Distribution and Divergent Process of Cr in Bottom Waters in Jiaozhou Bay

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Abstract

Cr is one of the critical heavy metal and many water bodies have been polluted bay Cr due to the rapid increasing of economic and population. This paper analyzed the content, pollution level and distribution of Cr in bottom waters in Jiaozhou Bay in 1979. Results showed that Cr contents ranged from 0.03-0.40 μg L^{-1} in bottom waters, and were more lower than Class I for Cr (50.00 μg L^{-1}) in National Standard of China for Seawater Quality (GB3097-1997), indicated that this bay had not been contaminated by Cr in 1979. Cr contents was lowest (0.03 μg L^{-1}) in August in the bay mouth in where the flow rate of marine current was relative high. The low Cr content region in the bay mouth indicated that there was a divergent process by means of the moving of marine current. Cr content was relative high (≤0.40 μg L^{-1}) in bottom waters inside the bay mouth, indicating that there was accumulation effect in this region. Cr content was relative low (≤0.10 μg L^{-1}) in bottom waters inside the bay mouth, indicating that there was weak dilution effect in this region.

Keywords

Cr; Contents; Distribution; Divergent process; Bottom waters; Jiaozhou Bay.

1. Introduction

Cr has been widely used in metallurgy, chemical engineering, electroplate, leatherworking etc. A large amount of Cr-containing waste water is generating along with the rapid increasing of industries, yet the waste waters treatment is always lagging. Hence, Cr pollution has been one of the environmental issues in many countries and regions. Many marine bays were polluted by Cr since marine is the sink of pollutants [1-4].

Jiaozhou Bay is a semi-closed bay located in Shandong Province, eastern China, and has been polluted by various pollutants including Cr [1-6]. In order to provide scientific basis for the research on the migration and exist of Cr in Jiaozhou Bay, this paper analyzed the content, pollution level and distribution of Cr in bottom waters in Jiaozhou Bay based on investigation data in bottom waters in 1979, and revealed the divergent process of Cr.

2. Materials and method

Jiaozhou Bay (35°55′-36°18′ N, 120°04′-120°23′ E) is located in the south of Shandong Peninsula, eastern China. The area, bay mouth width and average water depth and average water depth are 390 km^2, 2.5 km and 7.0 m, respectively (Fig. 1). This bay is surrounding by cities of Qingdao, Jiaozhou and Jiaonan in the east, north and south, respectively. The bay mouth is located in the south of the bay, and is connected with the Yellow Sea. There are more than ten inflow rivers such as Loushan River, Licun River and Haibo River, all of which are seasonal rivers [5-6].

The investigation on Cr in three sampling sites (H34, H35 and H36) in bottom waters in Jiaozhou Bay was conducted by North China Sea Environmental Monitoring Center in August 1979 (Fig. 1). The investigation and measurement of Cr were following by National Specification for Marine Monitoring [7].

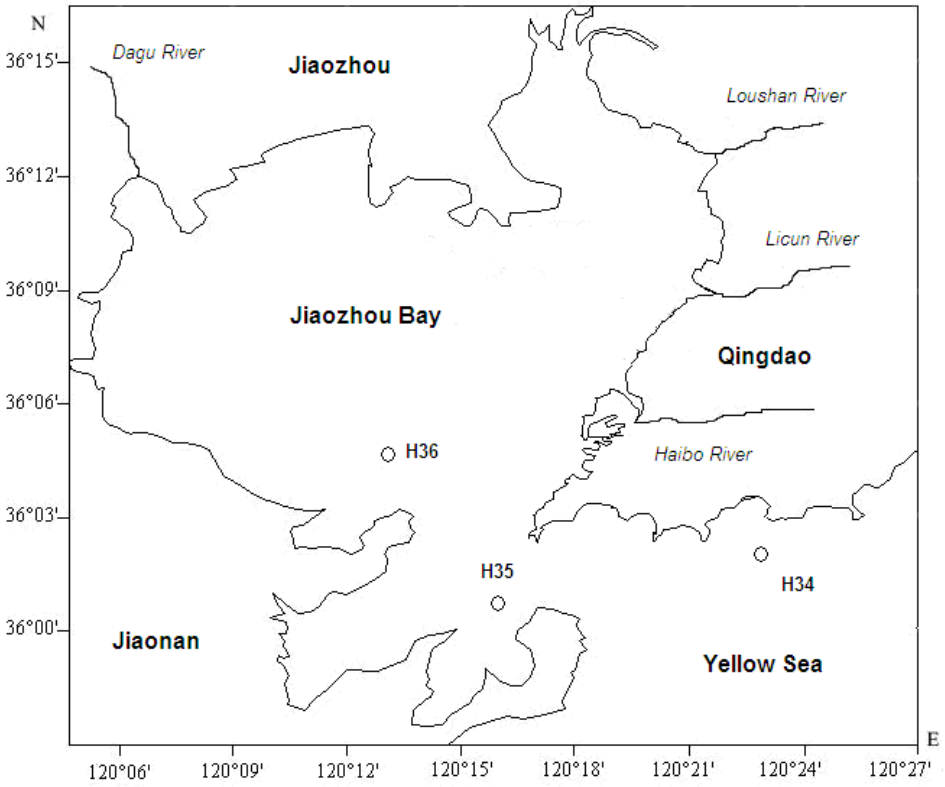

Fig.1 Geographic location and sampling sites of Jiaozhou Bay

3. Results and discussion

Contents and pollution levels of Cr. Cr contents in Jiaozhou Bay bottom waters in August 1979 were 0.01-0.40 μg L^{-1}**.** In according to the guide line of Class I for Cr (50.00 μg L^{-1}) in National Standard of China for Seawater Quality (GB3097-1997), Cr contents in bottom waters in August 1979 were very low. It could be found that Jiaozhou Bay had not been contaminated by Cr in 1979.

Horizontal distribution of Cr. In according to the location of the sampling sites, H34, H35 and H36 were in the outside of the bay mouth, the middle of the bay mouth and the inside of the bay mouth, respectively. In according to the contour lines of Cr contents, there were a series of parallel lines that decreasing from the inside of the bay mouth to the outside of the bay mouth (0.10 μg L^{-1}). The reason was that the flow rate of the current in the bay mouth was relative high and the strong water exchange leaded to the decrease of Cr contents.

Divergent process of Cr. Jiaozhou Bay is a semi-closed bay, whose width and length are 27.8 km and 33.3 km, respectively. Actually, there are two narrow bay mouths. The interior bay mouth (2.5 km) is between Tuandao Island and Huangdao Island. The exterior bay mouth (3.1 km) is between Tuandao Island and Xuejiadao Island, and is connecting to the Yellow Sea. There is a deep (40 m) water channel in the bay mouth area, in where the tidal current is very strong. For instance, the amplitude of tidal current of M2 is as high as 1m s -1, and the instantaneous velocity of the flow in this water channel during the spring tide is 2.01 m s-1 [9]. Since Cr contents were very low, and the flow rate was very high in the bay mouth, there was a low value region in this region around H35 (0.03 μg L^{-1}), and there was a divergent process of Cr by means of the movement of the water body.

Vertical water's effect. There was very weak external Cr source in Jiaozhou Bay in August 1979, and the external input of Cr was little. Once Cr had transferred thorough the water body from surface waters to bottom waters, the Cr contents in bottom waters were the Cr contents of the waters itself.

Hence, Cr contents was lowest (0.03 μg L^{-1}) in August in bottom waters in the bay mouth in where the flow rate of marine current was relative high. The low Cr content region indicated that there was a divergent process by means of the moving of marine current. Cr content was relative high (≤0.40 μg L^{-1}) in bottom waters inside the bay mouth, indicating that there was an accumulation effect in this region. Meanwhile, Cr content was relative low (≤0.10 μg L^{-1}) in bottom waters inside the bay mouth, indicating that there was a weak dilution effect in this region.

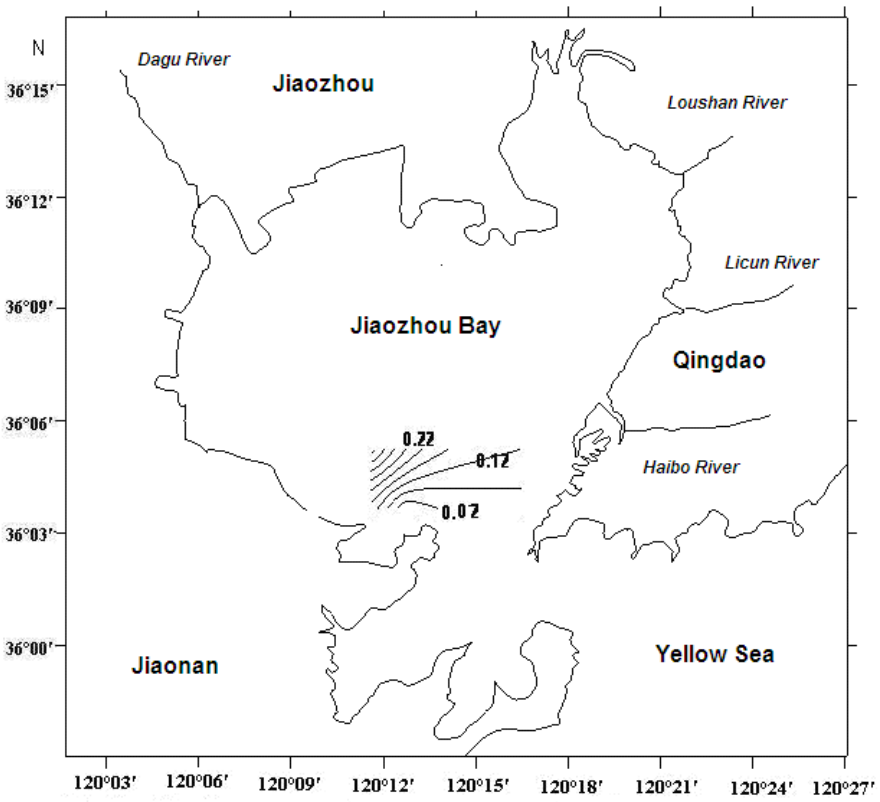

Fig. 2 Distributions of Cr in bottom waters in Jiaozhou Bay in Agust 1979

4. Conclusion

Cr contents in Jiaozhou Bay bottom waters in August 1979 were very low, and Jiaozhou Bay had not been contaminated by Cr in 1979. The low Cr content region in the bay mouth indicated that there was a divergent process by means of the moving of marine current. Cr content was relative high in bottom waters inside the bay mouth, indicating that there was an accumulation effect in this region. Cr content was relative low in bottom waters inside the bay mouth, indicating that there was a weak dilution effect in this region.

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