

ANALYSIS OF CHANGES IN WATER QUALITY OF THE SONGHUA RIVER IN 2003

SHI F. AND LI R.

College of Life Sciences, NanKai University

INTRODUCTION

The Songhua river is one of the seven greatest rivers in China. It runs a total of 1,700 km with its mainstream extending over 800 km, which, however, is basically stretching within the Heilongjiang Province. The Songhua river have two main branches, the 2nd Songhua River from south by origin and the Nenjiang from north. Taking its source in Changbai Mountain in Jilin province, the 2nd Songhua River is 824 kilometers long, navigation mileage is 595 kilometers, watershed area is 79,000 square kilometers. Having its origin in the Yilehuli Mountain of north Daxingan Mountain, the Nenjiang is 1,370 kilometers long, watershed area is 297,000 square kilometers. Due to a long-time pollution by sewage from town, as well as industry waste water from farmland and grassland and so on, many stretches along the river have more or less been polluted. Meanwhile the Songhua River pollution becomes an important factor of ecological risk for vital functions of all aquatic organisms including fish fodder supply and fish resources reproduction, creates certain difficulties for water treatment. The authors of the paper make the attempt to fill gaps in information of the parameters of water pollution of the Songhua River.

Traditionally used hydrochemical parameters can indicate some pollution characteristics. The main parameters include pH, dissolved oxygen(DO), chemical oxygen demand (COD), ammoniac nitrogen ($\text{NH}_3\text{-N}$) of water in assessing water pollution. Through analysis of them, we commentates the present situation of the water quality in the Songhua River, sampling four sites as shown in Fig.1, Nenjiang, Tongjiang, Baishatan and zhaoyuan. Estimating the water quality during the latter half year of 2003. Points out their changes in different periods, analysis and evaluates the trend in the light of the data of 2003.

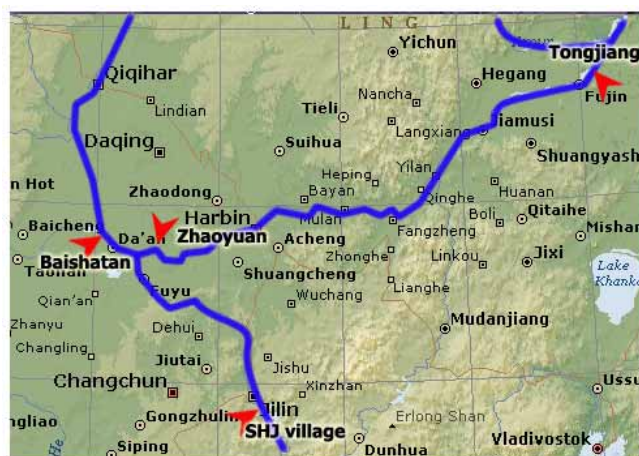


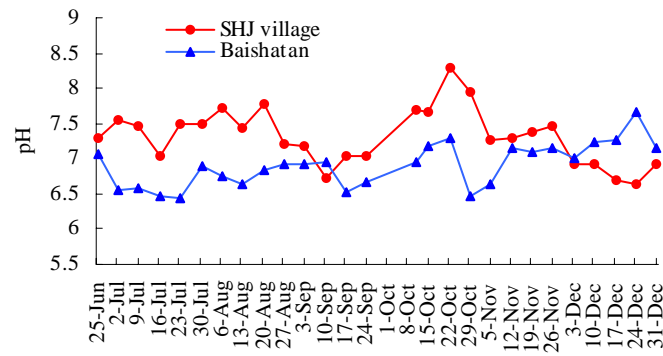
Figure1. Map of the Songhua River of China showing sampling sites.

CHANGES IN PH OF WATER IN DIFFERENT SAMPLING SITES

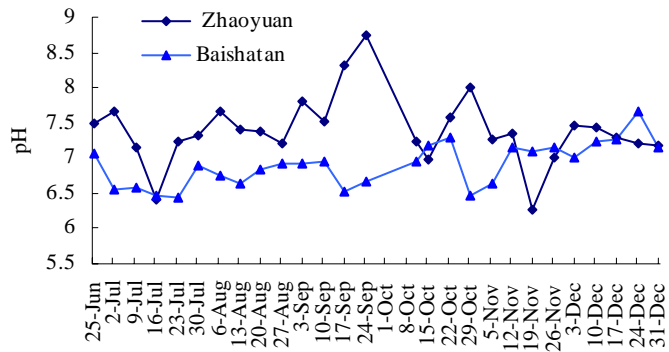
Biology and environment science are always combined with the physical and chemical methods nowadays. Among many parameters the pH of water plays an important role in assessing water pollution. The pH of water is always believed to be one of the most basal chemical character, indirectly indicating the amount of the acidity or alkaline substance of the water thus some pollution characteristics. We were trying to find if there was a difference in water pH among Nenjiang, Baishatan, Zhaoyuan and Tongjiang. The results indicate that there is a measurable difference in pH in different sampling sites. We obtained the four graphs that had the most consistent pH from each region as shown in figure 2.

Generally, the curve of changes in pH of water in different periods in Baishatan is gently and not dramatically up and down. The curve climbs up in October whereas declines in the first several days of November, eventually rises again up to the highest point. Maybe it is correlated to the rainfall of the sampling site. As a whole, that of SHJ village is higher than the Baishatan's except in December. The curve of changes in pH of water in Zhaoyuan is similar to Baishatan, however, its largest value occurs earlier than Baishatan's. Meanwhile compared to SHJ village, the curve of changes in Zhaoyuan has a larger value in highest point exactly in late September. Interestingly, the pH of water in Tongjiang is lower than the former region as a whole. Its curve of change in trend is more gentle. Summarily, along the Songhua River, the pH of water in SHJ village as well as Zhaoyuan is higher, nevertheless the curves of the pH of water in Baishatan and Tongjiang are gentle and have lower values.

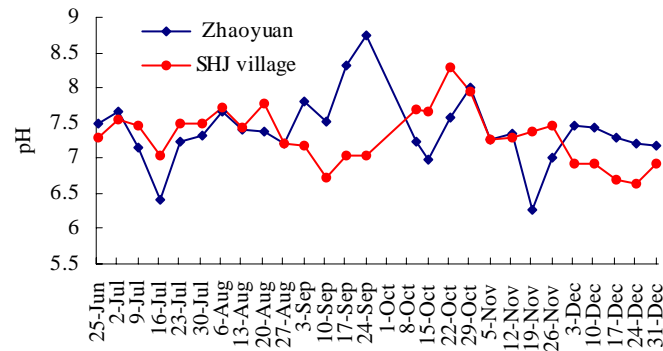
We know well that environmental problems are associated with natural phenomena and more importantly with economical, political, sociological, historical factors. This is probably because the River is polluted by wastewater from town and industrial estate when stretching to the sampling sites of SHJ village and Zhaoyuan. However, when the River stretching to Tongjiang region, maybe it's mainly joined in by its other branches, and then added water may dilute the River thus a relatively gentle curve of the pH.



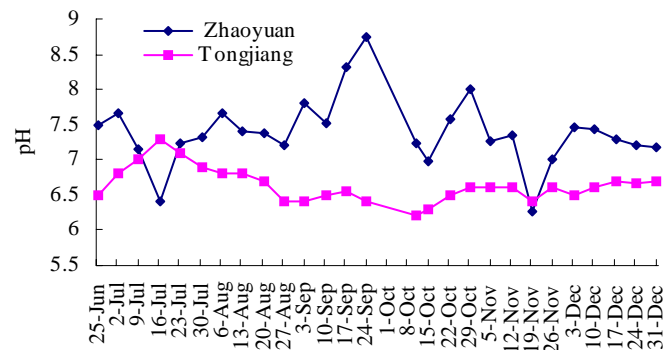
A. Between SHJ village and Baishatan



B. Between Zhaoyuan and Baishatan

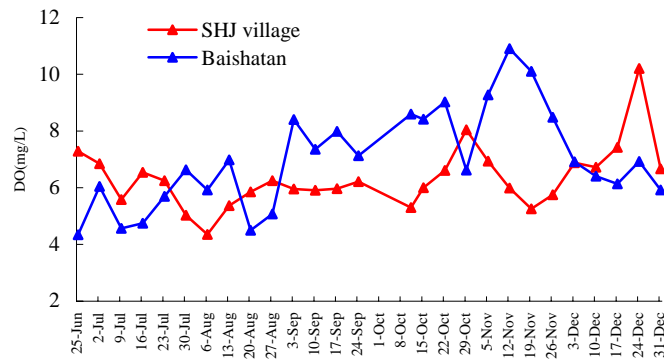


C. Between Zhaoyuan and SHJ village

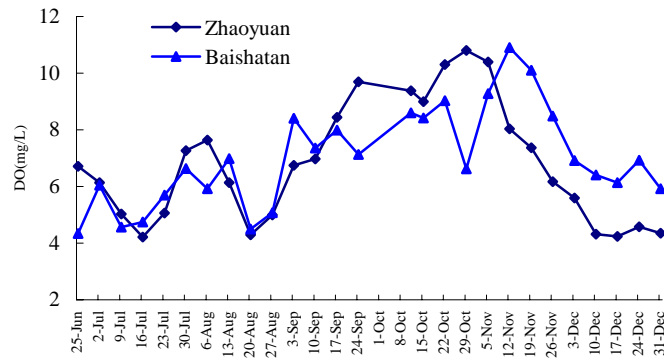


D. Between Zhaoyuan and Tongjiang

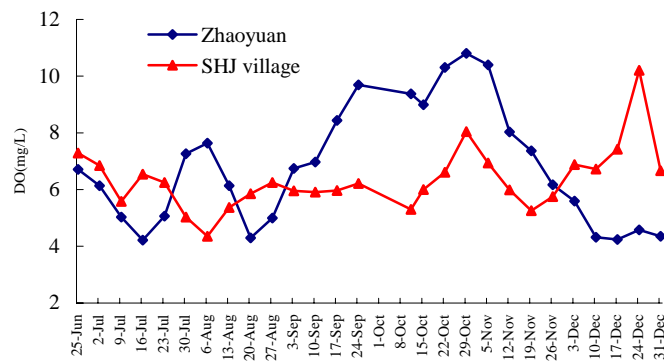
Fig.2 Changes in pH of water of different sampling sites in different periods



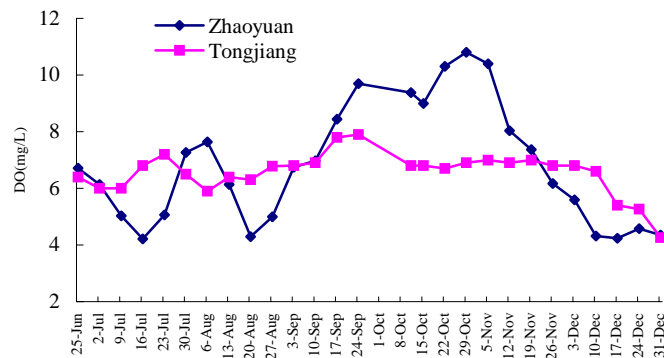
A. Between SHJ village and Baishatan



B. Between Zhaoyuan and Baishatan



C. Between Zhaoyuan and SHJ village



D. Between Zhaoyuan and Tongjiang

Fig.3 Changes in DO of water of different sampling sites in different periods

CHANGES IN DO OF WATER IN DIFFERENT SAMPLING SITES

Among many parameters dissolved oxygen (DO) plays an important role in assessing water pollution, as well. Dissolved oxygen (DO) is generally defined amount of oxygen dissolved in a certain water sprite in a certain condition. DO can also be used to indicate the amount of the deoxidization substance of the water, but indirectly. It is mainly used to compare on the amount of deoxidization substance mainly including organic matters among samples.

This paper focuses mainly on a comparison DO of four different sampling sites of the Songhua River in latter half year of 2003. Six months of weekly water quality data from four sampling sites of the SHJ were available for analysis. DO (chemical oxygen demand) has historically been considered to be an estimate of dissolved oxygen and is the parameters used as the index of water pollution matter. Showing as the figure.3, generally, the curve of changes in DO of water in different periods in Baishatan is gently and not dramatically up and down. As a whole, that of SHJ village is higher than the Baishatan's except in a few days. The curve of changes in DO of water in Zhaoyuan is Similar to Baishatan. Meanwhile compared to SHJ village, the curve of changes in Zhaoyuan has a larger value in highest point exactly in late October. Interestingly, the pH of water inTongjiang is lower than the former region as a whole. Its curve of change in trend is more gentle.Summarily, along the Songhua River, the DO of water in SHJ village as well as Zhaoyuan, Baishatan is higher and changes sharply, nevertheless the curves of the DO of water in Tongjiang are gentle and have lower values.

We know well that environmental problems are complex. This is maybe because the River is less polluted by waster water from town and industrial estate when stretching to the sampling sites of SHJ village and Zhuanyuan and Baishatan. However, when the River stretching from Zhaoyuan to Tomgjiang region, maybe it's mainly joined in by its other branches, and then added water may dilute the River thus a relatively gentle curve of the DO.

CHANGES IN COD_{MN} OF WATER IN DIFFERENT SAMPLING SITES

Biology and environment science are always combined with the physical and chemical method nowadays. Among many parameters chemical oxygen demand (COD) plays an important role in assessing water pollution. Chemical oxygen demand (COD) is generally defined that a demand of a strong oxidant in disposing a water sprite in a certain condition. COD can be used to indicate the amount of the deoxidization substance of the water. It is mainly used to compare on the amount of deoxidization substance mainly including organic matters among samples. KM_nO_4 is one of strong oxidants, which is well known to be extraordinarily effective , extensively adopted in water pollution assessment. In this study the authors of the paper make the attempt to adopt KM_nO_4 as a oxidant (COD_{Mn}) to indicate the amount of the deoxidization substance of the water of 4 different sampling sites of the Songhua River.

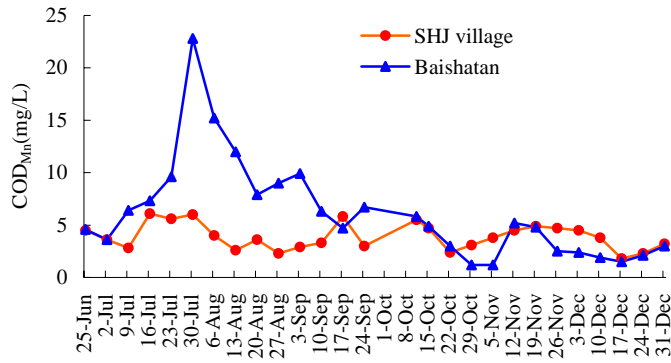
This paper focuses mainly on a comparison COD_{Mn} of four different sampling sites of the Songhua River in latter half year of 2003. Six months of weekly water quality data from four sampling sites of the SHJ were available for analysis. COD_{Mn} (chemical oxygen demand) has historically been considered to be an estimate of organic substance and COD_{Mn} is the parameters used as the index of water pollution matter. From the figure.4 ,we can see that, Compared to SHJ village and Tongjiang ,The COD_{Mn} of Zhaoyuan was high except in late July, and fluctuated around a constant value 8 mg/L. SHJ river, as well as Tongjiang, Baishatan, all three curves of them are changing flatly. The COD_{Mn} of the water of SHJ village, and Tongjiang were below the COD_{Mn} upper limit for Zhaoyuan, SHJ village. The second SHJ origins from the sky lake of Changbai mountain, along its bank there have no serious pollution source, so the COD_{Mn} tended to be low and kept in a constant value of 5 mg/L. As for Baishatan runs through the valley of Xiaoxingan mountain, There are large quantity of rain fall in mountain area during summer, flood brought many chemical substance to Baishatan and results in a suddenly peak value as high as 248 mg/L in late July and the following half monthes. Compared to Zhaoyuan river, Tongjiang's downstream location was significantly affected by the other rivers' influxion. The dilute effect may play a role in reducing the COD_{Mn} value. The main conclusion from the figure.4 is that the location and the influx of other rivers may be the most important factors that affect the COD_{Mn} . After the joining of Baishatan river with SHJ village, The COD_{Mn} in Zhaoyuan had increased and fall when SHJ get to Tongjiang.

CHANGES IN NH_3-N OF WATER IN DIFFERENT SAMPLING SITES

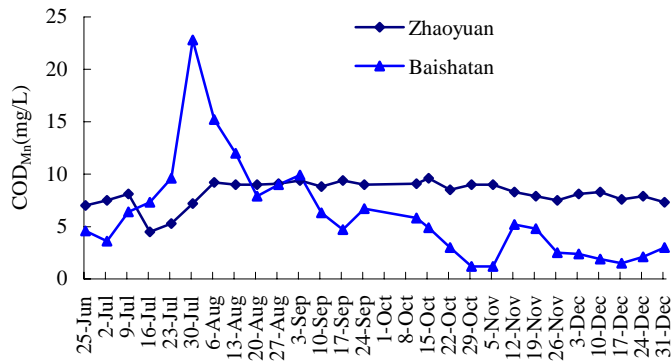
We were trying to find if there was a measurable difference for NH_3-N in water among Nen River, Baishatan, zhaoyuan and Tong River. We obtained the four graphs from each region. we respectively compare among the different areas to find the differences. The results indicate that there is not a measurable different change in four different areas. Compared to the Tongjiang, SHJ Village, Baishatan, zhaoyuan is lower in amount of NH_3-N in water .

As Shown in the figure.5, generally, the curve of changes in NH_3-N of water in different periods in the three sampling sites except Baishatan is gently and not dramatically up and down. As a whole, that of Zhaoyuan is the most lowest among four except a few days, interestingly. The curve of changes in NH_3-N of water in Zhaoyuan is Similar to Baishatan. Meanwhile compared to SHJ village, the curve of changes in Baishatan has a larger value in highest point.

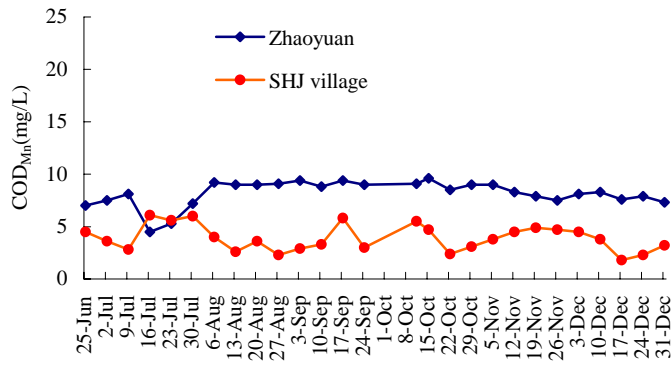
We know well that environmental problems are associated with natural phenomena and more importantly with economical, political, sociological, historical factors. However, interestingly that of Zhaoyuan is the most lowest among four except a few days. As for location, when the River stretching to Zhayuan region, the largest branches of the Songhua River, the 2nd Songhuang River and Nen River are joined together. Thus we maybe conclude that it's mainly the key factors.



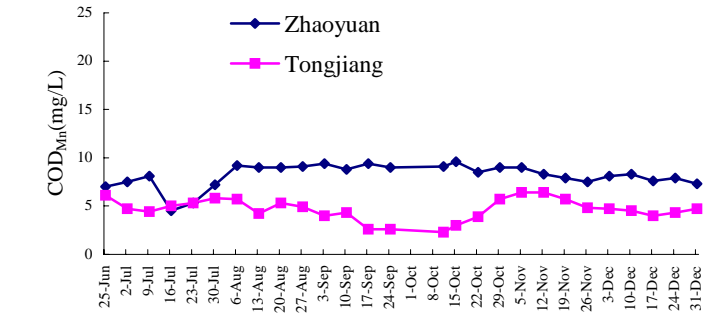
A. Between SHJ village and Baishatan



B. Between Zhaoyuan and Baishatan



C. Between Zhaoyuan and SHJ village



D. Between Zhaoyuan and Tongjiang

Fig.4 Changes in COD_{Mn} of water of different sampling sites in different periods

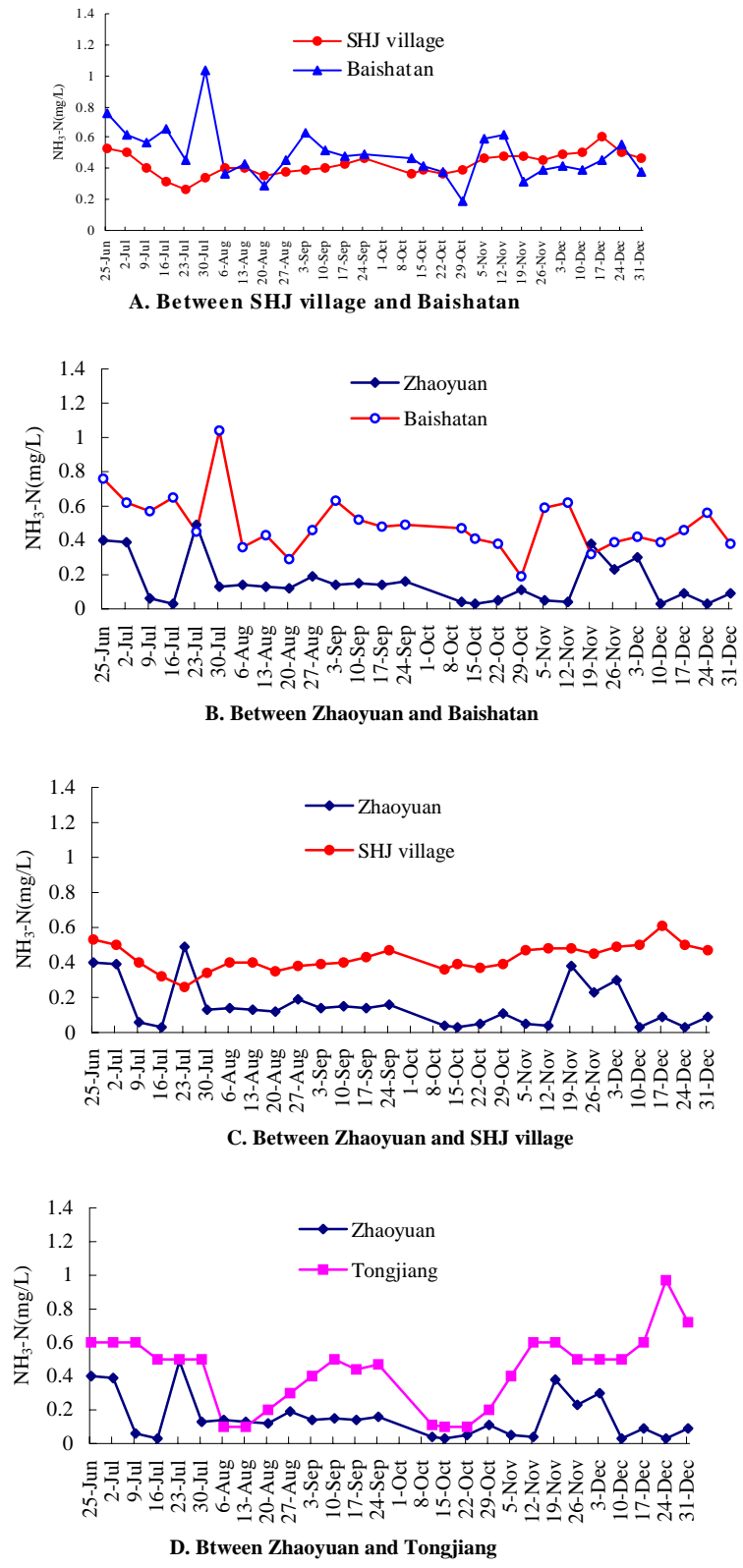


Fig.5 Comparisons of changes in NH₃-N of water of different sampling sites in different periods

CONCLUTIONS AND DISCUSSIONS

Based on comparisons of the main parameters include pH, dissolved oxygen(DO), chemical oxygen demand (COD), ammoniac nitrogen ($\text{NH}_3\text{-N}$) of water in assessing water pollution. Our results suggested that the present situation of the water quality in the Songhua River, sampling four sites as shown in Fig.1, Nenjiang, Tongjiang, Baishatan and zhaoyuan. Points out their changes in different periods, analysis and evaluates the trend in the light of the data of 2003. Summarily, due to a long-time pollution by sewage from town, as well as industry waste water from farmland and grassland and so on, many stretches along the Songhua river have more or less been polluted.

The reported results are based on the very limited observation temporally and spatially, indicating that the more comprehensive and integrated observation would be necessary to understand the role of the water quality. The overall goal for the research trends mentioned above is to reduce ecological risks for the people. Sustainable development of the Songhua River and pollution risks reduction will depend by and large on joint efforts of many specialists, experts in environment monitoring and conservation, water ecosystem functioning laws.

Water chemical composition changes throughout the river and in time. It characteristics are not yet studies to the full. Main pollutants include ammonia and nitrite nitrogen, phosphates, iron, oil products, phenols, heavy metals (mercury, lead, copper, zinc, etc.). Owing to increase of industrial, agricultural and sewage contamination of the Songhua River in the last decade, the concentration of dissolved substances, especially organic matter significantly rose, thus causing changes of water quality, the worst being in winter. For many years already the water in winter down the stream gets an unpleasant smell and “chemical” taste.

Intensive anthropogenic impact on hydrosphere pollution of natural waters makes quite important and urgent the survey of processes in inner water reservoirs and mechanisms of organic matter destruction there. Biochemical assessment of pollution in water ecosystem is mainly based on the investigation of complex function of bottom sediments and hydrobionts. Appearance of new classes of pollutants significantly influence species diversity of biotic complexes and peculiarities of bacterial metabolism in organic compounds studied earlier, depending on their localization. Such aspects as concentration ratio of certain substance substrate inhibition, secondary pollution by metabolism produces gain special significance. Seasonal dynamics of microbial communities structure, changes of their dominant forms and extreme conditions in transitional zones cause formation of products and their combinations, earlier unknown. Processes of destruction of allochthonous and autochthonous organic matter in contact zone.

The ecosystem and environment of the Songhua River are important not only with respect to the environment but also the economics in Northeast of China.

We know well that environmental problems are associated with natural phenomena and more importantly with economical, political, sociological, historical and philosophical factors. In this regards, the environmental problems occurring in the Songhua River should be recognized as international. It is essential to organize international research specialists with various disciplines in solving the environmental problems in the Songhua River.