

Protection and Recovering Plans of Water System in Datian County, Fujian Province, China*

LIN Yumei

Environmental Monitoring Station of Datian, Fujian, 366100

Abstract: *With the reform and opening to the outer world, Datian has become a new industrial county from an agricultural one. With the development of industry, most of the waste water from the factories, families, farms is poured into the river without being disposed. The water in the county is being polluted. Mining in large scale and the cutting down of forests has caused soil erosion and destruction of the water system. In order to harmonize the economic development and the environment, this essay will make comments on the destruction of the water system in the county of Datian caused by the pollution and soil erosion, and put forth some protection measures and recovering plans.*

Keywords: *River, Water System, Protection, Recovering Plans*

1. Water system in Datian County

Datian County is crisscrossed with rivers and canals. The rivers in the county flow into the Minjiang River, the Jiu Longjiang River and the Jinjiang River respectively. The Junxi River is the largest that runs through the county. It is 81.7 km long, with a drainage area of 1 271.2 km².

2. Assessment on the water system

2.1 Investigation for the water system

Many investigations had been made for the surface water system in Datian County. Monitoring was emphasized on the point pollution sources, such as for the Paper Factories, the Iron Factory, the Brewery, the Sulphur and Iron Factory, the Textile Mills and the Forestry Chemical Plant. The results of the analysis on the surface water quality are shown in Tab.1.

2.2 Assessment on the water system

2.2.1 Before the factories were built

In 1975, before the factories mentioned above were built, around the county, mountains were

* Received 1997-02-25; accepted 1998-03-27.

green, and the rivers were luxuriant with plants and living things, such as fishes, shrimps, turtles, shellfishes, snails, aquatic plants and so on. About 50 % of the drinking water of the villagers were from the river.

2.2.2 After the factories were built

From 1975 to the 80s, many factories were built, most waste water from the factories, families, hospitals and farms was poured into the river without being disposed, which did great harm to the water system. The aquatic creatures and plants were gradually destroyed, and the water system lost its ecological balance. The water in the part of the county could not be used. About 30 hm² farm land was left uncultivated.

2.2.3 Analysis of the water quality in the county

The upper reaches of the Junxi River (from Shipai Bridge to the wastewater outlet of the No. 2 Paper Factories), the pollution is not serious, there are still some aquatic creatures which can tolerate the pollution. the water is still clear. In the middle part of the river (from the waste water outlet of the No. 2 Paper Factory to the waste water outlet of Qianfeng Sulphur and Iron Factory), both sides of the river are red and black in color. The destruction to the water system is obvious. In the lower part of the river (from the waste water outlet of the Qianfeng Sulphur and Iron Factory to Wenzhen Bridge), the water is black and brown. There are foams on the turbid water. The water system is seriously destroyed, and it extends about 3 km.

3. The elements which affect aquatic lives

3.1 The status of the water pollution

The pollution in Datian County is mainly caused by the wastewater from factories, families, hospitals, and farming. In 1995 the wastewater from factories is about 1.3455×10^6 t, including BOD₅ 68.05 t, COD 351.04 t, and SS 1 213. 92 t. The main industrial pollution in Datian County are shown in Tab.1 and Tab.2.

Tab. 1 Main industrial pollution in Datian County, 1995

Factories*	Wastewater 10 ⁵ t/a	Mean Pollutants t·a ⁻¹			Total Output RMB 10 ⁶
		SS	COD	BOD	
No.1 P.F.	51.8	103.5	155.3	61.74	10.64
No.2 P.F.	34.6	83.5	41.20	0.06	19.45
Red Rock P.F.	1.7	19.9	93.42	/	1.65
Datian Brewery	8.2	3 233.6	0.71	/	7.20
No.2 I.F.	29.5	5.8	58.72	5.97	16.2
S.I. Factory	6.0	1 072.8	0.80	/	455.64
Textile Mill	2.8	0.2	0.90	0.28	9.75
Total	134.6	4 519.3	351.05	68.05	520.53

* P.F. -Paper Factory; I.F. -Iron Factory; S.I.-Sulphur & Iron Factory

3.1.1 Assessment on water quality

From the testing results of the surface water in raining, wet and dry seasons in 1995, according to the Surface Water Quality Standards of GB3838-88, we choose the third kind of water as appraising standard. From Chart 3-3 we know that, with the change of the seasons, the concentrations decrease by degrees from Shipai Bridge, Xiaqiao to Wenzhen Bridge.

Tab. 2 The main industrial pollution in Daian County averaged during 1992-1995

Factories*	Concentration (mg·L ⁻¹)								
	PH	SS	COD	BOD5	VP**	CHro	Sul	Ars	Lead
No.1 P.F.	8.00	100.5	156.50	118.91	0.326	625	/	/	/
No.2 P.F.	7.90	4 116.0	22.55	/	0.050	/	0.50	0.068	0.02
Red Rock P.F.	/	720.0	427.56	/	/	/	/	/	/
Datian Brewery	/	316.1	801.38	268.62	0.121	/	/	/	/
Forestry Chem	/	12.1	347.05	150.34	0.05	/	/	/	/
S.I. Factory	6.30	1 852.5	15.60	/	0.05	/	0.50	0.421	0.06
Textile Mill	11.40	126.5	473.00	272.68	0.05	160.5	0.50	/	/

* P.F. -Paper Factory; Forestry Chem. -Forestry Chemical Factory; S.I.-Sulphur & Iron Factory

** VP-volatile phenol, Chro-Chromaticity, Sul-Sulfuret, Ars-Arsenic

Tab. 3 Concentration of pollutants in surface waters in Datian County averaged during 1992-1995 (mg·L⁻¹)

Seasons	Test spots	pH	COD _{Mn}	SS
Raining Season	Shipai Brd.*	7.90	1.81	15.2
	Xiaqiao	7.90	2.36	24.0
	Wenzhen Brd.	7.84	3.53	50.2
Wet Season	Shipai Brd.	8.00	3.91	19.0
	Xiaqiao	7.96	7.88	23.4
	Wenzhen Brd.	7.84	7.13	73.2
Dry Season	Shipai Brd.	8.26	0.97	29.0
	Xiaqiao	8.01	1.13	62.0
	Wenzhen Brd.	8.50	8.84	91.4

Note: *-Brd.-Bridge. Shipai Bridge is on the upper part of the River. Xiaqiao is on the middle part, and Wenzhen Bridge is on the lower part. The items during the raining and wet seasons are not up to the third class of water standard of GB3838-88. During the dry seasons, the density of permanganate in Wenzhen is higher than the third class of water standard. It is just up to the V class standard. The density of permanganate is 3 to 4 times higher than that in upper reaches. In Xiaqiao, the

density of SS is larger than 20 mg·L⁻¹ in all seasons. In dry seasons, it is over 60 mg·L⁻¹. In Wenzhen Bridge, the density of SS is larger than 50 mg·L⁻¹ in all seasons, In dry seasons, it is even over 90 mg·L⁻¹. The industrial output of SS is 0.22 times higher than the 3rd Class of water quality.

Most of the wastewater from the factories and families in the county is poured into the river before it is treated. It makes the river very dirty. Before the No. 2 Paper Factory was built, in the five villages, from the spot where the wastewater is poured from the factory, to Hua'an Village, 50% of the villagers' drinking water is from the river. But now the water from the river is no longer suitable for drinking. And because of the pollution, about 30 ha of farmland are left uncultivated. The pollution not only affects the agriculture and people's life, but also aggravates the water shortage. It has become one of the main restricting factors for the economic development of

the county.

3.1.2 Types of water pollution in the Junxi River

In accordance with the characteristics of the river, there are two types of pollution---chemical pollution and physical pollution.

(1) Chemical pollution:

Main pollutants are COD, BOD₅. When these organic substances decompose in the water, they need a large amount of dissolved oxygen, which destroys the balance of oxygen in the water, reduces the water quality, causing the death of fishes and other aquatic lives and plants.

(2) Physical pollution:

Turbid and dark-colored water with high concentration of suspended substances show the characteristics of this kind of pollution. Foams on the surface of the water are increasing, preventing sunshine getting into the water, which causes breathing trouble to the creatures with gills. And the tiny grains of inorganic substances from the factories may strike the sells of aquatic plants, threatening their existence.

3.2 The present situation of soil erosion

With the economic development, increase of population, extracting of minerals, more and more basic constructions, especially road building, house building, cutting down of forests, now the forest coverage is becoming smaller and smaller, which causes serious soil erosion. Trees and plants are being destroyed, function of the mountains to conserve water is becoming weaker and weaker, The flow of river changes greatly with seasons, and in dry seasons, water quantity reduces greatly, which to some degree reduces the ability of river to carry away the pollutants.

The soil erosion in the countryside of Datian County is shown in Tab. 4.

Tab. 4 Land loss in Datian county in 1995

Items		Whole County	Junxi Town
Destruction of vegetation cover (1 · hm ⁻²)	Mining, construction	10 222	1 408
	Agricultural Exploitation	10 400	850
Geomorphologic destruction	Area (1 · hm ⁻²)	8 228	1 294
	Volume (10 ⁴ t)	1 623.23	118.7
Piling up earth	Area (1 · hm ⁻²)	7 000	1 096
	Volume (10 ⁴ t)	1 087.1	87.5
Collapse	Places	472	80
	Volume (10 ⁴ t)	26.6	10.8
Into cultivation field	Volume (10 ⁴ t)	220.25	22.7
Destruction of forest	Area (1 · hm ⁻²)	47 705	1 277

4. Protection and recovering plans for the water system.

4.1. Plans and measures to get rid of the pollution

Protecting the water system, recovering the functions of water system is our main task in com-

prehensive management. COD, SS, BOD₅ are the main pollutants. So the most important thing to do is to control the pollutants, especially the pollutants from the paper factories and dressing plants, to clear the water of the Junxi River in the county.

4.1.1 Controlling the pollutants

We should strengthen the controlling of the pollutants, improving the abilities to cure the pollution, carry out the measures to control the amount of the pollutants by using the comprehensive means to test the density and the amount of pollutants. We adopt the license system which permit the factories to put out a limited amount of pollutants, bring pressure to bear on the factories to settle down the problems of the pollution in a given time. Dam the river in order to control the pollution, Step by step, the river will be made clear again. The plans of controlling the pollution have been made.

4.1.2 Improve the efficiency of the wastewater treatment equipment

To supervise the use of the equipment and to improve their efficiency are of great importance. It is planned to strengthen the construction of environmental monitoring stations, to improve the ways of monitoring, to introduce the environmental laws to people and to improve the techniques of comprehensive controlling.

4.1.3 Recycling the wastewater

The technique for recycling the wastewater is an effective way to solve the problem of water shortage. At the same time, as more and more wastewater is reused, less and less wastewater flows into the river. It plays an important role in reducing the pollution of the rivers. The water recycling projects for decreasing the main resources of the pollution have been made in the county.

4.1.4 Controlling the domestic wastewater

The domestic wastewater in the Datian County is about 4 200 tons per day. The main pollutants in it are BOD₅, COD and SS, detergents, bacteria, etc. Our task is gradually stopping using the detergents containing phosphorus, introducing to people the detergents containing no phosphorus, and building a waste water treatment plant which can treat about 5 000 tons of domestic wastewater. By using the wastewater treatment devices, we can improve the water quality, and the recycled water can be used to wash toilets.

4.1.5 Harnessing the agriculture wastewater

Technology for rational irrigation and application of fertilizer must be popularized in the agriculture. To heighten the utilization ratio of the fertilizer is the main measure for harnessing the agriculture wastewater.

4.2 Prevention and control of soil erosion

Open mining and destroy vegetation are the main reasons of soil erosion. The important measure is to give an effective administration in the mining area for preventing the informal mining. Secondly, we must protect the vegetation and promote forestation bring the affect of vegetation on conservation of water and soil from erosion.

4.2.1 Planting eulalyptus along the banks of Junxi River

Eulalyptus grow very fast. They have great economic value. Planting along the river banks of Junxi River, it can improve the ecological balance as well as prevent soil erosion.

4.2.2 Planting bamboo on the barren mountains along the roads

Bamboo has a strong life. It grows very fast and has economic value. It can make the barren mountains green again in short period and keep ecological balance in the area. The plans of planting bamboo have been drafted.

4.2.3 Resuming the vegetation of the mining slash

Massonpine and some suitable species of fruit trees may be planted on the remained area of mining slash. It not only can maintain soil and water but also increases the revenue. Many economic plants can be planted, for instance, reed, elephant-root grass, glossy privet, shrub, chin berry. These plants grow fast and have a flourishing root system and big biomass. There fore, it is suggested to the mining administration unit to plant tree and grass, and to resume the vegetation for controlling soil erosion.

4.2.4 Establishment of ecology protection areas

The areas along the river banks, and around the reservoirs are regarded as the water conservation areas. The cultivated land on the slopes, the wasted land with soil erosion and the mining areas are regarded as potential water conservation areas and forestry areas. The mountains around the towns and in the county are regarded scenery spots. We should establish ecology protection areas, and plant trees in these areas. Farming in these areas. Anything that will do harm to the trees is forbidden in these areas. Entry to these mountains without permission is forbidden too. By doing so, we can improve the functions of the mountains for conservancy of water and prevention of soil erosion.

4.3 Restoration of aquatic plants and other creatures in Junxi River

Fishing in Junxi River is not allowed. While preventing wasted water from flowing into the river, we should restore and keep some aquatic plants and other creatures in the surface waters, such as fishes, shrimps, shellfishes and so on, try to restore its ecological balance as soon as possible.

5. Conclusions

5.1 The efficacious measures for resuming the water functions may be listed as follows:

- * To increase the investment of environmental protection;
- * To increase the working efficiency and handle efficiency of the environmental protection installation;
- * To put into practice the policy of total amount control of contaminant in the area;
- * To give more effective controlling and monitoring work to the contaminate source;
- * To force the administration of the environment legal system.

5.2 Pay more attention onto the protection of the vegetation, and prohibiting pick stone, mine and soil without permission. Carry on the comprehensive control of the mountains, the water, the field, the forest, the roads, persisting in combining with the economic development, environmental protection and ecological benefits.

References

Li, Yonghan. 1993. Fresh Water Biology. High Education Printing House, Beijing.

