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Effect of HCH on the Jiaozhou Bay waters-The transfer laws of HCH

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Abstract

By investigation data in Jiaozhou bay waters from 1979 to 1986(absent of 1980), in spacial scale, by the analysis of the annual dataset, from the view of the content, and the horizontal, vertical and seasonal distributions of HCH, the study of the source, water quality, distribution and transfer state in Jiaozhou bay showed many results of the HCH transfer laws. In temporal scale, by the analysis of the five-year dataset from 1979 to 1986(absent of 1980), the study of the variation process of HCH in Jiaozhou bay showed the below results: the annual variation of the content, the change process of the source, the land transfer process, the water transfer process and the sedimentary process. These laws and process variations provided the solid theoretical base for the HCH transfer in the water body and edified for the study of the other organic compound transfer in the water body.

Keywords: HCH; distribution; process; transfer laws; Jiaozhou Bay

In 1962, the book "Silent Spring", written by marine biologist Rachel Carson in the United States, boldly predicted the pesticides hazards to environmental and human, marking human beings firstly to pay attention to the Environmental problems. Especially in the day of June 12, 1972, the United Nations held the human and environment conference in Stockholm, indicating the beginning of the environment protection enterprise. The HCH did not easily degrade and remained in environment for long time. As a result, there would be a long-time damage to the people's health, studying the HCH migration laws in the water body played a significant role in HCH migration process.

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By investigation data in Jiaozhou bay waters from 1979 to 1986(absent of 1980), the existence case of HCH every year was studied [1-7] . And then by investigation data in Jiaozhou bay waters from 1979 to 1984(absent of 1980)，studied was the HCH variation processes during the five years in Jiaozhou bay waters[8-12]. So, the studies on effect of organic pesticides HCH on water quality showed the HCH transferring laws in Jiaozhou bay waters, providing the theoretical basis for controlling the pollution.

1. Materials and methods

1.1. The natural environment of Jiaozhou bay waters

Jiaozhou Bay is semi-closed at 35°55′-36°18′N, 120°04′-120°23′E, its area is 390 km^2 with 7 m in average depth in the eastern China, surrounded by the cities of Qingdao, Jiao Zhou as well as Jiao Nan(Fig. 1). There are more than ten of rivers into the Jiao Zhou bay. Among those rivers, the Dagu river and the Yang river have the larger runoff and sand.

1.2. The data resource and the method

The investigation data used in this paper was provided by the North China Sea Environment Monitoring Center, State Oceanic Administration, the investigation method of Jiaozhou bay waters HCH was insistent with the Gu Tangxiu's [13] ,by virtue of the international method,.
May, August, November in 1979; April and August in 1981; April, June, July and October in 1981; May, September and October in 1983; July, August and October in 1984; April, July October in 1985and April, July and October in 1986, HCH in the Jiaozhou Bay water body was investigated[1-12]. Each year April, May and June stands for spring, July, August and September for Summer, October, September and November for autumn.

2. Results

2.1. The study result of 1979

By the investigation data in Jiaozhou bay in 1979, analyzed was the distribution, transport and seasonal variation of HCH in Jiaozhou Bay. The study results showed belows: in one year, HCH pollution was serious in spring in Jiaozhou Bay, while it was light. In temporal and spacial scale, HCH distribution there was comparatively uniform with the variation in spring, summer and autum, which belongs to the souce of area pollution. HCH contents between surface and bottom layer waters were close and its content in the waters was perpendicularly well-distributed. In the whole Jiaozhou Bay, HCH content increased in spring, it reached the peak in summer as 5.393-12.480μg/l, then it fell down to the low value 0.073-0.685μg/l, whose process showed the identical variation with the flow of the rivers into the bay. Therefore, the use of agricultural pesticide resulted in the variation of HCH content in Jiaozhou bay.

2.2. The study result of 1981

Based on data from the investigation in Jiaozhou bay waters in 1981, the distribution, displacement and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that in spring in Jiaozhou bay, the pollution of HCH is less, the water quality in the most of the waters is better, while in summer the pollution of that is serious. In temporal scale, HCH content in surface layer in summer was almost higher than that in spring, HCH content in bottom layer in the whole Jiaozhou bay in summer was higher than

that in spring. In spatial scale, in the northeast of Jiaozhou bay, there were the estuaries of Haibo River, Licui River and Lushan River to provide the river transport with HCH for the coastal waters of the northeast in the bay. So, it is considered that HCH was from the source of area pollution, which was formed by the rivers into the bay. The analysis of the land and waters displacement process found that the higher content of HCH in surface layer resulted in the higher one of it in bottom by sedimentation, and that HCH into sea rapidly sank. By the vertical and horizontal distributions of HCH in surface and bottom layers, put forward was the schematic diagrams of the displacement process of HCH in spring and summer in Jiaozhou Bay waters, which presented the trail of HCH movement and clearly determined the rules of the surface and bottom distribution of HCH in spring and summer.

2.3. The study result of 1982

Based on data from the investigation in Jiaozhou bay waters in 1982, the distribution, pollution source and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that the pollution of HCH in Jiaozhou bay was less in April, June, July and October.In April, June, July, HCH content change formed the grad from the coast to the bay center: the fall tendency from large to small, and in October the grad change was just reverse. The horizontal distribution in surface layer was identical with that in bottom layer. HCH content from rivers to the coastal waters was higher than that from surface water directly to the coastal waters. Therefore, the HCH content change in Jiaozhou bay proved the displacement process of HCH on land [6,7], which showed the HCH content into in Jiaozhou bay waters in summer was almost higher than that in spring; the HCH content change in surface and bottom layers in temporal and spacial scales proved the displacement process of HCH in waters [7], which unveiled that the higher content of HCH in surface layer resulted in the higher one of it in bottom by sedimentation, and that HCH into sea rapidly sank. By the content change of HCH in surface and bottom layers, put forward was the water body effect, dilution effect and cumulation effect and its schematic diagrams, which presented the content change of HCH through water body and quantitatively described the action of water body to HCH.

2.4. The study result of 1983

Based on data from the investigation in Jiaozhou bay waters in 1983, the distribution, pollution source and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that in Jiaozhou bay there was no pollution of HCH in May, September and October. In the coastal waters of the bay north, there was no river into the bay. By the horizontal distribution of HCH content in May, September and October, it was discovered that HCH left in the soil run into the coastal waters by the runoff on the land surface and the HCH content was very low. Moreover, HCH content was transported by rivers the same as by the runoff on the land surface and was very low. The source was an area source. The HCH content in surface layer was descending in the direction from the northern coast to the southern bay mouth, which fully proved the displacement process of HCH on land. The HCH content into in Jiaozhou bay waters in summer was relatively higher than that in spring or autumn, whose content change was determined by the rainfall in the basin around the bay. In the bay mouth waters, the HCH content change in surface and bottom layers in May, September and October showed that the horizontal distributions of the HCH content between the surface and bottom layers were identical, which in temporal and spacial scales proved the displacement process of HCH in waters. the horizontal distributions of the HCH content in the surface in the bay waters and of the one in the surface and bottom layers in the bay mouth waters showed that the decrease of the HCH content in the surface layer was completely relyed on the dilution of the Jiaozhou bay tide. In the bay mouth waters, the marine water was strongly exchanged between the inside and outside of the bay, when the flow speed was large, the HCH content in the surface layer rapidly decreased and was diluted

fast, which resulted that the HCH content in the surface layer formed the region with low HCH content. In addition, when the HCH content was very low in the surface layer, it not only in the surface layer formed the region with low HCH content, but also in the bottom layer so did it.

2.5. The study result of 1984

Based on data from the investigation in Jiaozhou bay waters in 1984, the distribution, pollution source and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that in Jiaozhou bay there was no pollution of HCH in July, August and October. In the coastal waters of the bay north, there was no river into the bay. By the horizontal distribution of HCH content in July, August and October, it was discovered that HCH left in the soil run into the coastal waters by the runoff on the land surface and the HCH content was very low. The source was an area source. The seasonal variation of the HCH content into in Jiaozhou bay waters showed that in July was relatively higher than that in October, which unveiled that the sinking action made the higher content of HCH in the surface in July become the lower content in October.

The horizontal distributions of the HCH content, in the surface in the whole bay waters and between the surface and bottom layers in the bay mouth waters, represented that the decrease of the HCH content in the surface depended on the dilution of the Jiaozhou bay. After the prohibtion of HCH pesticide use, the HCH content in the sea water largely decreased, showing the decline of HCH remnant on land resulted in the decrease of the HCH content in the seawater. Moreover, the rapid decrease of the HCH content in the seawater showed the decline of HCH remnant on land was rapid, the decline amount of about 38.14％-212.17％.

2.6. The study result of 1985

Based on data from the investigation in Jiaozhou bay waters in 1985, the distribution, pollution source and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that in Jiaozhou bay HCH contents was very low and less than 0.150μg/L in this year. In April, July and October, it was discovered that HCH left in the soil run into the coastal waters by the runoff on the land surface and the rivers, and that the HCH content in the bay was very low. The source was an area source. The seasonal variation of the HCH content in Jiaozhou bay waters has already vanished, the variable range of the HCH content in the surface in October was that of the HCH content in this year, the seasonal variation was not influenced by the rainfall, the runoffs and rivers. The change of HCH contents in the surface and bottom in temporal and spacial scales proved the transfer process of HCH in the waters. The horizontal and vertical distributions of the HCH content in the whole bay waters showed that the distribution of the HCH content in the whole bay waters was very uniform, which unveiled that the actions of tides and ocean current made the ocean have the characteristic of uniformity. The authors considered that the ocean was of uniformity.

2.7. The study result of 1986

Based on data from the investigation in Jiaozhou bay waters in 1986, the distribution, source and seasonal variation of HCH in Jiaozhou Bay are analyzed. It is showed that in Jiaozhou bay HCH content was very low and less than 0.100μg/L in this year, and better than the standard Ⅰ of the sea water quality, and the water quality about HCH was very clean; and that The seasonal variation of the HCH content in Jiaozhou bay waters has already vanished, which, the seasonal variation of the HCH content in this year was not influenced by the rainfall, the runoffs and rivers. The horizontal and vertical distributions of the

HCH content in the whole bay waters showed that the HCH content at surface was not consistent with that at bottom, and that the distribution of the HCH content at surface was not consistent with that at bottom, and that only the HCH contents at surface and bottom were very close. Since 1983, after the prohibition of HCH use, all the HCH contents in the waters arrive at the standard Ⅰ of the sea water quality, and after 1985, all the HCH contents in the waters were better than the standard Ⅰ of the sea water quality. Therefore, the nation might amend and reconstitute the sea water quality standard about the HCH in order to adapt to the new environment change.

3. Discussion

3.1. The process of appearance and vanish

3.1.1. The content yearly change

Base on the investigation data from 1979 to 1984(absent of 1980), analyzed was the content size, yearly change and the seasonal change of the HCH in the Jiaozhou bay waters. The study results showed that in the period of from1979 to 1984 (absent of 1980), the HCH content was decreasing every year. In 1983, the HCH use was prohibited in China, after this prohibition, the content of HCH reached the quality sea water standards for grade I. Moreover, the content of HCH was very low, there was almost no seasonal variation. Therefore, the prohibition of HCH use has achieved the remarkable effect on the improvement of the environment.

3.1.2. The change process of the pollution sources

By investigation data in Jiaozhou bay waters from 1979 to 1984(absent of 1980), the horizontal distribution and pollution source change of HCH in Jiaozhou Bay are analyzed. The results showed that in Jiaozhou bay the pollution source of HCH greately changed because of the prohibition of HCH use in China in 1983 during from 1979 to 1984(absent of 1980). The pollution source change was divided into three types: heavy pollution source, light pollution source and no pollution source, which was respectively expressed with three schematic diagrams, exhibiting the change process of HCH pollution sources. Before and after the prohibition, largely changed were the content, horizontal distribution, import way and pollution source degree. However, it was only no change that the HCH pollution source was area pollution source, even in the case of no pollution, the HCH source into the Jiaozhou bay waters was still a area source.

3.1.3. The Land transfer process of HCH

By investigation data in Jiaozhou bay waters from 1979 to 1984(absent of 1980), the seasonal variation of HCH in Jiaozhou Bay and month rainfall variation around it are analyzed. The results showed that in the spatial and temporal distribution in the whole Jiaozhou bay, HCH content increased in spring, arrived at the high peak, and then fell to the lowest value in autumn during one year. The HCH content change in the coastal waters of Jiaozhou Bay presented the land transfer process of HCH: The HCH content change was determined by the rainfall in the basin near Jiaozhou bay. Therefore, the seasonal variation of HCH content in the waters of the bay was determined by the land transfer process, which was divided into three phases: the HCH use of human, the HCH sediment in the soil and land surface, the HCH transport of the rivers and runoffs into the coastal waters in the sea. The process was denoted by the schematic diagram,

which unveiled that HCH from production to land was determined by human and that it from land into sea determined by rainfall.

3.1.4. The waters transfer process of HCH

By investigation data in Jiaozhou bay waters from 1979 to 1984(absent of 1980), the vertical distribution of HCH in Jiaozhou Bay is analyzed. The authors would put forward the waters transfer process of HCH, which was divided into three phases: the HCH from the source to Jiaozhou Bay, the HCH to the surface in the bay waters and the HCH from the surface to the bottom in it. The results showed that the waters transfer process: in spring, in the coastal waters of the estuaries of the rivers into the bay and in the waters inside the bay near it, the HCH surface values is less than the bottom ones; in the bay mouth and outside the bay, the HCH surface values is more than the bottom. In summer, in the coastal waters of the estuaries of the rivers into the bay and in the waters inside the bay near it, the HCH surface values is more than the bottom; in the bay mouth, the HCH surface values is less than the bottom. outside the bay, the HCH surface values is more than the bottom. In autumn, in the coastal waters of the estuaries of the rivers into the bay and in the waters inside the bay near it, and in the bay mouth and outside the bay, the HCH surface values is more than the bottom in the part waters and less than the bottom in the other part waters . Therefore, in Jiaozhou Bay, the vertical distribution of HCH divided the areas according to the temporal and spatial distribution. In temporal scale, the spring, summer and autumn are divided in one year; in spatial scale, Jiaozhou Bay is divided into the three part waters: inside the bay, the bay mouth and outside the bay. By the different temporal and spatial vertical distributions of HCH, the authors would further put forward the waters transfer mechanism of HCH, which elucidated the rules and reasons of the HCH vertical distributions.

3.1.5. The sediment process of HCH

By investigation data in Jiaozhou bay waters from 1979 to 1984(absent of 1980), the bottom distribution variations of HCH in Jiaozhou bay are analyzed. The results showed that in the water body in the bottom of the Jiaozhou bay, the bottom distributions had the characteristics as below: (1) in spring, summer and autumn seasons, the contents of HCH between the surface and bottom were close. (2) in the water body in the bottom of the Jiaozhou bay, in the seasonal distribution, the HCH contents in the surface were low, so the corresponding HCH contents in the bottom were low, too; the contents in the surface were high, so were the corresponding ones in the bottom. And the range of the HCH contents variation in the bottom was smaller than that in the surface. (3) in the waters of Jiaozhou bay, into which the HCH was transported, inside the front of HCH contents, the horizontal distributions of HCH between surface and bottom were coincident, while outside the front of HCH contents, they were not coincident. Therefore, In the waters of Jiaozhou bay, the three characteristics that the bottom distribution possessed made us understanding the variation and distribution of HCH content in the bottom by analyzing the variation of HCH content in the surface. Moreover, the sediment process of HCH contents unveiled the transfer path of HCH in the spacial and temporal variation.

3.2. The transfer laws of HCH

The analysis of the investigation data in Jiaozhou bay waters from 1979 to 1984 (absent of 1980) [1~7] unveiled that the study results of annual HCH had the below laws:

1) The main resource of the HCH in Jiaozhou bay was from the application of the pesticides.

2) With the comparison of HCH contents in spring、summer and the autumn, in the spring the content was low, in the summer it was high, while in the autumn it was lower.

3) The HCH contents between the surface and bottom was close, and the vertical distribution of HCH in water body section was uniformed.

4) The horizontal distributions between the surface and bottom were insistent.

5) The variation rang of HCH content in the bottom was smaller than that in the surface.

6) In the case of the pollution sources, in the spring and summer, the HCH content was higher in the shore, while it gradually became low down off the shore.

7) The HCH pollution source was an area pollution source

8) In the transfer process of HCH source, there were two main kinds of transfer: the transfers of land source and ocean current source.

9) After the prohibition of HCH, the main source of HCH is from the soil remains, by the HCH content in seawater, considered was the HCH remain content in land decreased, and rapidly decreased.

So, with the space changing, the study results above showed the transfer laws of HCH in the water body. The analysis of the investigation data in Jiaozhou bay waters from 1979 to 1984 (absent of 1980) [8-12] unveiled that the result of five years' study: In the period of from 1979 to 1984(absent of 1980) the content in Jiaozhou bay water was decreasing every year [8]. The use of from the large amount to the prohibition of HCH in China presented the change process of HCH pollution source [9]. The HCH content change in Jiaozhou bay costal waters showed the HCH land transfer process: The HCH content change was determined by the rainfall in the basin around the Jiaozhou bay [10]. By the HCH vertical distributions in different space and time zone, put forward was the waters transfer mechanism, dilated the laws and causes of HCH vertical distribution [11]. to the settlement course of HCH, show the HCH transferring root in the time-space transferring courses. The sediment process of HCH contents unveiled the transfer path of HCH in the spacial and temporal variation [12].So, with the time changing, the study results above showed the transfer processes of HCH in the water body.

4. Conclusions

Based on the investigation data in Jiaozhou bay waters from 1979 to 1984 (absent of 1980), in spacial scale, by the analysis of annual HCH dataset, from the view of contents, horizontal and vertical distribution and seasonal change, the study of source, water quality, distribution and transfer cases showed many results of transfer laws. Based the investigation data in Jiaozhou bay waters from 1979 to 1984 (absent of 1980), in temporal scale, by the analysis of five-year HCH dataset, the study of the change processes of HCH in Jiaozhou bay waters showed the follwing results: 1)The content yearly change; 2)The change process of the pollution sources; 3) the Land transfer process ; 4) the waters transfer process; 5) the sediment process. These laws and change process would provide the solid academic basis for studying the transferring process in the waters, and also provide some ideas for the other organic compound transferring process.

The human beings are very smart, for their own profits, to invent the agrochemical which has the most effectives on the some main insects, such as locust, cotton buds, corn borer, the pests under the earth. In this way, food chain would be broken up at the insects point, along the food chain upward, some birds would be absent of some food. Even if the food chain of the insects was not separated, the HCH would accumulate in the insects, with the transportation of the food chain, the human beings would be endangered by the HCH. Furthermore, the large amount use of HCH, with the transportation of the river and the runoff, polluted land, rivers, lakes and ocean, at last, it polluted the human's living environment, and do some harm to the human's health. Therefore, the human should not harm the other creatures on the earth, and in turn cause harm to the human health as well. Human should adapt to the earth environment

which he depends for survive, and comply with the natural laws, in this way we could lead the healthful and sustainable life.

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