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The Influence of Marine Current to Cd in Jiaozhou Bay

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Abstract: Based on the investigation data on Cd contents in surface waters in Jiaozhou Bay in April, July and October 1985, we analyzed the content, pollution level, distribution and source of Cd. Results showed that Cd contents in waters inside the bay and in the bay mouth were 0.01-0.94 μg L^{-1}, and were meeting Grade I in Chinese Sea Water Quality Standard for Cd (1.00 μg L^{-1}), indicating that the pollution level of Cd in waters inside this bay was very slight in 1985. However, Cd contents in the open waters outside the bay were 0.38-6.48 μg L^{-1}, and were meeting Grade I to III, indicating that the pollution level of Cd in open waters and the bay mouth of this bay was moderate in 1985. The major souces of Cd were marine current and strem flow, whose source strengths were 6.48 μg L^{-1} and 0.75-0.94 μg L^{-1}, respectively. In generally, the stream flows had not been polluted by Cd in 1985, yet the open waters had been moderately polluted by Cu.

Keywords: Cd, Distributions, Sources, Pollution level, Marine current, Jiaozhou Bay

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1. INTRODUCTION

Cd is one of the widely used heavy metal elements in industries. However, Cd is also one of the most critical heavy metal elements due to the high toxicity. A large amount of Cd-containing wastes were generated along with the rapid increasing of industry. The marine environment is finally polluted by Cd since ocean is the sink of various pollutants [1-2], and the pollution of marine environment could finally be harmful to human beings by means of food chain, e.g., the Itai-itai disease in Japan.

Hence, it is necessary to understanding the pollution level and sources of Cd in the marine environment [3-7]. Jiaozhou Bay is a semi-closed bay located in Shandong Province, eastern

China, and has been polluted by various pollutants. Based on the investigation data on Cu waters in different seasons in 1985, the aim of this paper was to analysis the content, pollution level, and sources of Cd, and to provide basis for the research and pollution control countermeasures on Cd.

2. MATERIAL AND METHOD

Jiaozhou Bay (35°55′-36°18′ N, 120°04′-120°23′ E) is located in the south of Shandong Province, eastern China (Fig. 1). It is a semi-closed bay with the total area, average water depth and bay mouth width of 446 km^2, 7 m and 3 km, respectively. There are more than ten inflow rivers such as Haibo Rriver, Licun Rriver, Dagu Rriver, and Loushan Rriver etc., most of which have seasonal features [8, 9].

The data was provided by North China Sea Environmental Monitoring Center. The survey was conducted in April, July and October 1985. Surface water samples in six stations (i.e. 2031, 2032, 2033, 2034, 2035 and 2047) were collected and measured followed by National Specification for Marine Monitoring [10].

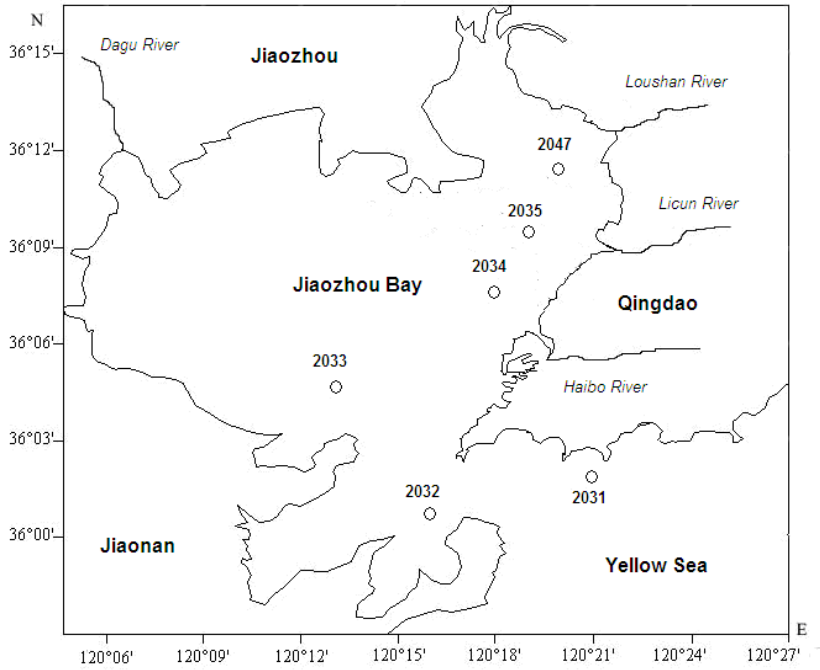

Fig.1 Geographic location and monitoring sites in Jiaozhou Bay

3. RESULTS AND DISCUSSION

3.1 Contents and pollution levels of Cd

Cd contents in Jiaozhou Bay waters in April, July and October 1985 were 0.01-0.94 μg L^{-1}, 0.10-6.48 μg L^{-1} and 0.19-0.95μg L^{-1}, respectively. In according to the guide line of Grade I

(1.00 μg L^{-1}), Grade II (5.00 μg L^{-1}) and Grade III (10.00 μg L^{-1}) for Cd in National Standard of China for Seawater Quality (GB3097-1997), this bay was slightly contaminated by Cd in April and October in 1985, while was moderate contaminated in July 1985 (Table 1). In generally, the pollution level of Cd in this bay was very slight in 1985. However, Cd contents in the open waters outside the bay were 0.38-6.48 μg L^{-1}, and were meeting Grade I to III.

Table 1 The pollution level of Cd in Jiaozhou bay in April, July and October 1983

	April	July	October
Content /μg L^{-1}	0.01-0.94	0.10-6.48	0.19-0.75
Grade	I	I to III	I

3.2 Horizontal distribution of Cd

In April 1985, high value of Cd contents was occurred in Site 2035 in the estuary of Licun River, and there was a high value region around Site 2035. A series of semi-concentric circles were forming and were decreasing from the high value center (1.75 μg L^{-1}) to the bay mouth (0.01 μg L^{-1}) (Fig. 2). In July 1985, high value of Cd contents was occurred in Site 2031 in the open waters outside the bay, and there was a high value region around Site 2031. A series of parallel lines were forming and were decreasing from the high value center (6.48 μg L^{-1}) to the coastal waters in the east of the bay (0.10 μg L^{-1}) (Fig. 3). In October 1985, high value of Cd contents was occurred in Site 2035 in the estuary of Licun River, and there was a high value region around Site 2035. A series of parallel lines were forming and were decreasing from the high value center (0.75 μg L^{-1}) to the coastal waters in the northeast of the bay (0.19 μg L^{-1}).

3.3 Pollution sources of Cd

In according to the horizontal distributions of Cd in surface waters, we found that there were some relative high value regions in different seasons. In April 1985, high value of Cd contents was occurred in Site 2035 in the estuary of Licun River, and there was a high value region around Site 2035, indicating that stream flow was the major source, whose source strength was 0.94 μg L^{-1}. In July 1985, high value of Cd contents was occurred in Site 2031 in the open waters outside the bay, and there was a high value region around Site 2031, indicating that marine current was the major source, whose source strength was 6.48 μg L^{-1}. In October 1985, high value of Cd contents was occurred in Site 2035 in the estuary of Licun River, and there was a high value region around Site 2035, indicating that stream flow was the major source, whose source strength was 0.75 μg L^{-1}. In generally, the major souces of Cd were marine current and strem flow, whose source strengths were 6.48 μg L^{-1} and 0.75-0.94 μg L^{-1}, respectively. The stream flows had not slightly polluted by Cd in 1985, yet the marine current had been moderately polluted by Cd in 1985.

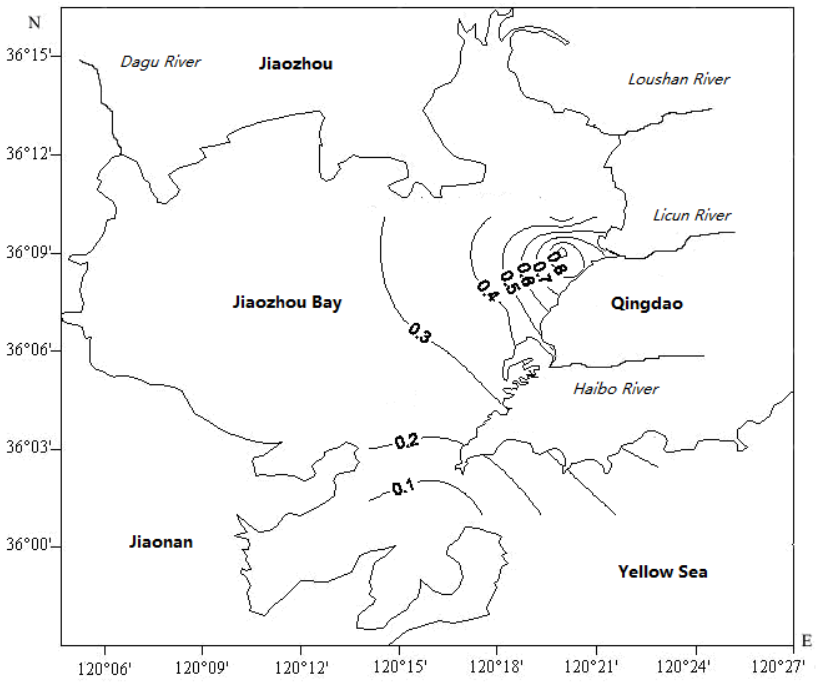

Fig. 2 Distributions of Cd in surface waters in Jiaozhou Bay in April 1985

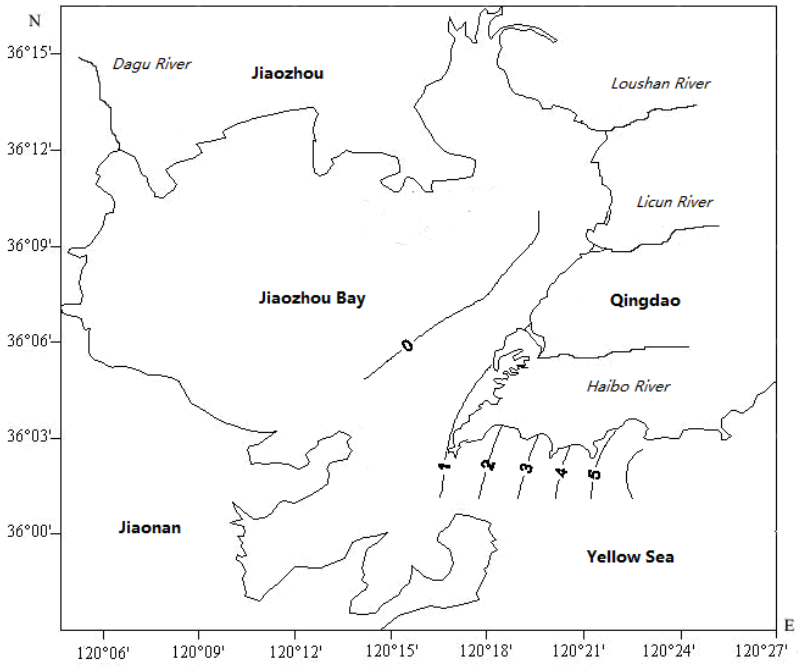

Fig. 3 Distributions of Cd in surface waters in Jiaozhou Bay in July 1985

4. CONCLUSION

Cd contents in Jiaozhou Bay waters in April, July and October 1985 were 0.01-0.94 μg L^{-1}, 0.10-6.48 μg L^{-1} and 0.19-0.95μg L^{-1}, respectively. The pollution level of Cd in water inside the

bay was very slight in 1985, yet in the open waters outside the bay was moderate.

The major souces of Cd were marine current and strem flow, whose source strengths were 6.48 μg L^{-1} and 0.75-0.94 μg L^{-1}, respectively. The stream flows had not slightly polluted by Cd in 1985, yet the marine current had been moderately polluted by Cd in 1985.

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