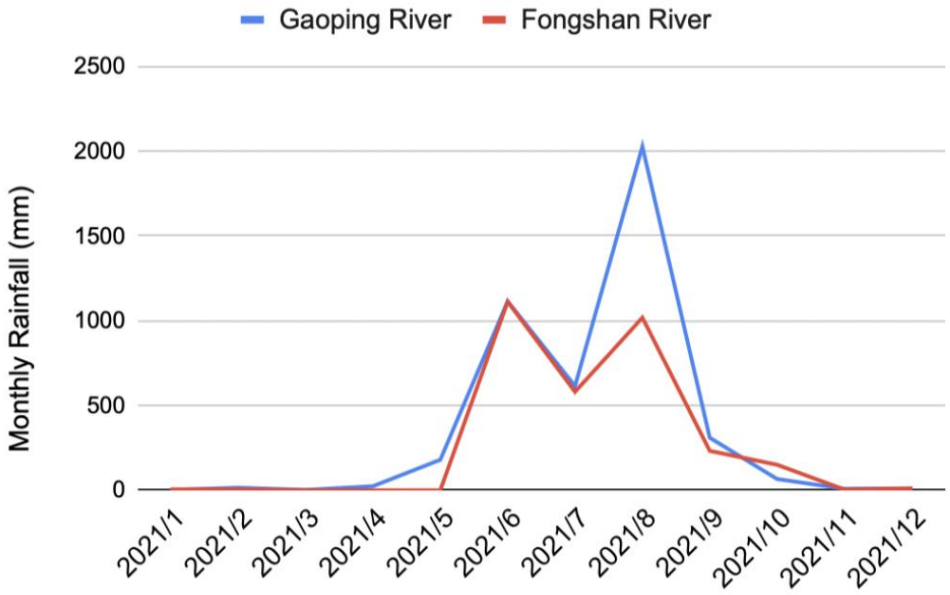
And we used the website of Data Bank for Atmospheric & Hydrologic Research to inquire about the hourly rainfall data of Gaoping River and Fongshen River in 2021. The rainfall measuring station adopts the data of the upstream of the two rivers. The data of Gaoping River were taken by C1V340, and the data of Fongshan River were taken by C1V390. And we observed the environment of the river basin by Google Maps to inquire about the industrial activities around the two rivers.

Discussions

1. Rainfall:

(1)Introduction:

Rainfall is an important factor affecting the flow of rivers. River flows lightly in dry seasons, and chemical substances in the river may stay and accumulate in place. On the contrary, when the river flows heavily in rainy seasons, chemical substances in place may be washed away. However, it is possible to bring the upstream material to the measuring station and change the value of the station.



1-A Comparison of the rainfall between Gaoping River and Fongshan River in 2021

(2)Discussion:

According to Figure 1, the two rivers have the most rainfall from June to August, while there is hardly any rainfall from January to April and from November to December. They are typical barren stream-type rivers that rain in summer and dry in winter. Summer rainfall restores the stream flow state.

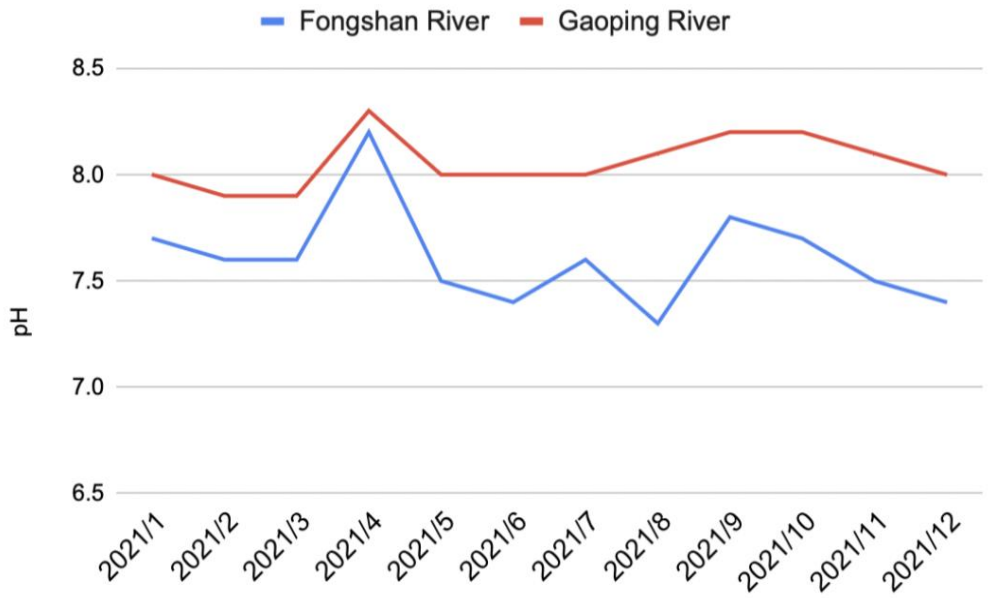
Taiwan relies on spring rains from February to April to alleviate the water shortage at the end of dry seasons every year. However, it hasn't rained a lot since the beginning of 2021, which was affected by La Nina, resulting in a severe water shortage in southern Taiwan in 2021. Water cutoffs, water restrictions and water resource issues were discussed quite often. However, this chart also shows that there were several rainfalls in the monsoon season from May to June which the drought began to ease. From July to August, there were successive typhoons and southwesterly flow, which brought a lot of rainfall and solved the drought crisis.

2. pH:

(1)Introduction:

pH depends on the concentration of hydrogen ions in the river. The higher the pH value is, the more alkaline the water contains; the lower the pH value is, the more acidic the water contains. And the pH of 7 represents the water is neutral.

The normal range of river pH is from 6.5 to 8.5.



2-A Comparison of pH between Gaoping River and Fongshan River in 2021

(2)Discussion:

According to Figure 2, the average pH of the Gaoping River is between 7.9 and 8.3, while that of the Fongshan River is between 7.3 and 8.2. In contrast, the pH of the Fongshan River is slightly lower than that of the Gaoping River every month, and the pH variation of the Fongshan River is also relatively larger than that of the Gaoping River. Generally speaking, the pH of the two rivers are within the normal range of pH value.

Looking at Gaoping River alone, the highest pH value in the chart is 8.3 in April. In addition, the pH value from August to November is also slightly higher than the average.

Looking at Fongshan River alone, the highest pH value is also 8.2 in April. And, the pH value from May to August shows a concave shape in the chart.

(3)Conclusion:

The month with the highest pH value of two rivers is both in April. Comparing the rainfall charts, it can be seen that it happens in the last month of the dry season.

In the rainy season, from June to August, the pH value tends to decrease to be neutral. It can be speculated that rainfall may change the concentration of pH-affecting substances in the water to maintain a stable pH value.

3.Water temperature:

(1)introduction:

Water temperature indicates how hot or cold water is, and is an important data for testing and evaluating water quality.

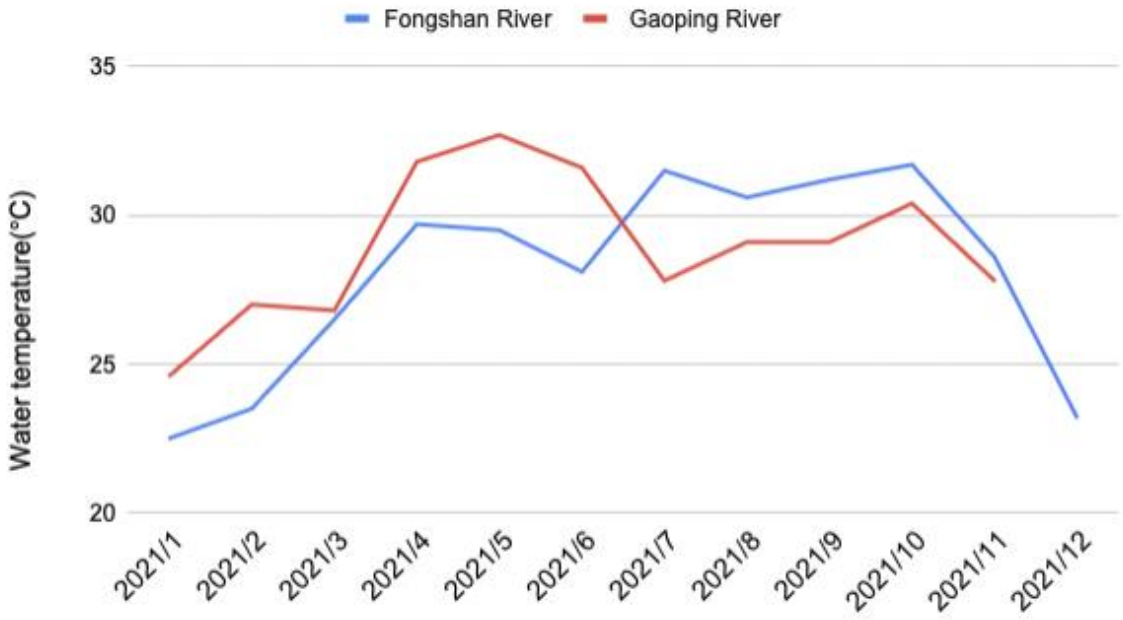
The change of water temperature is mainly affected by the climate, and the discharge of wastewater will also have an impact on the water temperature.

(2)Influence:

Water temperature will affect the physical properties of water such as density, viscosity, vapor pressure, surface tension, etc. In the chemical aspect, it can affect the chemical reaction rate and gas solubility, etc. In the biological aspect, it can affect the activity and metabolic rate of microorganisms, etc.

(3)Discussion:

It can be seen from the figure that the water temperature of Fengshan River has changed with the predicted curve in 110 years (cold in winter and hot in summer), while the water temperature of Gaoping River has decreased in winter, but in 4, 5, 6 The water temperature in the month is higher than that in the summer. We currently speculate that it is because the Gaoping River has more precipitation in July and August than other months, and the water temperature in the upstream is lower than that in the downstream.A large amount of rain washes will make the overall water temperature lower downstream.



3-A Comparison of the water temperature between Fongshan River and Gaoping River in 2021

4.Chemical Oxygen Demand (COD) :

(1)Introduction:

Chemical Oxygen Demand (COD) stands for the organic content of chemical oxidation in water, using potassium dichromate to be oxidant. Heated in a strong acid condition, the potassium dichromate would be depleted. The weight of the potassium dichromate depleted can then be converted to the same weight of oxygen gas, and that is COD.

(2)Discussion about Gaoping River:

The COD data in July and August this year is more than those in other months. We have made some hypotheses about the reasons behind the phenomenon.

The following are the two hypotheses:

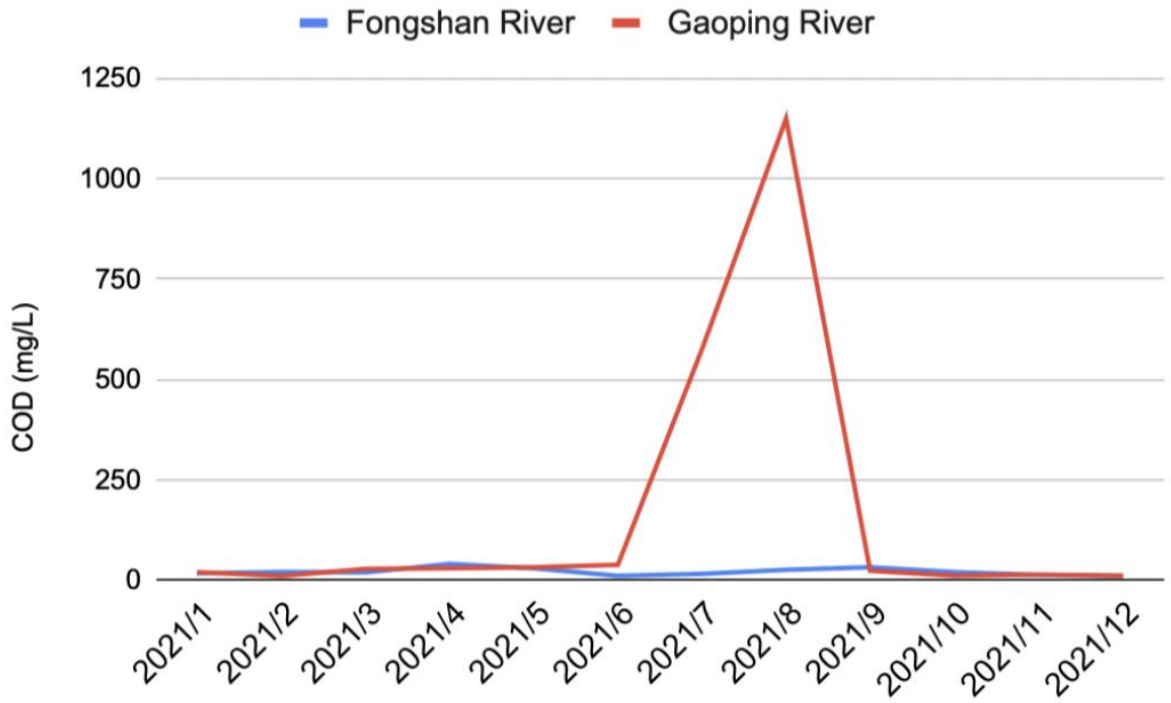
i.There are many farmlands around Gaoping River, where farmers use fertilizer to help grow their crops. Since July and August are the harvest season, the farmers will use the fertilizer even more. Due to the abundant organic matters in the fertilizer, it impacts the water quality in the river.

ii. Heavy rain can increase the COD in the river because the rain can wash away the organic matter from the air and ground into the water. Since there are many typhoons in summer in Taiwan, the skyrocketed rainfall causes the organic matter to erode from upstream to downstream, resulting in higher COD.

We found and checked the data of last year, which shows no significant difference between the COD data in July & August and other months. Therefore, the first hypothesis cannot be proved. We then consider the second hypothesis (regarding the effect of rainfall) is more correct.

(3)Discussion of Fongshan River:

According to data this year, COD of January, June, July, November, and December are lower than that of the other months. So we can conclude that the Fongshan River has less pollution these years.



4-A Comparison of the chemical oxygen demand (COD) between Fongshan River and Gaoping River in 2021

5.River Pollution Index (RPI):

(1) Introduction:

River Pollution Index (RPI) consists of four water quality parameters, which are biochemical oxygen demand, dissolved oxygen, Ammonia, and suspended solids.

RPI is between 1 to 10.

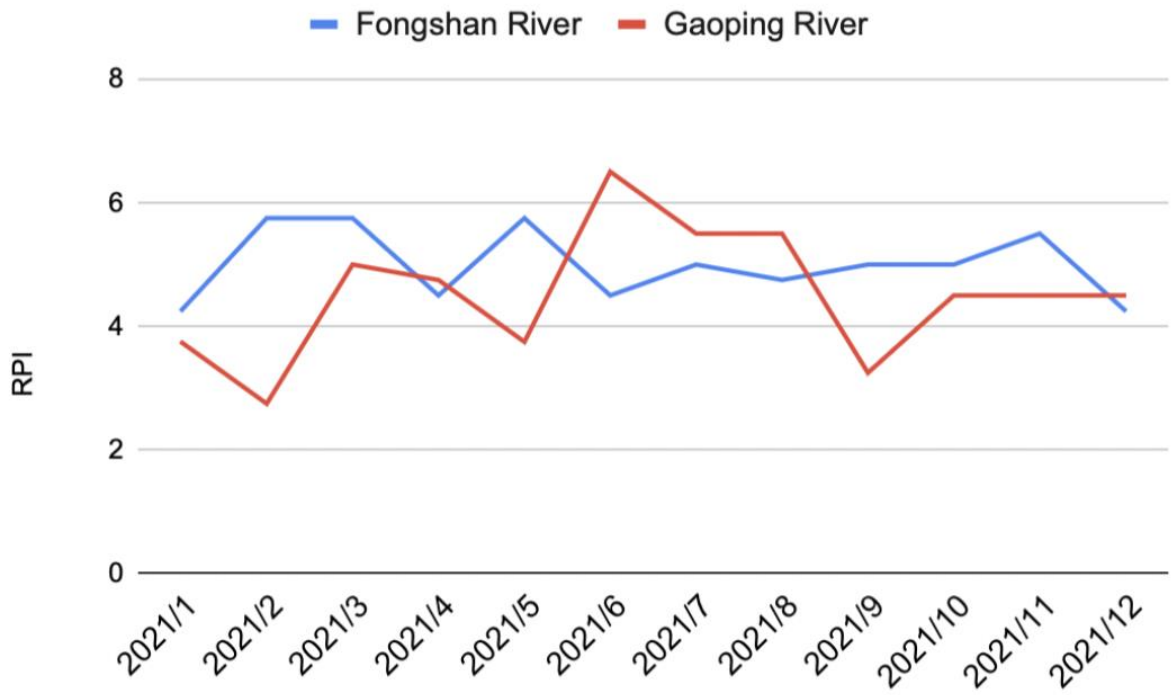
RPI	Degree of Pollution
Below 2	uncontaminated water
2 to 3	light pollution
3.1 to 6	medium pollution
more than 6	heavy pollution

(2) Discussion on RPI in both rivers:

According to the chart 5-A, we found that the RPI of the Gaoping River, which is more rural than the Fongshan River, is higher and more unstable. Below are two hypotheses for this phenomenon:

i.Gaoping River is near the industrial area, where there may be wastewater emission.

ii. With lots of stock farming along the river, wastewater is also discharged into the river.



5-A Comparison of the river pollution index (RPI) between Fongshan River and Gaoping River in 2021

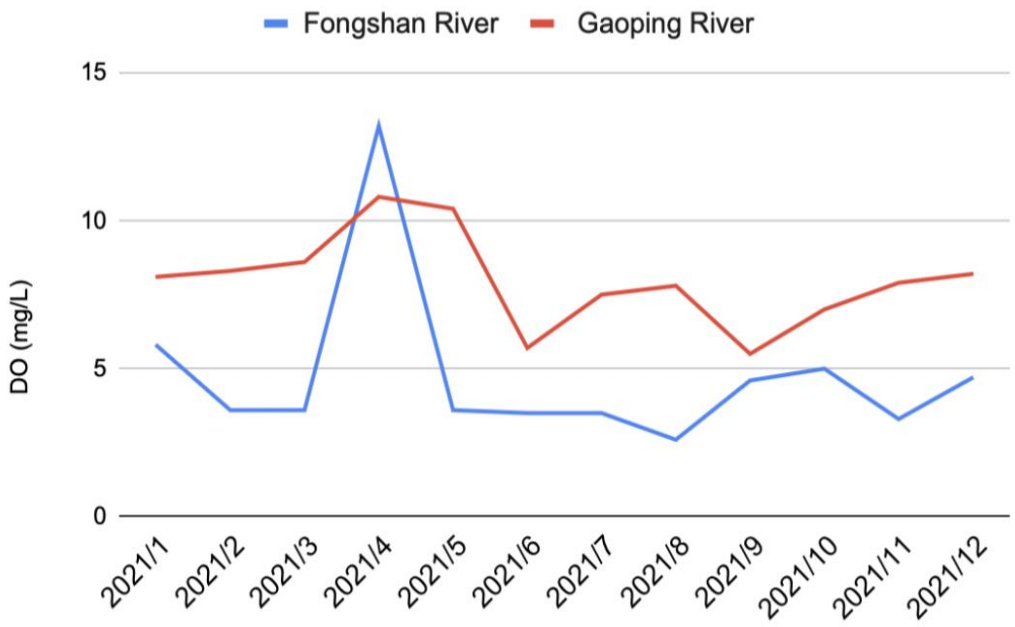
6.Dissolved Oxygen(DO)

(1)Introduction:

DO is affected by the water temperature of the river. The higher the water temperature is, the lower DO is. DO can not only be used to judge water quality but also is an essential for the survival of fish. The basic requirement for fish survival is 3mg/L or more than 4 mg/L. If it is lower than 2mg/L, fish may die.

(2) Discussion on DO in both rivers:

In the following chart 6-A, we can see that the water quality of the Gaoping River is relatively stable compared to that of the Fongshan River. Since the Fongshan River is in the city, it is speculated that domestic wastewater or garbage may be thrown into the river more often. Hence, the water quality of the Fongshan River is relatively unstable; that is to say, suddenly high and suddenly low. In August, the DO in Fongshan River was 2.6, making it difficult for fish to survive.



6-A Comparison of the dissolved oxygen (DO) between Fongshan River and Gaoping River in 2021

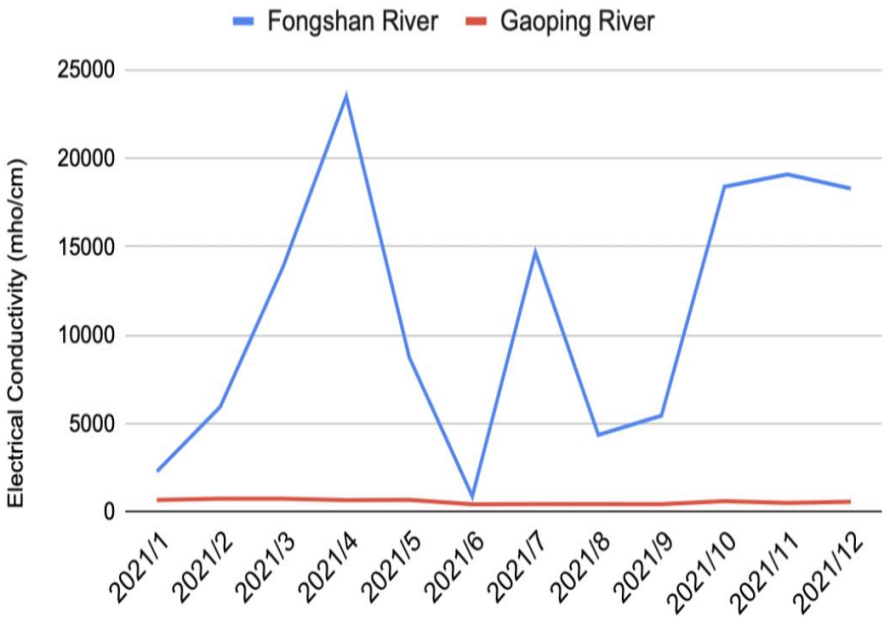
7.Electrical conductivity(EC)

(1) Introduction:

The higher the EC, the more electrolyte is in the water. So the EC can indicate the amount of total solids that can be dissolved into the water. Furthermore, if the EC is too high, it can have a bad effect on irrigation.

(2)Discussion on EC in both rivers:

As mentioned above, high EC has a negative impact on irrigation. The chart 7-A shows that Gaoping River has low EC, which means that the water resources of Gaoping River are more suitable to be used for irrigation for the surrounding farmland.



7-A Comparison of the electrical conductivity (EC) between Fongshan River and Gaoping River in 2021

Conclusions

The differences between the two rivers are mainly in the proportion of nearby farmland and whether there is an industrial area. From the above analysis, it can be found that the water quality is not necessarily equal to the amount of pollution. The water quality of Gaoping River is more stable than that of Fongshan River because of the need for irrigation, and it is more friendly to the creatures in the river. However, the pollution (RPI) of Gaoping is relatively unstable, presumably because the date of measurement is different and therefore the date of discharge of wastewater by the factory is different. In today's industrialized era, industrial development is inevitable, and the government should encourage enterprises to filter wastewater before discharging, so as to balance the environment and economy, and win-win between nature and human beings.

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