Hg Content Sedimented at Bottom Layer of Eastern Nearshore Waters

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Abstract: According to the investigation data of Jiaozhou Bay in 1991, the Hg content and horizontal distribution at bottom layer were studied. The results showed that the variation range of Hg content was 0.011-0.054μg/L, which satisfies the Case I and II Sea Water Quality Standard. Therefore, in May, August and October, the bottom layer from bay center to southern bay mouth was mildly polluted or not polluted by Hg content. In May and August, the bottom layer of eastern nearshore waters was mildly polluted by Hg content, and in May, August and October, other areas were not polluted by Hg content. There was high sediment of Hg content in eastern nearshore waters. In other words, Hg content first reached the surface waters, and then sedimented to bottom layer of eastern nearshore waters.

1. Introduction
With the increasing emission of Hg content by human, it is transported to the land, atmosphere and finally the sea water [1-11]. Hg, which is hard to be metabolized and degraded, reaches the bottom layer from the surface. Affected by vertical waters effect [12-14], the variation of Hg content at bottom was displayed. In this paper, according to the investigation data of Hg in Jiaozhou Bay in 1991, the bottom waters of bay mouth was studied, the Hg content, distribution and vertical transport were determined, and the Hg content and distribution characteristics were displayed, to provide scientific reference for the study on Hg content and its transport in bottom waters.

2. Investigation Waters, Materials and Methods

2.1 Natural environment of Jiaozhou Bay
Jiaozhou Bay, located in southern Shandong Peninsula, is a typical semi-closed bay. The geographical location is 120°04'-120°23'E, 35°58'-36°18'N. Bounded by the line connecting Tuandao Cape and Xuejiadao Island, it connects with Yellow Sea, covering an area of about 446km², with the average depth of about 7m. There are dozens of rivers reaching the ocean in Jiaozhou Bay, among of which, the rivers with a larger volume of runoff and sand content include Dagu River, Yang River, Haibo River in Qingdao, Licun River, Loushan River and so on. These rivers are seasonal streams, and hydrological characteristics vary seasonally [15, 16].
2.2 Materials and methods
The materials about Hg in Jiaozhou Bay waters in May, August and October of 1991 was provided by North China Sea Environment Monitoring Center, State Oceanic Administration. In May, site 52, 55, 60 and 61 were established, site 55, 60, 61 and 2106 were established in August, and site 60 was established in October, which are shown in Figure 1. Samplings were performed for three times in May and August in 1991, respectively. According to the depth of water, sampling and survey were conducted (surface and bottom layers were sampled when the depth of water is more than 10m, but just surface layer when less than 10m). The survey on Cu of Jiaozhou Bay waters was in accordance with national standard method, which was included in The Specification for Marine Monitoring (1991) [17].

![Fig.1 Investigation sites in Jiaozhou Bay](image)

3. Results

3.1 The Hg content at bottom
The variation of Hg content at bottom layer from bay center to southern bay mouth was 0.011-0.051μg/L in May, August and October, which satisfies the Case I Sea Water Quality Standard of Hg content in sea water (0.05μg/L), Case II (0.20μg/L), Case IV (0.50μg/L). In May and August, the variation of Hg content was 0.016-0.051μg/L and 0.032-0.054μg/L, respectively, which satisfies the Case I and II Sea Water Quality Standard. It was 0.011μg/L in October, which satisfies the Case I Sea Water Quality Standard. Hence, the variation of Hg content in May, August and October was 0.011-0.054μg/L, satisfying the Case I and II Sea Water Quality Standard, showing that there is mild or none pollution at bottom layer from bay center to southern bay mouth. It is shown in Table 1.

|                  | May  | August | October |
|------------------|------|--------|---------|
| Hg content in sea water/μg·L⁻¹ | 0.016-0.051 | 0.032-0.054 | 0.011 |
| National sea water quality standard | Case I and II | Case I and II | Case I |

3.2 The horizontal distribution at bottom
In May, at bottom layer from bay center to southern bay mouth, in site 61 in eastern nearshore waters, Hg content reached high as 0.05μg/L, forming a series of parallel lines with different gradients. It decreased from 0.05μg/L in eastern nearshore to 0.020μg/L in northern bay mouth along with the gradients, shown in Figure 2.
Fig.2 Hg content distribution at bottom in Jiaozhou Bay in May (μg/L)
In August, at bottom layer from bay center to southern bay mouth, in site 61 in eastern nearshore waters, Hg content reached high as 0.054μg/L, forming a series of semi-circles with different gradients. It decreased from 0.054μg/L in eastern nearshore to 0.039μg/L in northern bay mouth along with the gradients, shown in Figure 3.

Fig.3 Hg content distribution at bottom in Jiaozhou Bay in August (μg/L)

4. Discussion

4.1 The water quality
In Jiaozhou Bay, Hg content was mainly transported by ships and wharfs, atmospheric sedimentation and open sea current. It first reached the surface and reached the bottom through the waters. Affected by vertical waters effect [12-14], the variation of Hg content at bottom layer from bay center to southern bay mouth was 0.011-0.054μg/L, which satisfies the Case I and II Sea Water Quality Standard, showing that there is mild or none pollution at bottom layer from bay center to southern bay mouth.

The variation of Hg was 0.016-0.051μg/L in May and 0.032-0.054μg/L in August, causing mild or none pollution. In eastern nearshore waters, it reached high as 0.051μg/L in May and 0.054μg/L in August, more than 0.05μg/L, however, it was lower than 0.05μg/L in other waters. It showed that in May and August, there was mild pollution from Hg content in bottom layer of eastern nearshore waters, but there is not pollution in other waters. Whereas, in October, the variation was 0.011μg/L, so there was no pollution from Hg content.

At bottom layer of eastern nearshore waters, the water quality was mildly polluted by Hg content in
May and August, however, there was no pollution in May, August and October in other waters.

4.2 The higher sedimentation
The variation of Hg was 0.016-0.051μg/L in May and 0.032-0.054μg/L in August. From eastern nearshore waters to northern bay mouth, Hg content decreased along with the gradients, showing that there was high sedimentation in eastern nearshore waters in May and August.

5. Conclusion
In Jiaozhou Bay, Hg content was mainly transported by ships and wharfs, atmospheric sedimentation and open sea current. It first reached the surface and reached the bottom through the waters. Affected by vertical waters effect [12-14], the variation of Hg content at bottom layer from bay center to southern bay mouth was 0.011-0.054μg/L, which satisfies the Case I and II Sea Water Quality Standard, showing that there is mild or none pollution at bottom layer from bay center to southern bay mouth.

The variation of Hg was 0.016-0.051μg/L in May and 0.032-0.054μg/L in August, causing mild or none pollution. In October, the variation was 0.011μg/L, so there was no pollution from Hg content. At bottom layer of eastern nearshore waters, the water quality was mildly polluted by Hg content in May and August, however, there was no pollution in May, August and October in other waters.

From eastern nearshore waters to northern bay mouth, there was high sedimentation in eastern nearshore waters in May and August.

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