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Monitoring of Pollution Status of Hongnong River in Lingbao City

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ABSTRACT:*Taking the Hongnong River in Lingbao City as an example, this study focused on the main industrial pollution sources causing heavy metal Thallium **(TI)** pollution in Hongnong River, the water quality of the outlets of industrial enterprises, the water quality of sewage treatment mineral processing plants, and the key monitoring sections. The water quality was sampled and tested to analyze the current pollution status of the Hongnong River in Lingbao City. Gold smelting Co., Ltd., Open Source Mining and Xinling Lead Industry contain heavy metal* **(TI)** *in the discharged industrial wastewater. The monitoring results of external drainage indicate that the heavy metal Thallium* **(TI)** *content exceeds the limit of 0.0001 mg/L of surface water quality standard, and sewage the water quality of the imported and exported water of the treatment mineral processing plant exceeded the standard. The key section of the monitoring section was the section of the Poitou Bridge, the 500m before the entrance to the Yellow River, the 3000m before the entrance to the Yellow River, the water intake of the standby water source, and the water quality of the water at the 500m before the entrance to the Yellow River. When the content reached the standard, the content of heavy metal Thallium **(TI)** in the other two sections exceeded the standard.*

KEYWORDS: *Hongnongjian River, industrial pollution, Thallium*

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I. INTRODUCTION:

1. Research background and significance:

Water is an integral part of human and animal's life. China has abundant water reservoirs, however, the resources for fresh water are limited (Mandal, Das, and Nanda 2011)**.** In recent times, China is boosting up its mining industry, that produces a large amount of wastewater that contains heavy metals(Jianqing et al. 2016)**.** As this wastewater mixes up with the local water supply and causes serious concerns to the life of people(Jähnig and Cai 2010)**.** However, as the use of national resources is increasing day by day and the pollution caused by this scenario makes this situation more serious(Belzile and Chen 2017)**.** In the past few years, the government has taken many steps to solve this serious problem and made many rules and regulations to protect the environment from the poison of environmental pollution(Zhang et al. 2015)**.**

Thallium **(TI)** is an element that belongs to main group **III** that occurs naturally at very low concentrations and its higher concentration are found in different sulfide minerals. Its utilization is increasing rapidly in recent times. Thallium exhibits higher toxicities in mammalians then lead, zinc, copper, and cadmium (Jiaet al. 2013)**.** In China from the last 20 years' environmental problems form the **TI** released from the Ti-rich sulfide minerals is becoming a serious concern(Liu et al. 2016)**.** As **TI** pollution is rapidly increasing so its phytoremediation is gaining more and more important in recent years(K. Li et al. 2018). As China is developing very fast so the water scarcity is another serious concern as per capita water availability is very low and unevenly distributed. Ultimately this situation rises the water demand in the country(Jiang 2015)**.** Increasing emissions from the industrial activities (e.g. coal combustion and mining and smelting of ferrous and non-ferrous compounds) lead to an increase the **TI** contents in the environment(Xu et al. 2018)**.** Hazardous effects of different heavy metals have been evaluated but **TI** is usually excluded from this list, despite its extremely toxic nature(Bai et al. 2011). Plasma-mass spectrometry (ICP-MS) can be used to measure the **TI** contents precisely because of its low concentration in the environment, although it is widely distributed in nature. The mean abundance of **Tl** in the Earth's upper crust is 0.75 mg/kg, 0.001–0.25μg/L in groundwater, 0.001–0.036μg/L in lake water, and 0.012–0.016μg/L in seawater. Tl in soil is generally less than 1mg/kg, and it is low to 0.03–0.3 mg/kg in the world edible mineral processing plants (T. Xiao et al. 2012). In China, the ICP-MS technology available for use used just recently but still the **TI** pollution is common due to intensive mining of sulfide minerals e.g. pyrite, Galena, chalcopyrite, etc. In the country, severe **TI** pollution is reported in two major rivers of the Pearl River basin (PRB) in 2010 and 2013(Liu et al. 2017)**.** Nowadays TI is used in the

electronics industry that releases 2000-5000 tons of **TI** per year. However, in the past,**TI** was widely used only as a pesticide or rodenticide (Shen and Yang 2017). Thallium is very toxic to all the organisms e.g. humans and animals than any other heavy metal e.g. mercury, cadmium, lead, copper and zinc. Moreover, its toxicity causes the same symptoms as caused by the malfunction of potassium-associated metabolic disturbance(Yu et al. 2018). **TI (I)** is mobile and more stable and its properties are similar to potassium, in contrast, **TI (III)** seems to be very reactive and can be hydrolyzed under alkaline or neutral conditions and having properties like aluminum(H. Li et al. 2018).

In the areas contaminated, concentrations of **TI** near the coal burning mineral processing plants or coal mines were not very high as compared to the wastewater samples collected from the same location(Belzile and Chen 2017)**.**Rapid industrialization and urbanization in the last two years cause great heavy metal pollution in urban and agricultural soils and it's becoming a serious concern for the authorities(Wei and Yang 2010)**.**

Zebra fish(Daniorerio), whose genome is closely related with the human genome and considered a model organism for research due to its small body, fast growth and breeding ability(Song et al. 2018). As thallium is considered toxic element so it imposes very strong toxicity to this fish and other mammals than any other heavy metal. This metal can pollute the environment by means of smelting, combustion and other anthropogenic activities. Thallium is found in two chemical states e.g. **(TI^{+})** and **(TI^{3+}),** However, thallium **(TI^{+})** is considered as water-soluble other two thallium compounds(Chen et al. 2017)**.**

According to an estimated round, about 1.3 billion people smoke 10 cigarettes every minute in the world. The health problems related to tobacco smoking are mainly due to the presence of toxic chemical compounds. Interestingly, more than 4000 chemicals have been identified and isolated from the tobacco including (hydrocarbons, ketones, aldehydes, and aromatic hydrocarbons) and these contain different heavy metals including cadmium, lead, and arsenic (Karbowska and Zembrzuski 2016)**.**Higher toxicity of these compounds can cause chronic poising in the human body and severe nerve damage. It can also cause hairs loss, teratogenicity, hair loss, mutagenicity, kidney/liver failure(Cui et al. 2005)**.**

In May 2016, the state held a symposium on the "13th Five-Year Plan" for heavy metal comprehensive demonstration zones and demonstration basins. Lingbao City made a relevant report as a demonstration platform for heavy metal demonstrations. Heavy metal treatment in the Hongnong River Basin is a national concern is one of the key issues. The results of the Yellow River Committee's monitoring of the section of the Baotou Bridge in the key monitoring section of the national control show that the heavy metal bismuth has exceeded the standard. The pollution problem of the Hongnong River has caused the Sanmenxia Environmental Protection Bureau, the Lingbao Environmental Protection Bureau, the Yellow Committee and the government departments to attach great importance to it. Based on this background, the local environmental protection department commissioned a special study on the pollution investigation and treatment measures of the Hongnongjian River Basin in Lingbao City.

1.1 Current situation of Thallium Pollution in China :

The experienceworth of Thallium **(TI)** in the environs is comparativelylow;therefore it consumes not been sufficientdevotion. Since it profits a lengthy time to rotationplusimproves in the environment (commonly 20~30a), in the method of sourcegrowththenoperation, the difficult of contamination is often ignored.For instance, a significant water formation in significant China, the **Han River**must reinforce water value monitoring and handling in instruction to confirm the tolerabledevelopment of crisis and joinedparts(S. Li et al. 2009)**.**Attractivecharacteristicunits of dominant and inferioramounts of the **Han River**by way of the study space(S. Li et al. 2008).

Dongjiang River Sink in Southeastern China,the drop of river water worthoutstanding to untenableanthropological activities has convertedimportant environmental anxiety. Anthropogenic actions are straightproduced in terrestrialcustomfeatures.The **Dongjiang River** (22°21′–25°12′N, 113°04′–115°50′E) is one of the three keybranches of the Precious object River in southern China. It creases after the Xunwurepublic in Jiangxi areaas well asmovementaddicted to the Pearl River inletafter northeast to southwest(Ding et al. 2015).

The **Shenzhen River** is situated in a quickly urbanizing seasideprovince of Southeast China plusformulas the manageriallimitations Shenzhen City as well as Hong Kong. The entire catchment part of the Shenzhen River is 312 km^2.The River is a characteristic tidal river beside is 14 kmextended. The key river drains southwest into BottomlessInlet, which joins the Pearl River inlet on its seaward lateral. The large quantity of manufacturing wastewater covering strontium cutting-edge the Shenzhen River has produced a large quantity of superficial water much satisfied in certainsubdivisions(Qin et al. 2014)**.**

Water quality in **the Jinshui River** of the **South Qinling Mts**., China Regular river system in the South Qinling Mts., China. The logicalconsequencesdesignate that popularprecipitation of the South Qinling Mts., river water excellence is chieflyprejudiced through natural inland release and farmingexcessafter the wornplot. These consequencesoffer a root for organicrenewal and safety of river environments now the South

Qinling Mts., then a locationmeant for the central way of South-to-North Aquatic Transfer SchemeChina(Bu et al. 2010)**.**

The water capitals in Beijing mustcertain the wealththan the growth of the urban to this idea, the fee of overexploitation has caused in the important fifth of the setting and ecosystems. In exact, streams are aerationawake and the pulverized is dropping in particular extent. Bestowing to examinationgrades, the spoilt area exceeds 5,980 km^2, around one-third of the city's part(J. Wang et al. 2015)**.**

Though, by the growth of removal, metallicmelting, besides the biochemical industry, bigquantities of **Tl** is unceasinglyfreehooked on the environment resultant in thoughtfullocal**Tl**effluence. For example, it remainedstated that release of removallittersplus smelter wastewater was answerable to mustinstigategrave**Tl** contamination of **Beijiang River** (0.18–1.03 μg L^{-1}) and **Xijiang River** (0.22–0.40 μg L^{-1}), branches of Nugget River in Southern Fine China (Xinhua Newscast Agency, 2010, 2013). These two thoughtfulcontaminationchances have stimulatedcommunityanxietiesaround**Tl**contaminationcutting-edgePorcelain(Huang et al. 2018).By way of a significant water font in dominant China, the **Han River**mustreinforcerivervalueintensive care and running in the direction to confirm the workableprogress of watershed also related areas.Due to the environmental pollution caused by the development and utilization of **strontium mercury (Hg)** near the Han River; there have been two large-scale poisonings in the area. Many people have died of sputum poisoning(X. Xiao et al. 2015)**.**

The **Songhua River** Basin is one of the biggest river basins in China, which consists of Nen River, Second Songhua River, and Songhua River. The sinkpart is 556,800 km^2 and the leading stream spans 2,308 kmextended, cutting-edge the north-eastern areaof China. The rivers are the main freshwater source for businesses, farmhouses, and billions of populaceslengthways their growths(Y. Li, Xu, and Li 2009).The drainage expanse of the **Dongjiang River** is roughly 35,340 km^2; also the core river canal is 562 km length of around 0.039%. The Dongjiang River basin has a subtropical monsoon climate, with an annual average temperature of 21 °C and mean annual precipitation of approximately 1800 mm. The nastyyearexcess of the sink is about 296 ×10 $8m^3$(Zhou, Wu, and Peng 2012)**.**

The **Yangtze and Ganga** these two rivers mustsomestrikecomparisons. Chief oftogether withremains of inordinate ranktowardtheir nation-wide economies. The Yangtze inningsdid onthroughpopulace equal to 39% of China's entirepopulace; the joinGDP of these parts accounts for around 40% of China's total GDP. The Ganga establishes 25% of India's continent, donatesabout 30% of wholeobtainable aquatic in India (Ganga River Basin Environment Management Strategy [GRBEMP] Short-term Report, 2013), theropes 43% (as per Survey 2001) of its populace(Y. Wang et al. 2016)**.**

The problem of pollution has become more prominent in most parts of southern China, and there are many related studies and reports. The Lingbao City Hongnong River is located in the central part of China. There are related studies on heavy metals such as mercury and arsenic in the Hongnong River. However, there is no relevant research on the pollution of the Hongnong River.

II. RESEARCH CONTENT AND TECHNICAL ROUTE:

2.1. Research purposes

The Yellow River is an important drinking water source for the Chinese. If the Hongnong River enters the Yellow River, if it exceeds the standard, it will cause immeasurable harm to the environment and the human body. The section of the Hongnong River in Lingbao City is a heavy metal country in the key areas of the country. Control the section, so the water quality of the Yellow River must be guaranteed. In order to understand the pollution status of the Hongnong River basin in Lingbao City, improve the quality of the water environment, ensure the safety of the water ecological environment of the Sanmenxia Reservoir and the Yellow River, and promote the sustainable development of the society, economy, resources and environment of Lingbao City, and safeguard the people's body. Health, the research topic is determined. The purpose and significance of this research include the following aspects.

(1) The purpose of this study is to conduct an in-depth investigation of the current pollution status of the Hongnong River in Lingbao City.

2.2. Research content

2.2.1. Investigation on pollution status of Hongnong River

The research on pollution status of Hongnong River in Lingbao City mainly through field investigation, collecting of relevant monitoring results of environmental protection departments and water conservancy departments. The conducting investigations of key polluting enterprises and mainly monitoring the import and export of sewage outlets and sewage treatment mineral processing plants. Water quality monitoring and analysis of the section to understand the pollution status of the Hongnong River.

2.2.2. Research Technology Route

Before conducting the research of this thesis, first consult the literature to understand the physical and chemical properties, pollution characteristics and research status at home and abroad. On this basis, collect a large number of relevant information on water conservancy and environmental protection departments, and learn about Hongnong basin through on-site investigation and research. The river mainly pollutes the source of pollution, and then conducts sampling and monitoring at different monitoring points and monitoring sections to understand the current pollution situation of the Hongnong River

III. STUDY THE STATUS OF MANTLE POLLUTION:

3.1. Investigation on industrial sources of pollution in Hongnong River

Since April 2016, the industrial enterprises on both sides of the Hongnong River Basin in Lingbao City have been thoroughly investigated and the following results have been achieved. The distribution of enterprises in the Hongnong River Basin, the distribution of monitoring points, the distribution of sewage treatment mineral processing plants, and the discharge of wastewater from wastewater treatment mineral processing plants into sewage treatment mineral processing plants are shown in Table 3. 1.

The Thallium **(TI)** pollution of Hongnong Weihe in Lingbao City is mainly caused by the wastewater discharged by industrial enterprises in Lingbao City. The survey results of industrial enterprises around Hongnong River show that the main enterprises around Hongnong River in Lingbao City have 29 The industrial wastewater generated by 26 enterprises has no efflux, and its wastewater reuse rate has reached more than 70%. The remaining part of the wastewater is recycled into the tailings pond. The wastewater generated by the three enterprises is reused after treatment and reused. The remainder is discharged directly into the sewage treatment mineral processing plant. The statistical results of the industrial pollution sources of Hongnong River are shown in Table 3. 1.

Table 3.1 Statistics of industrial pollution sources in Hongnongjian basin of Lingbao City

Number	Company Name	Industry	Industrial wastewater production (t/d)	Recycling rate	Industrial wastewater
1	Lingbao Gold Co., Ltd. Nanshan Branch Yuxin Mineral processing plant	Gold mining	2500	70%	
2	Lingbao Gold Co., Ltd. Nanshan Branch Gunma Second Selection Mineral processing plant	Gold mining	1140	80%	
3	Lingbao Gold Co., Ltd. Nanshan Branch Gunma First Selection Mineral processing plant	Gold mining	2500	70%	
4	Lingbao Jinyuan Holdings Co., Ltd. Xinbao Branch	Gold mining	1500	70%	
5	Lingbao Jinyuan Chenguang Nonferrous Mining and Metallurgy Co., Ltd. Pyrite Branch	Sulfur iron mining	8000	70%	
6	Lingbao Huaiyi Mining Co., Ltd.	Gold mining	1500	70%	Partially entering the tailings pond, not outside
7	Lingbao Yunfeng Mineral Products Co., Ltd.	Gold mining	1500	70%	
8	Lingfei Mineral processing plant	Gold mining	1500	70%	
9	Zhuyang Town, Lingbao City, Xiaoyan Mineral processing plant.	Gold mining	1500	70%	
10	The newly selected factory in Dongzhai, Sishang Gold Mine, Zhuyang Town, Lingbao City	Gold mining	1500	70%	
11	Lingbao Zhuyang Town Dongzhai Mineral processing plant	Gold mining	500	70%	
12	Lingbao City Zhuyang Town Walnut Ditch Mineral processing plant	Gold mining	1500	70%	
13	Lingbao Zhuyang Town Yuntou Concentrator	Gold mining	500	70%	

14	Lingbao Kaiguang Mining Co., Ltd.	Gold mining	900	80%	
15	Lingbao Zhuyang Town Orchard Iron Ore Mineral processing plant	Gold mining	1500	70%	
16	Lingbao Sishang Gold Mine Comprehensive Processing Factory	Gold mining	500	70%	
17	The second workshop of Huayu Mining Co., Ltd., Zhuyang Town, Lingbao City	Gold mining	500	70%	
18	Lingbao Zhuyang Town Yingli Mineral processing plant	Gold mining	500	70%	
19	WumuZhuang Mineral processing plant	Gold mining	500	70%	
20	Lingbao Jinkai Mining Engineering Co., Ltd. Oak Store Selection Mineral processing plant	Gold mining	900	80%	
21	Lingbao City Gold Investment Co., Ltd.	Ore-dressing	1500	70%	
22	Lingbao Xintai Mining Co., Ltd.	Ore-dressing	2400	70%	
23	Lingbao Xinghua Chemical Co., Ltd.	Chemical industry	1200	70%	
24	Lingbao Jinyuan Mining Co., Ltd. Tonghui Refinery Branch	Gold Smelting	0.08	90%	
25	Lingbao Jinyuan Chenguang Nonferrous Mining and Metallurgy Co., Ltd.	Gold smelting, phosphate fertilizer manufacturing	3200	70%	
26	Lingbao Huaxin Copper Foil Co., Ltd.	Non-ferrous metal copper processing	430	75%	
27	Lingbao Gold Co., Ltd.	Gold Smelting	7200	70%	Reuse of remaining parts into sewage treatment
28	Lingbao Kaiyuan Mining Co., Ltd.	Lead Smelting	70	100%	
29	Lingbao Xinling Lead Industry Co., Ltd	Smelting	400	70%	

Since the wastewater discharged into the sewage treatment mineral processing plant will be directly discharged into the Hongnong River after treatment, Lingbao Gold Co., Ltd., Lingbao Kaiyuan Mining Co., Ltd. and Lingbao Xinling, which are discharged into the sewage treatment mineral processing plant, will be discharged. Further investigation and analysis were carried out on the industrial wastewater generated by Lead Industry Co., Ltd. and the Thallium **(TI)** content in wastewater.

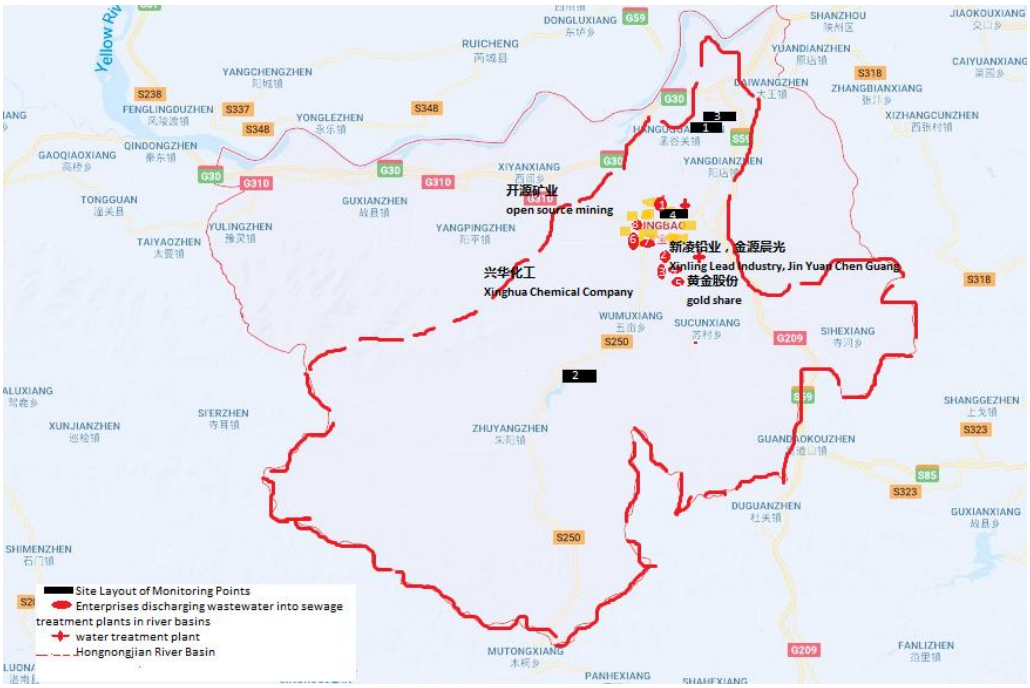

Fig 3.1Hongnongjian river basin of Lingbao City

3.2. Lingbao Gold Smelting Co., Ltd.

Lingbao Gold Co., Ltd. mainly uses gold concentrate as the main raw material for production. The main products produced are **gold, silver,** electrolytic **copper (Cu)** and industrial **sulfuric acid(H_2SO_4)**. The industrial wastewater generated by Lingbao Gold Co., Ltd. mainly includes acid-making system cooling water, cyanide wastewater, and acid leach extraction process acid wastewater, flushing floor water, and refining wastewater. The wastewater production process and treatment measures are shown in Table 3. 2.

Table 3.2 Location and treatment measures of industrial wastewater

Number	Product link	Major pollutant	Governance measures	Industrial wastewater
1	Cooling water for acid mineral processing plant	**COD、SS**	Circulating water tower recycling, regular sewage	Partial reuse, part of the discharge to the sewage pipe network
2	Cyanide wastewater	**COD、As、Cd、Zn、CN、Cu、Pb**	Returned to the roasting leaching process after being treated by the sewage treatment station, not discharged	Reuse
3	Acid leaching extractor	**COD、petrol、As、Cd、Zn、Cu、Pb、TI**	Wastewater treatment station	80% returned to the production process, 20% discharged into the sewage pipe network
4	Flush floor water			
5	Refined wastewater	**Pb、Zn**	Wastewater treatment station	Discharge into the sewage pipe network

At present, the process of the First second and third branches of the company is basically the same. The wastewater discharge port has a west discharge channel of the mineral processing plant, the amount of discharged sewage is 3500392t/a; the discharge of the external drainage after treatment by the wastewater treatment station is 2059200t/a; The discharge of sewage from the east discharge channel of the mineral processing plant is 816788t/a. The heavy metal bismuth is mainly found in the acidic wastewater of the acid leaching extraction process and the flushing floor water. After field investigation and monitoring, Lingbao Gold Co., Ltd. has heavy metal bismuth every year. The emission is 30kg.

3.3. Lingbao Kaiyuan Mining Co., Ltd.

Lingbao Kaiyuan Mining Co., Ltd. is located in Wulong Industrial Park in the north of Lingbao City. It mainly uses gold concentrate as the main raw material for production. The final products are gold, silver, electrolytic copper and industrial sulfuric acid. The industrial wastewater generated by Lingbao Open Source Mining Co., Ltd. mainly includes cyanide wastewater, acid leaching process acid wastewater, and flushing floor water. The wastewater production process and treatment measures are shown in Table 3.3.

Table 3.3The location and treatment of industrial wastewater of Kaiyuan mining Co.Ltd

number	Product link	Major pollutant	Governance measures	Industrial wastewater
1	Cyanide wastewater	**COD、As、Cd、Zn、CN、Cu、Pb**	Cyanide-containing wastewater treatment station	Partial reuse, part of the discharge to the sewage pipe network
2	Acid leaching extractor Sequential acid wastewater	**COD、Petro、As、Cd、Zn、Cu、Pb、TI**	Wastewater treatment station	80% returned to the production process, 20% discharged into the sewage pipe network
3	Flush floor water			

At present, Lingbao Open Source Mining Co., Ltd. finally discharges into the municipal pipe network through the total discharge of the mineral processing plant area, which is about 182,952 m3/a. Heavy metal **plutonium** is mainly found in acid leaching and acid washing wastewater in the acid extraction process. The company's annual discharge of heavy metal bismuth is about 1.5kg.

3.4. Lingbao Xinling Lead Industry Co., Ltd.

Lingbao Xinling Lead Industry Co., Ltd. is a high-tech enterprise in Henan Province, which is mainly operated in Chengnan Industrial Zone of Lingbao City. The company's main products are electrolytic lead and sulfuric acid. The production process can be roughly divided into a crude lead smelting system and an electrolytic lead system according to the output products. The industrial wastewater of Lingbao Xinling Lead Industry Co., Ltd. mainly includes desulfurization wastewater and lead electrolysis plate flushing water. The wastewater production process and treatment measures are shown in Table 3.4.

Table 3.4 The location and treatment of wastewater of Lingbao Xinling lead industry Co.

Number	Product link	Major pollutant	Governance measures	Industrial wastewater
1	Desulfurization wastewater	**H_2SO_4、TI**	Sewage treatment station	Discharged to the sewage pipe network after treatment
2	Lead electrode plate washing wastewater	**Pb、Ag**	/	Rinse the solution into the electrode bath for recycling

After the industrial wastewater generated by the company is treated by the sewage treatment station, it is discharged into the municipal pipe network through the total discharge port of the mineral processing plant. The water volume is about 54000m3/a. The discharge of heavy metal strontium is mainly generated in the desulfurization wastewater. The survey data shows that the annual spirit the emission of heavy metal bismuth from Xinling Lead Industry Co., Ltd. is about 0.023kg.

3.5. Status of water pollution in Hongnong River

3.5.1Status of water quality in the outlets of industrial enterprises

The mining industry and the smelting industry are the pillar industries of Lingbao's economic development. The development is very rapid, but the environmental problems brought by it have also attracted people's attention. In order to more accurately determine the number of pollutants discharged by enterprises, the research is mainly on the west discharge channel of Lingbao City Gold Co., Ltd., the branch of Lingbao City Gold Co., Ltd., and the third outlet of Lingbao Gold Co., Ltd. City Gold Co., Ltd. sewage treatment facility discharge port, Lingbao City Kaiyuan Mining Co., Ltd. sewage outlet, Lingbao Xinling Lead Industry Co., Ltd. sewage outlet monitoring points. The monitoring data of enterprises involved in heavy metal antimony emissions are shown in Table 3.5.

Table 3.5the monitor data ofcompanies that emit thallium

Sampling point	Sewage flow rate (m3/a)	Monitoring section concentration (mg/L) during the flat water period	Monitoring section concentration (mg/L) during the wet season
Lingbao City Gold Co., Ltd.	3500392	0.00384	0.00421
Lingbao City Gold Co., Ltd.	816788	0.00306	0.00267
Lingbao Gold Co., Ltd. discharge port	2059200	0.00729	0.00740
Lingbao City Open Source Mining Co., Ltd.	182952	0.00894	0.00913
Lingbao Xinling Lead Industry Co., Ltd.	54000	0.00042	0.00048

It can be seen from Table 2-5 that the concentration of heavy metal ruthenium in wastewater of sewage enterprises is very high compared with water bodies, so it is necessary for enterprises involved in the discharge of heavy metal lanthanum. On the whole, the monitoring data in April 2017 and July 2016 did not have much fluctuation. This may be due to the fact that the company did not carry out large industrial restructuring, and the production process and the amount of sewage discharged per month remained basically unchanged. The concentration of **TI** in Lingbao Gold Co., Ltd. during the flat water period was larger than that in the high water period. This may be due to the transformation of the overflow pipe section in the electric copper section of the water treatment mineral processing plant, which improved the adsorption capacity of the carbon adsorption tank. The monitoring data of heavy metals in Lingbao City Kaiyuan Mining Co., Ltd. has significantly decreased during the period of the flood season. According to the current situation, the company has recently updated the aging cyanide-containing wastewater treatment pipeline, and the treatment effect has been significantly improved. The monitoring concentration of heavy metal strontium in Lingbao Xinling Lead Industry Co., Ltd. during the wet season and the normal water period has not changed. Compared with the enterprises, Lingbao Kaiyuan Mining Co., Ltd. has the highest concentration of heavy metal bismuth, Lingbao Gold Co., Ltd. is the second, and Lingbao Xinling Lead Industry Co., Ltd. has the lowest. The reason may be gold. The concentration of heavy metals **TI** is also different due to different raw materials and different water consumption in the smelting industry and the lead smelting industry.

3.6. Status of water quality in sewage treatment mineral processing plants:

The remaining part of the wastewater reuse of industrial enterprises involved in heavy metal **TI** emissions needs to be treated by the sewage treatment mineral processing plant, and the treated wastewater will be discharged into the Hongnong River. Therefore, the sewage treatment mineral processing plant needs to constantly monitor the concentration of heavy metal ions and determine the discharge of pollutants. the amount. The monitoring data of heavy metal cesium in sewage treatment mineral processing plants are shown in Table 2-6 below.

Table 3.6. Water quality monitoring data of sewage treatment mineral processing plants

Table 3.6The monitor data of companies that emit thallium

Sampling point	**Sewage flow sewage (m3/a)**	**Monitoring section concentration during the flat water period(mg/L)**	**Monitoring section concentration during the wet season(mg/L)**
Sewage treatment mineral processing plant import	20440000	0.001510	0.001590
Sewage treatment mineral processing plant export	18350000	0.000630	0.000700

It can be seen from Table 2-6 that the enterprise wastewater involved in the discharge of heavy metal ruthenium enters the municipal pipe network and finally flows into the sewage treatment mineral processing plant. After treatment by the sewage treatment mineral processing plant, the content of heavy metal lanthanum is significantly reduced. In the flat water period, the wastewater treatment mineral processing plant enters and exits the heavy metalthallium **(TI).** The concentration is significantly lower than the flood season because the

pollutant discharge enterprises have adopted certain energy-saving and emission-reduction measures to reduce the emissions of heavy metal bismuth.

3.7. Status of water quality in key monitoring sections

The key water quality monitoring sections of the survey include the section of the Potou Bridge, the 500 meters before the entrance of the Hongnong River into the Yellow River, the 3000 meters before the Hongnong River into the Yellow River, and the water intake of the standby water source. The section of Potou Bridge is the key monitoring section of the national control. The spare source of water is the basis for the survival of Lingbao citizens. The water quality of the Hongnong River into the Yellow River has an important impact on the water quality of the Yellow River. Therefore, the section of the Potou Bridge and the Hongnong River the 3,000 meters before into Yellow River, the 500 meters before the Hongnong River into the Yellow River, and the monitoring points of the alternate water source intakes play an important role in understanding the water quality of the Hongnong River. As the last barrier to enter the Yellow River, the section of the Potou Bridge is in the water pollution action plan. The assessment is limited to reach the Class IV water quality target before the end of 2017, and the water quality is not lower than Class IV from 2018 to 2020. The installation of monitoring sections in the section of the Potou Bridge is also necessary for the management of water quality management. The water quality of the key monitoring sections is shown in Table 3.7.

Table 3.7 The monitor data ofcompanies that emit thallium

Sampling point	Monitoring section concentration during the flat water period(mg/L)	Monitoring section concentration during the wet season(mg/L)
sloped bridge section	0.00052	0.00053
Hongnong River reaches 3000 meters in front of yellow river.	0.00063	0.00067
Hongnong River is 500 meters before entering the Yellow River	0.00007	0.00007
Spare water source	0.00007	0.00007

It can be seen in Table 3.7. that the current water quality of the slope head bridge in the flat water period and the flood season cannot meet the standard limit of the heavy metal bismuth specified in the Surface Water Environmental Quality Standard (GB3838-2002) is 0.0001 mg/L. The water content of heavy metal strontium in the water quality of 3000 meters before entering the Yellow River mouth exceeded the limit of surface water environmental quality standard. At the 500 meters before the entrance to the Yellow River and the water source of the standby water source, the water quality monitoring results meet the standard requirements, indicating Lingbao City. The government and relevant departments have good control over the pollution of the Hongnong River, the key monitoring section of the Hongnong River, 500 meters before the entrance to the Yellow River and the water intake of the standby water source, which can guarantee the safety of people's living and drinking water, but in the national control monitoring section of the Potou Bridge The cross-section and the water quality in the water 3000 meters before the entrance to the Yellow River are still not up to standard, and it is necessary to further strengthen the management of coastal industrial enterprises and unwanted waste.

3.8. Conclusions and prospects:

This study mainly takes the Hongnong River in Lingbao City as an example to investigate the pollution sources of enterprises in Lingbao City, focusing on the investigation of gold smelting companies, open source mining and Xinling lead industries involving heavy metal emissions. The water quality of the sewage treatment mineral processing plant, the water quality of the key monitoring sections, and the analysis and testing of the water quality of the key monitoring sections, to understand the status of heavy metal **TI** pollution in Hongnong River

The main findings are as follows:

The study showed that Lingbao Gold Co., Ltd, Xintai Mining Co., Ltd, Lingbao Zhuyang Town Orchard Iron Ore Mineral processing plant, Open Source Mining and Lingbao Xinling Lead Industry hold heavy metal **TI** which issettled by way of industrial wastewater. The monitoring results of external drainage from these industries point out the heavy metal **TI** contented that is going to the maximum level about 0.0003 mg/L to 0.0001 mg/L of surface water quality standard, and dirt the water quality of yellow river by the discharge of

heavy metal **TI**, which is discharged from the treatment mineral processing plants that is realised more than the standard of government legislation about water quality. This part of water is needed to intensive care of key monitoring section from **2500m** to **3000m** before the entrance of the **Yellow River**, 500m before the entrance of the Hongnong River and Yellow River. In adding to the water intake of the fall-back water source in the calculation to the water quality than 500m before entering the Yellow River. The Popular calculation of water quality and other sections has increased the standard of changing the degrees of water.

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