

The influences of precipitation on Cr in Jiaozhou Bay

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Abstract: Understanding the seasonal variations of Cr pollution and pollution source is essential to pollution control and environmental remediation. Jiaozhou Bay is a semi-closed bay located in Shandong Province, China. This paper analyzed the seasonal variations of Cr and precipitation in Jiaozhou Bay in 1979-1983. Results showed that Cr contents in Jiaozhou Bay were showing high seasonal variations and were in order of spring > summer, yet the precipitation in Jiaozhou Bay was in order of summer > spring. Cr contents in Jiaozhou Bay were not only determined by precipitation or stream flow, since Cr inputs to Jiaozhou Bay were generated from both point and non-point sources, and the corresponding source control countermeasures were necessary.

1. Introduction

Cr had been widely used in various industries, and many bays have been polluted by Cr [1-4]. Jiaozhou Bay is a semi-closed bay located in Shandong Province, eastern China, and has been polluted by various pollutants including Cr [5-8]. Hence, Understanding the seasonal variations of Cr pollution and pollution source is essential to pollution control and environmental remediation. Jiaozhou Bay is a semi-closed bay located in Shandong Province, China. This paper analyzed the seasonal variations of Cr and precipitation in Jiaozhou Bay in 1979-1983, and provided scientific basis for pollution control and environmental remediation.

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 km², 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 [7-8].

The investigation on Cr in surface waters in Jiaozhou Bay was conducted by North China Sea Environmental Monitoring Center. The investigation times were in May and August 1979, April and August 1981, April, June, July and October 1982, and May, September and October 1983, respectively [1-6], and the sampling sites were showed in Fig. 1. The investigation and measurement of Cr were following by National Specification for Marine Monitoring [9].

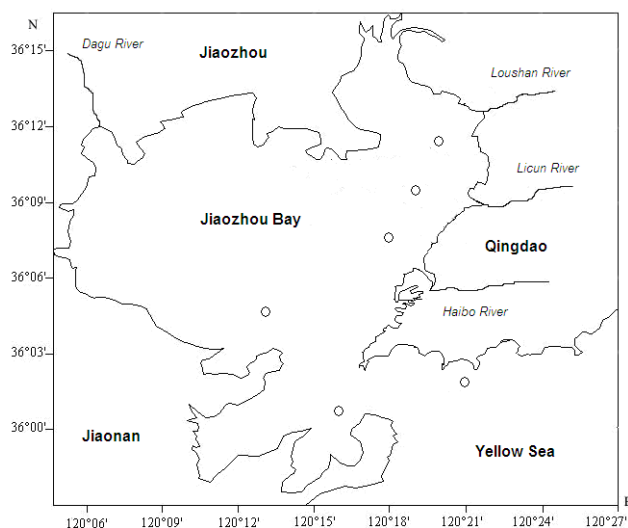


Fig.1 Geographic location and sampling sites of Jiaozhou Bay

3. Seasonal variations of Cr contents

In according to the climate in study area, April, May and June belong to spring, July, August and September belong to summer, and October, November and December belong to autumn, respectively. The investigation data on monthly highest Cr contents during 1979-1983 were showed in Fig. 2. Obviously, Cr contents in Jiaozhou Bay were showing high seasonal variations. In 1979, 1980 and 1981, Cr contents were in order of spring > summer. In 1982 Cr contents were in order of autumn > spring > summer. In 1983 Cr contents were in order of spring > summer > autumn. In generally, Cr contents were in spring were higher than in summer during 1979-1983. However, the order of Cr contents in autumn was uncertain.

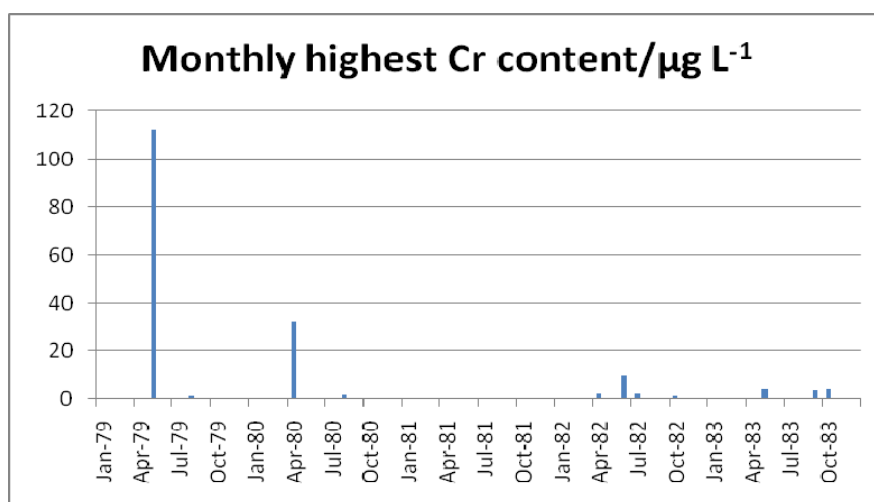


Fig. 2 Monthly highest Cr content during 1979-1983 in Jiaozhou Bay

4. Seasonal variations of precipitation

The annual average precipitation in Jiaozhou Bay was 700 mm, and the monthly average was 208 mm, which was showing significant seasonal variations that about 62% of the precipitation was concentrated in summer (Fig. 3). Hence, the stream flow in study area had significant seasonal variations. In generally, the monthly precipitation was increasing rapidly from May and reaching the climax in July, and was decreasing rapidly from July to November. The Cr inputs in Jiaozhou Bay were also different in different seasons since rainfall-runoff was the major force and stream flow was the major input channel of Cr. In generally, Cr contents in Jiaozhou Bay were in order of

spring > summer > during 1979-1983. However, the precipitation in Jiaozhou Bay was in order of summer > spring during 1979-1983.

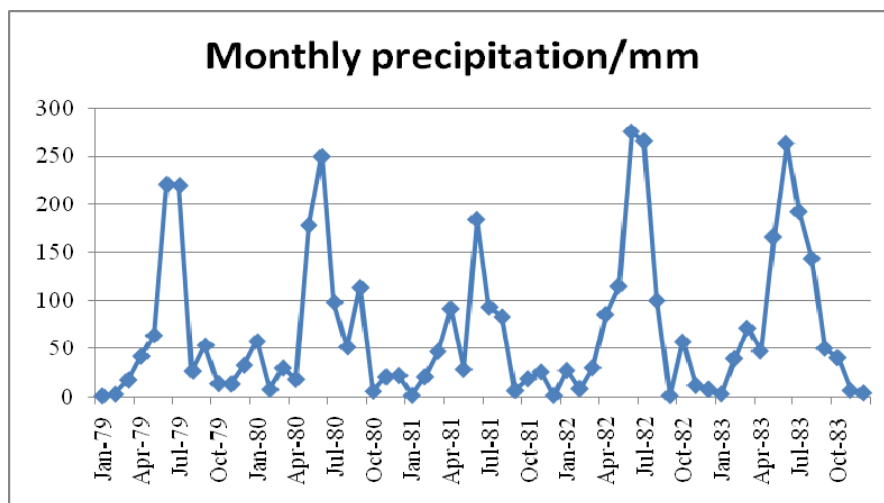


Fig. 3 Monthly average precipitation during 1979-1983 in Jiaozhou Bay

5. Influence of of precipitation on Cr content

It could be found that Cr contents were not only determined by precipitation of stream flow (Fig. 4). Cr contents in Jiaozhou Bay were mainly determined by Cr inputs, as well as precipitation. In case of Cr inputs were mainly generated from point source, both Cr inputs and Cr contents in the bay were not influenced by precipitation. In case of Cr inputs were mainly generated from non-point source, both Cr inputs and Cr contents in the bay were influenced by precipitation. In case of Cr inputs were generated from both point and non-point sources, both Cr inputs and Cr contents in the bay were varying more significantly. In according to the monthly highest Cr contents and monthly average precipitation, it could be found that Cr inputs to Jiaozhou Bay were generated from both point and non-point sources, hence the corresponding source control countermeasures were necessary.

6. Conclusions

Cr contents in Jiaozhou Bay were showing high seasonal variations and were in order of spring > summer during 1979-1983. However, the precipitations in Jiaozhou Bay were also showing high seasonal variations and were in order of summer > spring. Cr contents in Jiaozhou Bay were not only determined by precipitation or stream flow. Cr inputs to Jiaozhou Bay were generated from both point and non-point sources, hence the corresponding source control countermeasures were necessary.

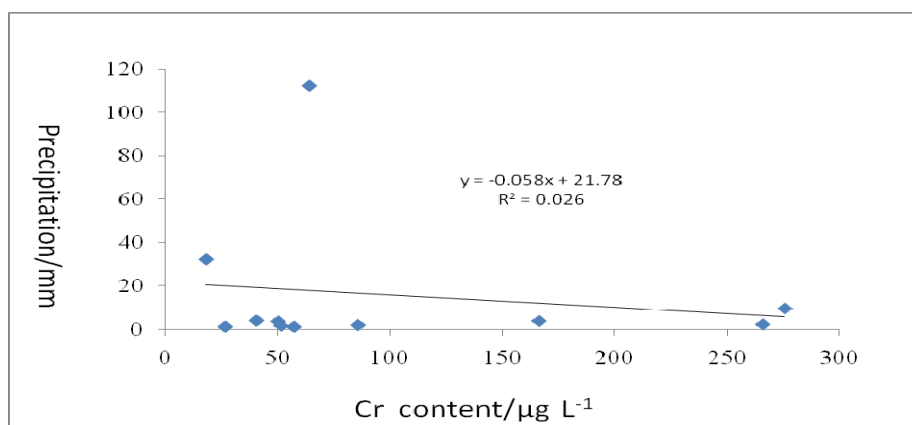


Fig. 4 Monthly average precipitation VS monthly highest Cr content in Jiaozhou Bay

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