FINAL REPORT
OF THE RESEARCH ON BIOGEOCHEMICAL
ROLE OF AMUR VALLEY FOR 2006

Nankai University
January 26, 2007

1.Main work in the fiscal year of 2006

1.1 Our survey of river plants and water chemistry was in the forest zone of Xiaoxing' an Mountains. The installing of plot monitoring instrument in the experimental field of Liangshui Natural Reserve was in March,2005.

1.2 Collect the water sample of stream, throughfall, stemflow and clearing from April 2005 to October 2006. The location of samples is showed in Fig.1. The basic information of sites is summarized in Table 1 and Table 2.

1.3 Analyzing items, Fe(Ⅱ), Fe(Ⅲ) and Mn(Ⅱ), are determined near field within 12 hours. Other items, K^+, Na^+, Ca^{2+}, Mg^{2+}, total Fe, NH_4^+, Cl^-, SO_4^{2-}, etc., are measured by LC-10A2.

2.Study site and methods

2.1 Study site

The study sites is located in Liangshui Natural Reserve , Tongjiang and Daxing`an mountains northeast China, This area belongs to Xiaoxing'an Mountains, with the warm temperate continent monsoon climate, and climax vegetation is the mixed forest of broadleaved and *Pinus koraiesnsis* species .

2.2 methods

2.2.1 forest investigation

19 sample plots was selected in the study area. The area of each plot was 20 m×20 m. Diameter at breast height (DBH), tree height and canopy diameter of all the trees were measured in those plots. Within each sample plot an area of 5 m×5m was used for registration of ground vegetation (Fig 1).

2.2.2 sample pre-processing and measurement

Volume-weighted stream water samples for major chemical constituents were collected monthly beginning on marth, 2005. After collected, water samples were treated for the processes of filtration, adding acid, low temperature conserve, etc..

The detailed approaches for all items are illustrated in Table 3.

The data material was tested statistically by EXCEL.

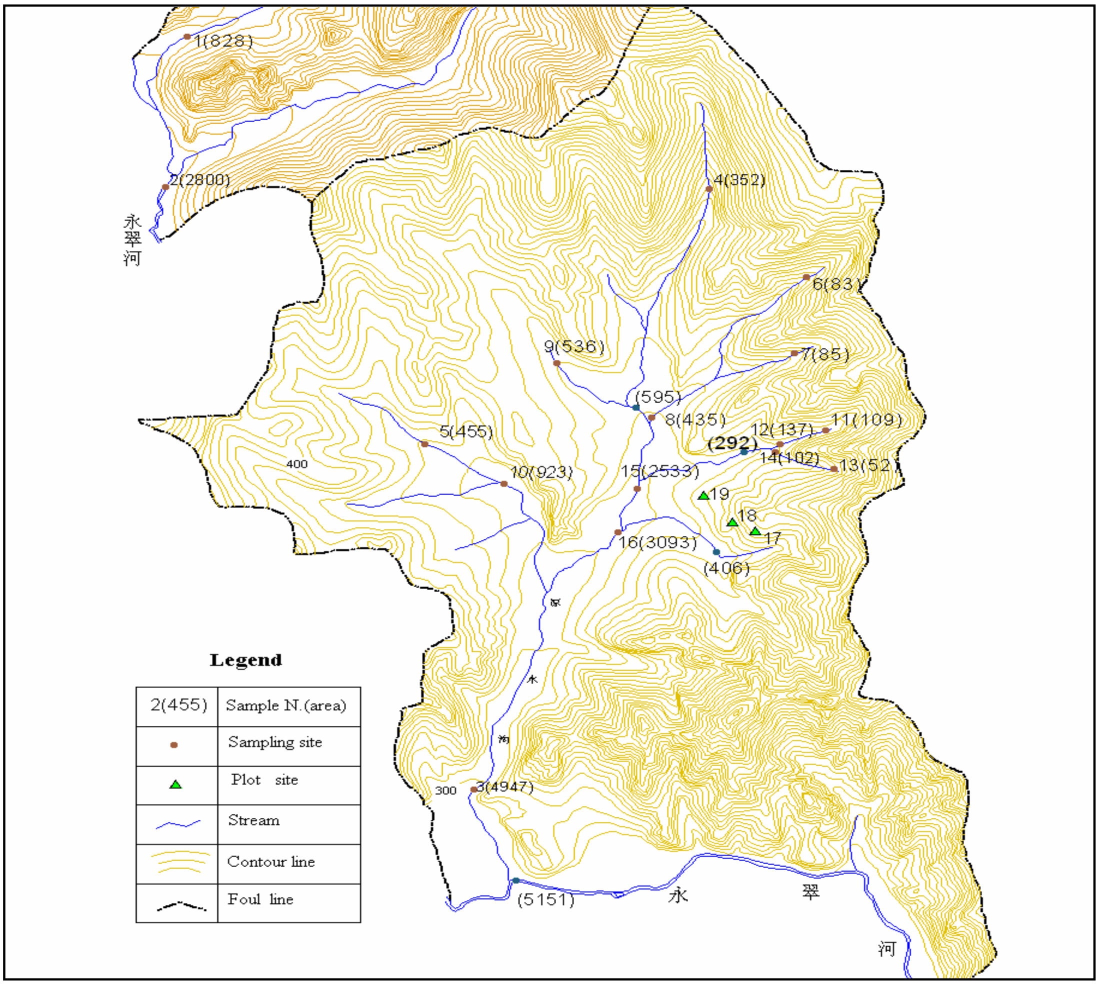

Fig1 Location of water sampling sites in Liangshui

Table 1 Basic information of water sampling sites

Sample number	sample types	site	community types
1	stream water	Hanyue St1	
2	stream water	Hanyue St2	
3	stream water	Liangshui St3	
4	stream water	Koreapine #1-2-3	Koreapine-Birch forest
5	stream water	Wetland #11	Spruce-Birch forest
6	stream water	Koreapine #6	Spruce-fir-Koreapine forest
7	stream water	Koreapine #10	fir-Koreapine forest
8	stream water	Koreapine #6-10	
9	stream water	Koreapine #5-8-12	Spruce-fir-Birch forest
10	stream water	Wetland #11-15	
11	stream water	Birch #14U	Spruce-fir-Birch forest
12	stream water	Birch #14L	Spruce-fir-Birch forest

13	stream water	Larch #16U	Spruce-Birch forest
14	stream water	Larch #16L	Spruce-Birch forest
15	stream water	Liangshui St1	
16	stream water	Liangshui St2	
17	throughfall	Koreapine	Koreapine forest
18	stem flow	Koreapine	Koreapine forest
19	stemflow	Larch	Larch plantation forest
20	throughfall	Larch	Larch plantation forest
21	stem flow	Birch	Birch forest
22	throughfall	Birch	Birch forest
23	control rain	Clearing	
24	brule forest	Daxing`an Mountain	
25	unfired forest	Daxing`an Mountain	
26	control rain	Daxing`an Mountain	
TJ	stream water	Tongjiang St.	

Table 2 Basic information of forest plots

Commuity number	Elevation(m)	Exposure(°)	Slope(°)	average tree height (m)	Average DBH(cm)	Cover degree
5	386	SE	3	21	32	71
9	412	NE	5	21	26	55
13	420	NW	8	17	22	55
11	437	NW	7	16	18	59
4	573	SE	12	24	46	59
6	469	SE	7	23	44	57
7	436	NW	9	23	36	58

Table 3 Method of conservation and Analyzing items

Method of conservation	Low temperature conserve	Adding acid and low temperature conserve	Filtration ,adding acid and low temperature conserve	Filtration and freeze
Analyzing items			Fe、Ca、Mg、K、Na、	NO_3^-、NH_4^+、Cl^-、F^-、Br^-

				SO_4^{2-}

3. The results of measurement and analysis

3.1 Species composition

Table 4 Species composition of each sample plot.Numbers mean Importance value(I.V.)

Species/Important value	5	9	13	11	4	6	7
Larix gmelini		15.26	59.64				
Pinus koraiensis	2.21		17.31		18.38	47.70	72.30
Tilia amurense			6.20		8.01	10.12	
Acer mono			3.71	3.36	9.51	7.48	9.59
Syringa amurensis			2.84	7.93	6.93		
Acer ukurunduense		8.68	0.95			7.42	
Betula costata	0.74		1.27		14.57	3.07	
Fraxinus mandschurica			4.98		1.17		2.73
Picea koraiensis	64.05	33.51	1.03	12.62	2.68	1.39	
Phellodendron amurense			2.06		1.12		
Acer tegmentosum		0.40				8.21	
Abies nephrolepis	1.87	25.22				12.49	12.80
Ulmus macrocarpa							
Betula platyphylla	28.14	11.60		57.34	25.65		
Alnus sibirica var. hirsuta	2.98						
Ulmus macrocarpa		0.47		18.75	0.34		
Populus davidiana					10.10		
Prunus padus					1.19		2.59
Ulmus laciniata					0.35		
Sorbus pohuashanensis		4.86				2.11	

3.2 Analysis of water quality in different types of forest

Forest had varying effects on stream water quality. We attempt to understand the role of forest type in water quality in this study. Average monthly stream ion concentrations were highly variable in forest types (Fig.2—Fig.13).

3.2.1 Seasonal change of iron concentrations

The concentrations of Fe(Ⅱ), Fe(Ⅲ) and total iron in streams are vary in seasons.The variation trends of Fe(Ⅱ) are same. The variation trends of Fe(Ⅲ) and total iron are same after June ,but different in March, April and May. The concentrations of Fe(Ⅱ) in streams was highest in June and lowest in October.

The concentration of Fe(Ⅱ) was highest in plot5 .This plot is Spruce-Birch forest. The elevation of the plot is lowest in seven forest plots, but the cover degree is highest. The concentration of Fe(Ⅱ) are close to each other in other plots (Fig.2).

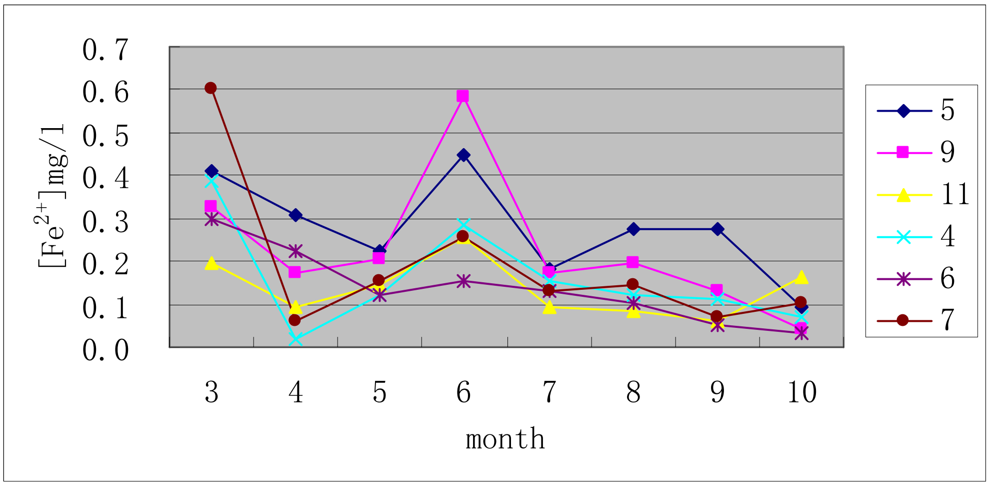

Fig.2 Seasonal variation of Fe(Ⅱ) in different types of forest

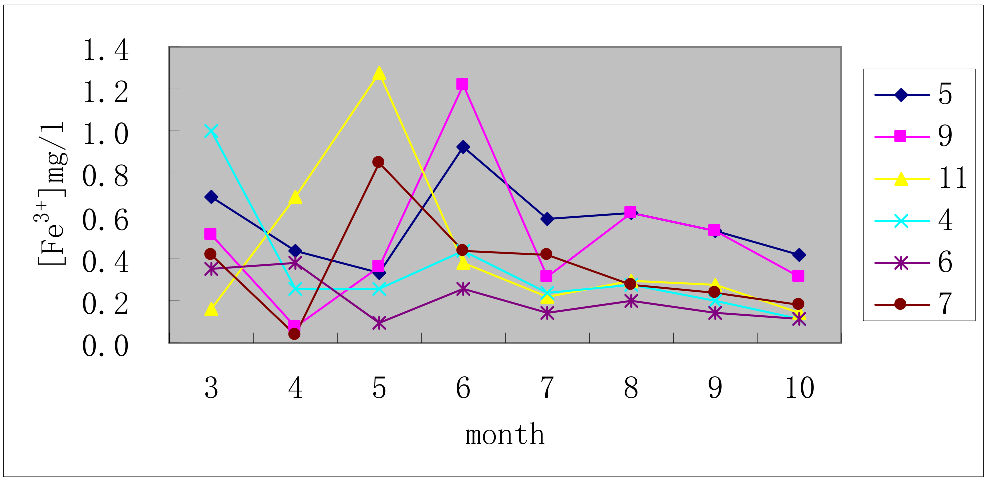

Fig.3 Seasonal variation of Fe(Ⅲ)in different types of forest

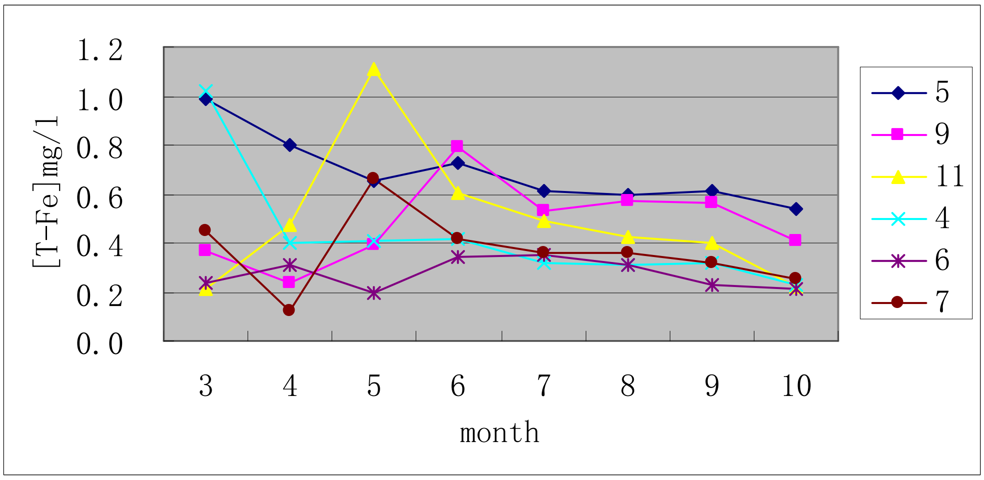

Fig.4 Seasonal variation of total Fe in different types of forest

3.2.2 Seasonal change of Na^+ and K^+ concentrations

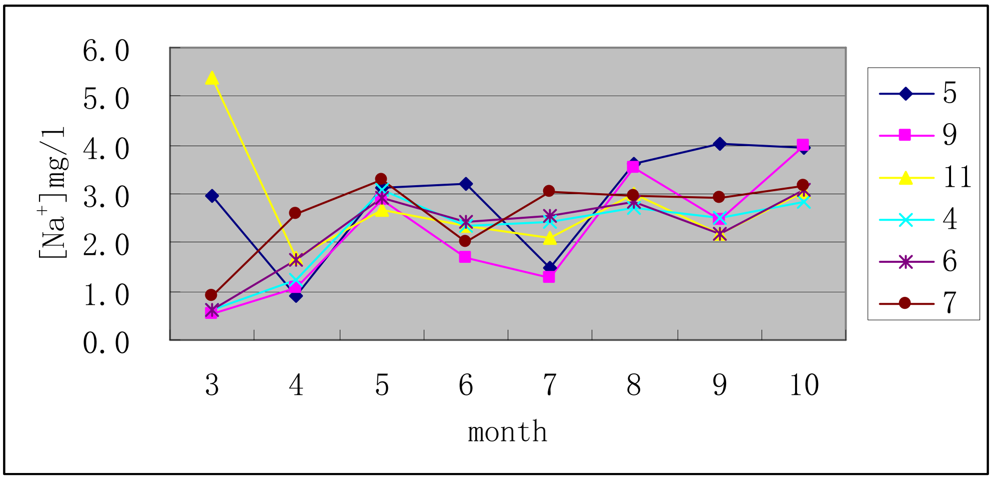

Fig.5 Seasonal variation of Na^+ in different types of forest

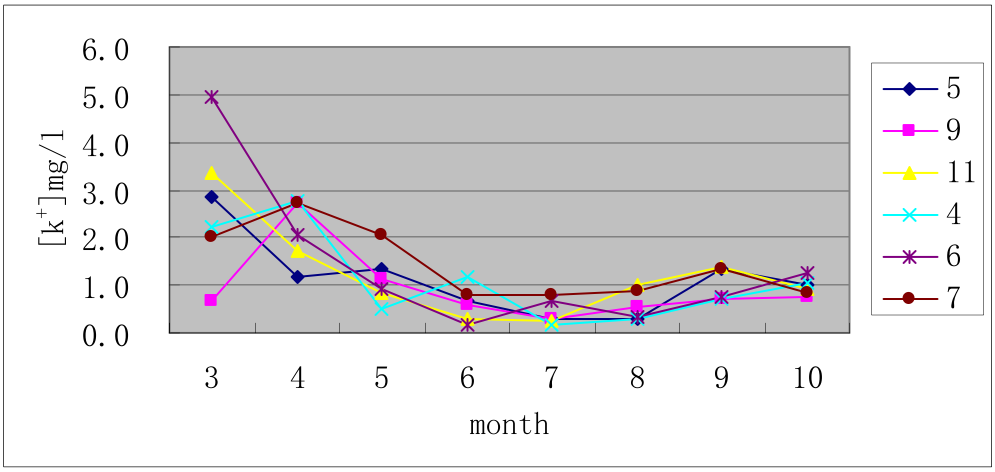

Fig.6 Seasonal variation of K^+ in different types of forest

The concentrations of Na^+ and K^+ in streams are vary in seasons. The variation trends of Na^+ are different. The variation trends of K^+ are same after April. The concentrations of Na^{+} in different types of forest was distinct difference. The concentrations of K^{+} in different types of forest was approximate except in March.

3.2.3 Seasonal change of Ca^{2+} and Mg^{2+} concentrations

The concentrations of Ca^{2+} and Mg^{2+} in streams are vary in seasons. The variation trends of Ca^{2+} are similar after April. The variation trends of Mg^{2+} are different. The concentrations of Ca^{2+} in different types of forest was approximate except in March and April. The concentrations of Mg^{2+} in different types of forest was distinct difference.

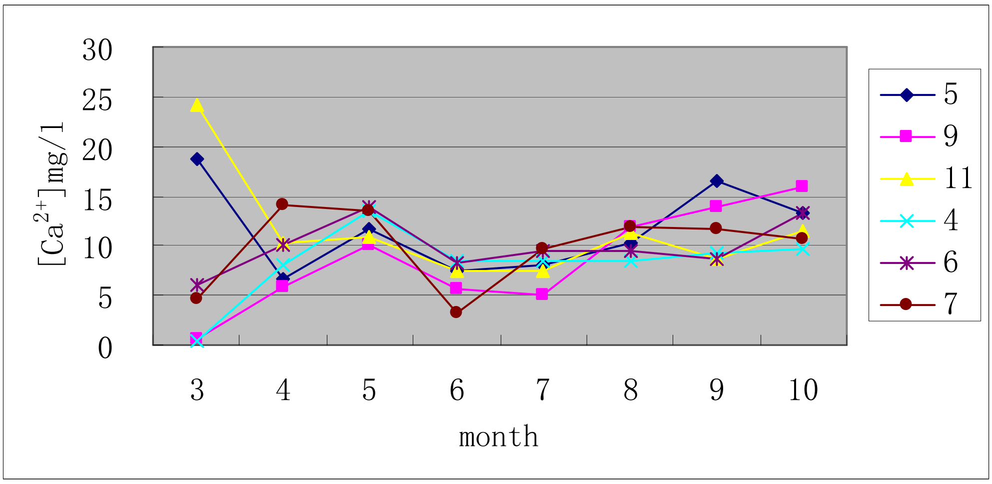

Fig.7 Seasonal variation of Ca^{2+} in different types of forest

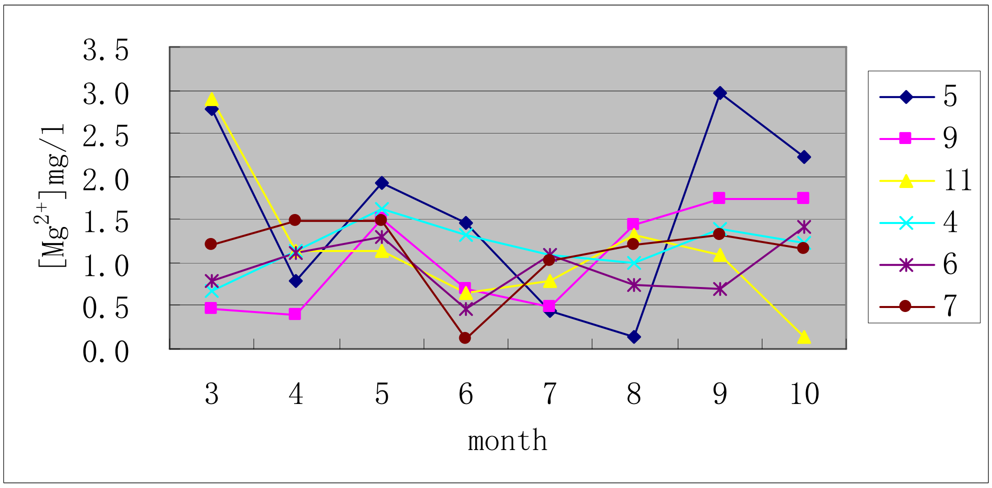

Fig.8 Seasonal variation of Mg^{2+} in different types of forest

3.2.4 Seasonal change of F^{-}, Cl^{-} and Br^{-} concentrations

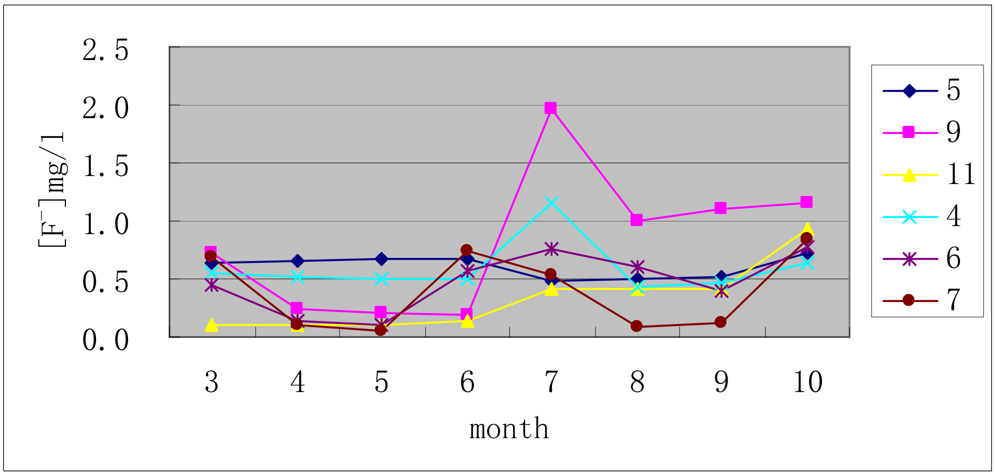

Fig.9 Seasonal variation of F¯ in different types of forest

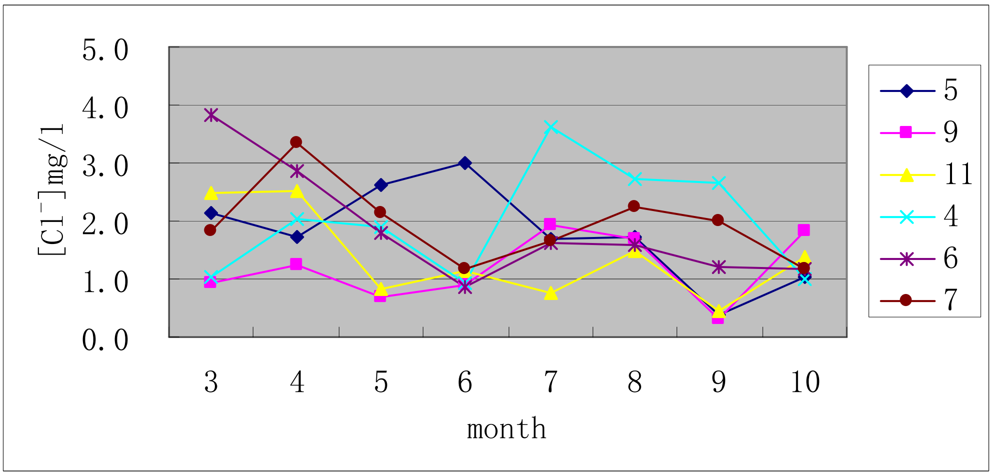

Fig.10 Seasonal variation of Cl¯ in different types of forest

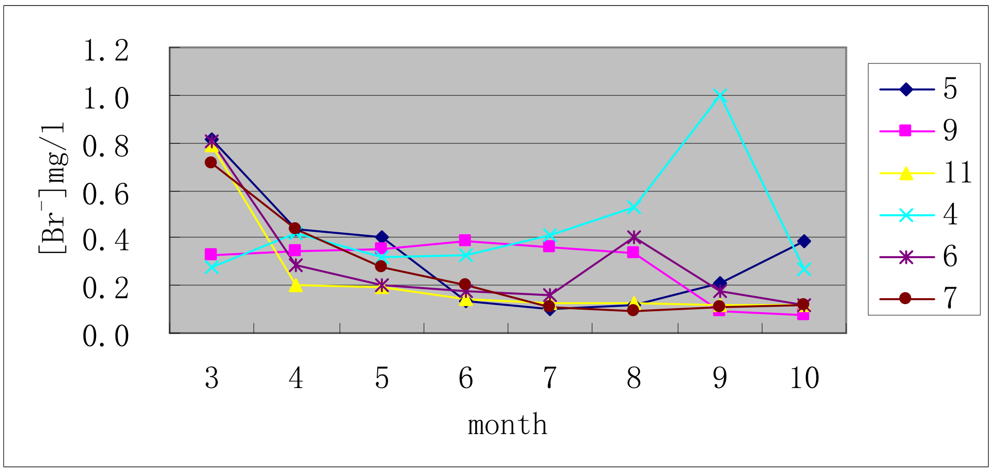

Fig.11 Seasonal variation of Br¯ in different types of forest

The concentrations of F¯, Cl¯and Br¯ in streams are vary by seasons. The variation trends of F‾ and Br‾ are similar. The variation trends of Cl‾ are different. The concentrations of F‾ and Br‾ in different types of forest was approximate before July. The concentrations of Cl‾ in different types of forest was distinct difference.

3.2.5 Seasonal change of NO_3^- and SO_4^{2-} concentrations

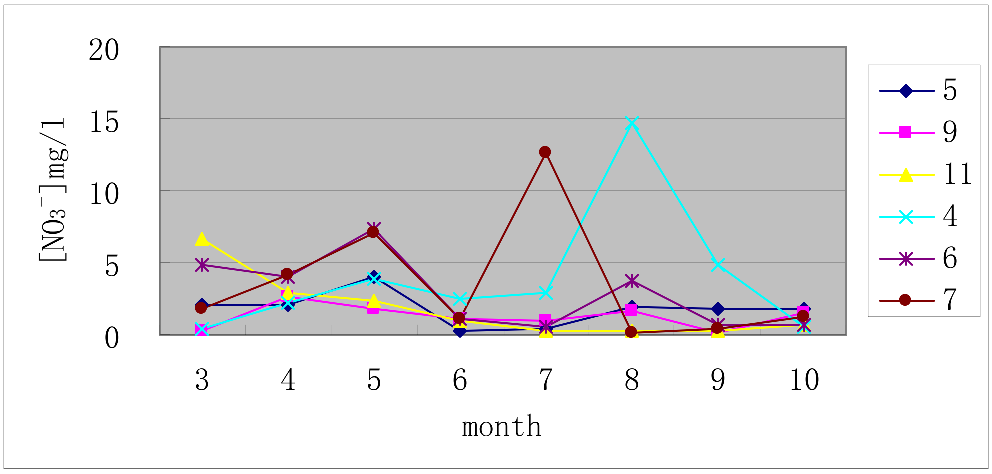

Fig.12 Seasonal variation of NO_3^- in different types of forest

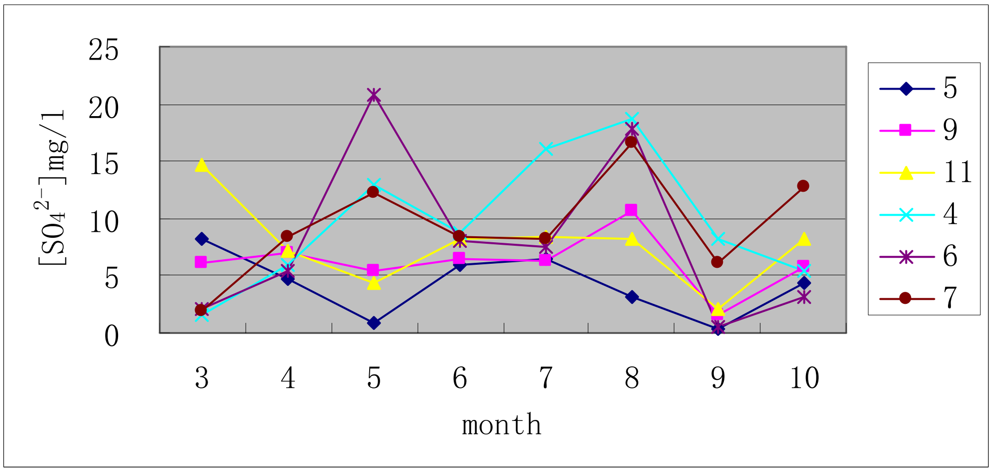

Fig.13 Seasonal variation of SO_4^{2-} in different types of forest

The concentrations of NO_3^- and SO_4^{2-} in streams are higher than other ions. The seasonally variation trends of NO_3^- was similar in different types of forest. The concentrations of SO_4^{2-} in plot4 was highest in June, July, August and September. The concentrations of SO_4^{2-} in plot5 was lowest except in March and October. The plot4 is Koreapine forest. The elevation of the plot is highest in seven forest plots, and the average DBH is largest.

3.3 Analysis of stream water quality in different concourse sites

3.3.1 Seasonal variation of positive ions

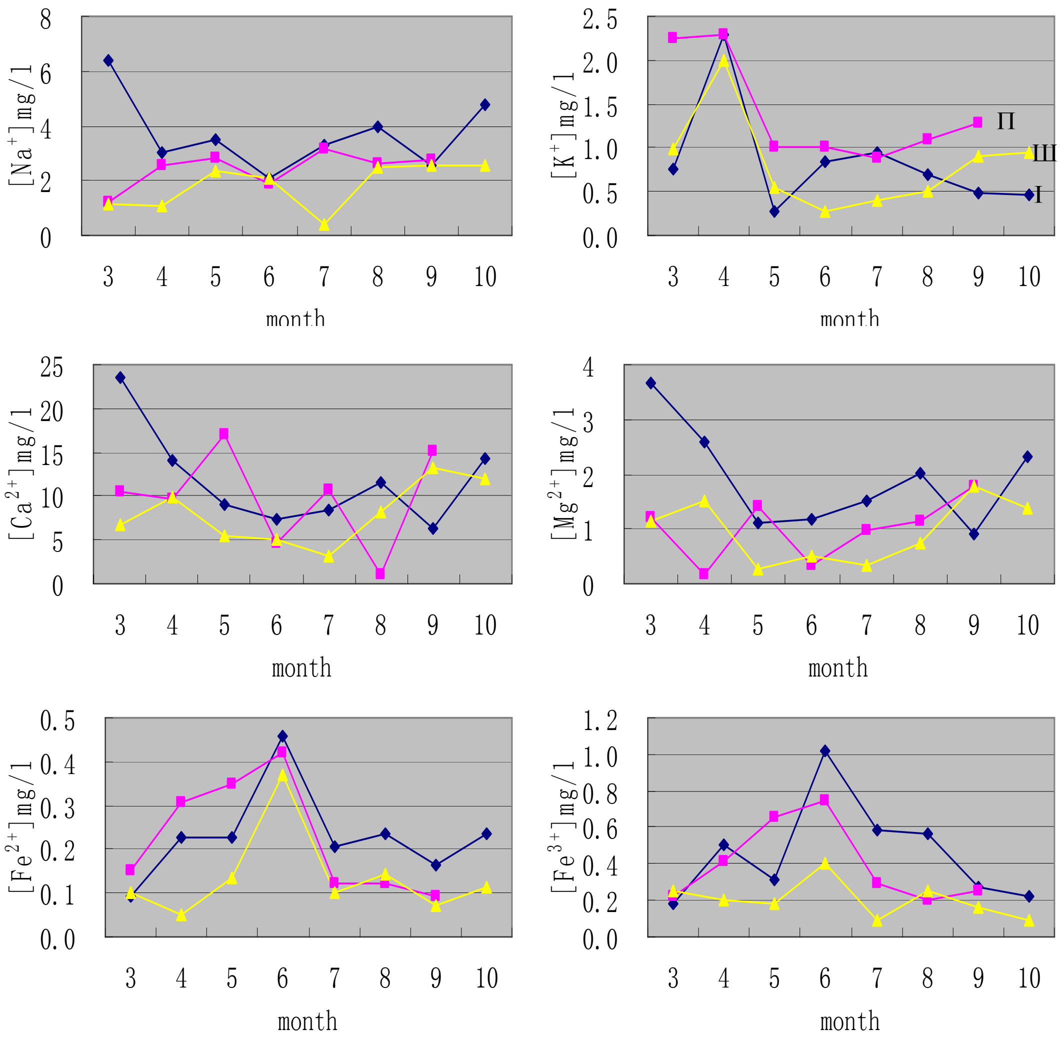

Fig.14 Seasonal variation of positive ions in different concourse sites

(Ⅰ:site10, Ⅱ:site8, Ⅲ:site15)

The environment of Site10 is forest bog.Site8 is the concourse of Site6 and Site7,the environment of it is mixed forests of deciduous broad-leaved tree and Korean pine. The stream water quality of these three sites are vary by seasons. Compare between sites, the variation trends of Fe(Ⅱ) and Fe(Ⅲ) are same. The concentrations of Fe(Ⅱ) and Fe(Ⅲ) was highest in June and lowest in March and October.Compare among three sites, the concentrations of Fe(Ⅱ) and Fe(Ⅲ) was highest in site10 from June to October and lowest in site15 from March to October.

The concentrations of Na^{+}, Ca^{2+}, Mg^{2+} ,Fe(Ⅱ) and Fe(Ⅲ) in stream water of Site10 was higher than Site8 and Site15 in most of months, otherwise, the concentrations of K+ in stream water of Site8 was highest. The concentrations of Na^{+}, K^{+},Ca^{2+}, Mg^{2+} ,Fe(Ⅱ) and Fe(Ⅲ) in stream water of Site15 was lowest in most of months.

3.3.2 Seasonal variation of negative ions

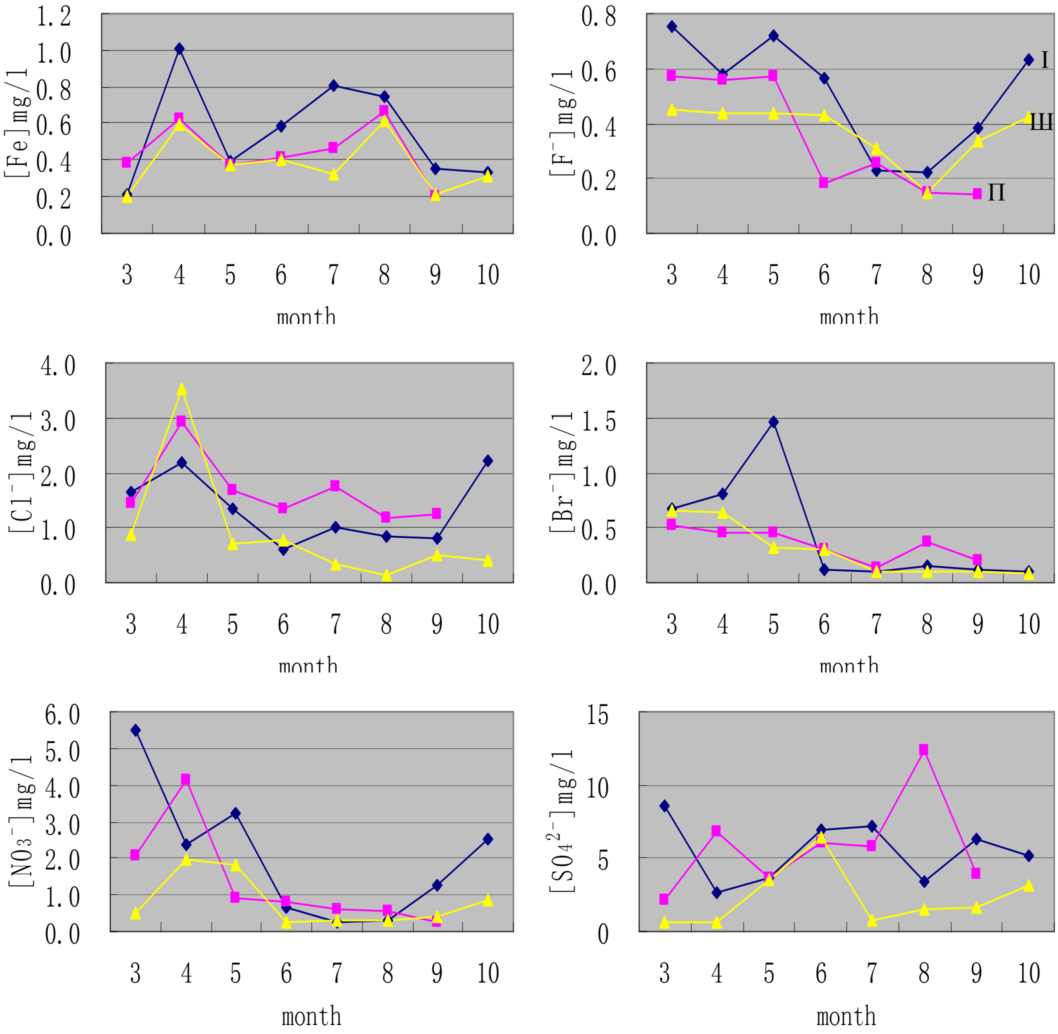

Fig.15 Seasonal variation of negative ions in different concourse sites
(Ⅰ:site10, Ⅱ:site8, Ⅲ:site15)

The negative ions of stream water in three sites was also varied by seasons. Compare between sites, the variation trends of Cl^- and F^- are same. The concentrations of total Fe, F^- and SO_4^{2-} was highest in site10 and lowest in site15 in most of months. The concentrations of Cl^- in stream water of Site8 was higher than Site10 and Site15 except in April.

3.4 Analysis of the effects of forest fire on stream water quality

Above all, three sites was installed in the forest zone of Daxing' an Mountains. Attempt to understand the effect of forest fire on the water quality. These three sites was Site24, Site25 and Site26.

3.4.1 Seasonal variation of positive ions

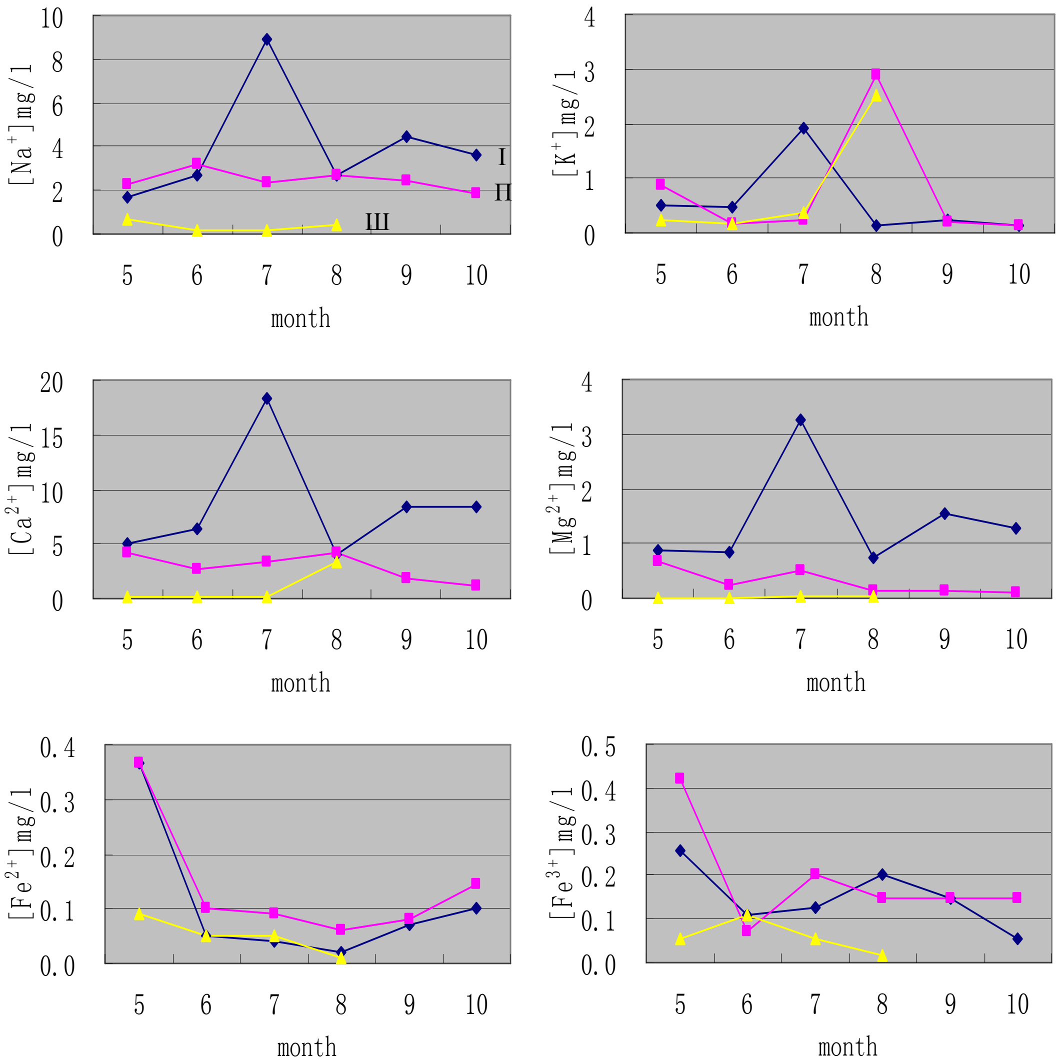

Fig.16 Seasonal variation of positive ions in stream of fired and unfired forest and in bulk deposition(Ⅰ:site24, Ⅱ:site25, Ⅲ:site26)

Site24 is Daxing' an Mountains brule.Site25 is Daxing' an Mountains forest.Site26 is Daxing' an Mountains bulk deposition. Water quality varied considerably, both seasonally and among sites. The concentrations of Na^{+}, Ca^{2+} and Mg^{2+} was highest in brule and lowest in bulk deposition. The concentrations of Fe(Ⅱ) was highest in unfired forest. The seasonally variation trends of Na^{+}, Ca^{2+} and Mg^{2+} are same. The concentrations of them were highest in July in brule and had no statistically seasonally variables in unfired forest.

3.4.2 Seasonal variation of negative ions

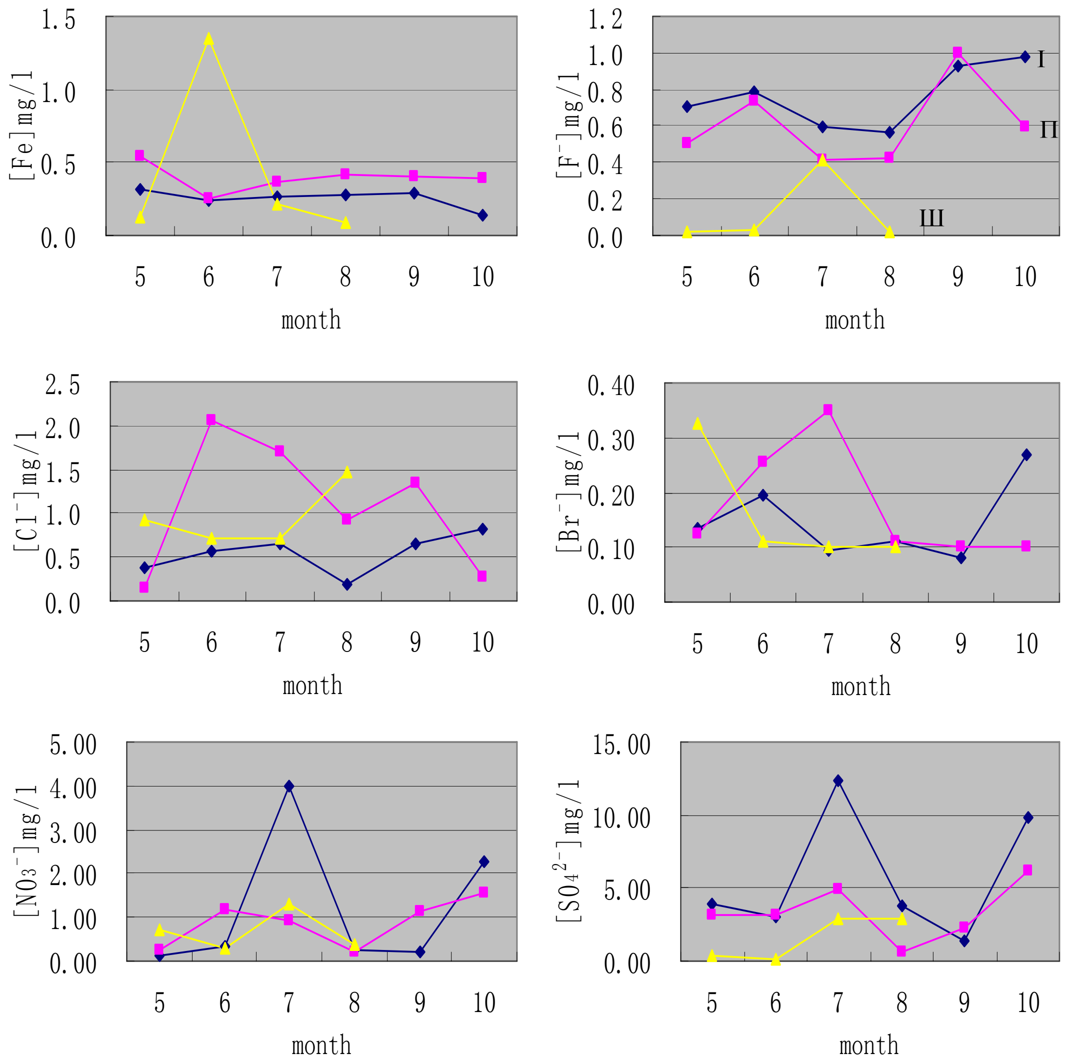

Fig.17 Seasonal variation of negative ions in stream of fired and unfired forest and in bulk deposition (Ⅰ :site24, Ⅱ :site25, Ⅲ :site26)

The negative ions also varied considerably, both seasonally and among sites. The concentrations of total Fe, Cl^{-} and Br^{-} was highest in unfired forest in most of months. The concentrations of F^{-} and SO_4^{2-} were highest in brule except in September. The seasonally variation trends of NO_3^{-} and SO_4^{2-} are same. The concentrations of them were highest in July in brule (Fig.17).

3.5 Analysis of water quality in Tongjiang (TJ)

In the same time, one water sample site was installed in Tongjiang. The seasonally variation of water quality was showed in Fig.18—Fig.21.

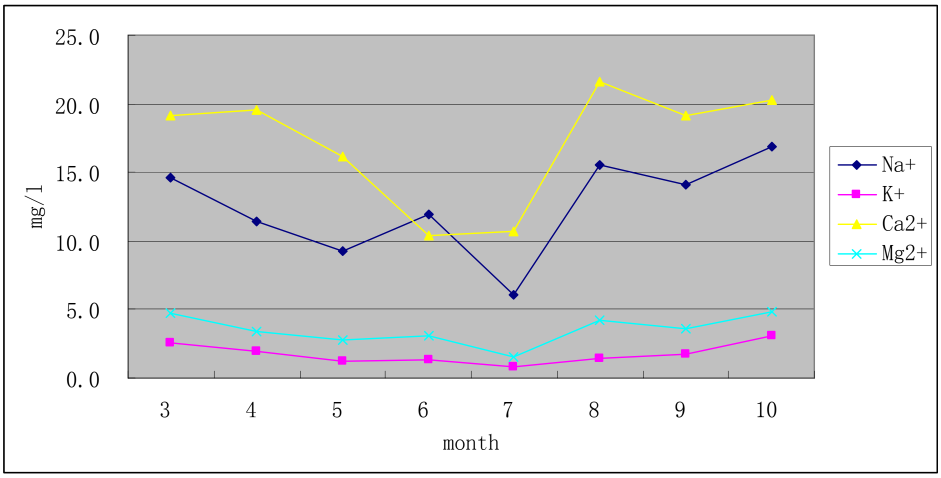

Fig.18 Seasonal variation of Na^+,K^+,Ca^{2+} and Mg^{2+} in Tongjiang

The concentrations of Na^+, K^+, Ca^{2+} and Mg^{2+} in Tongjiang varied seasonally. But compare to K^+ and Mg^{2+},the seasonal variation of the concentration of Na^+ and Ca^{2+} was considerable. The seasonally variation trends of Na^+ and Ca^{2+} are similar. The concentrations of them was highest in August.

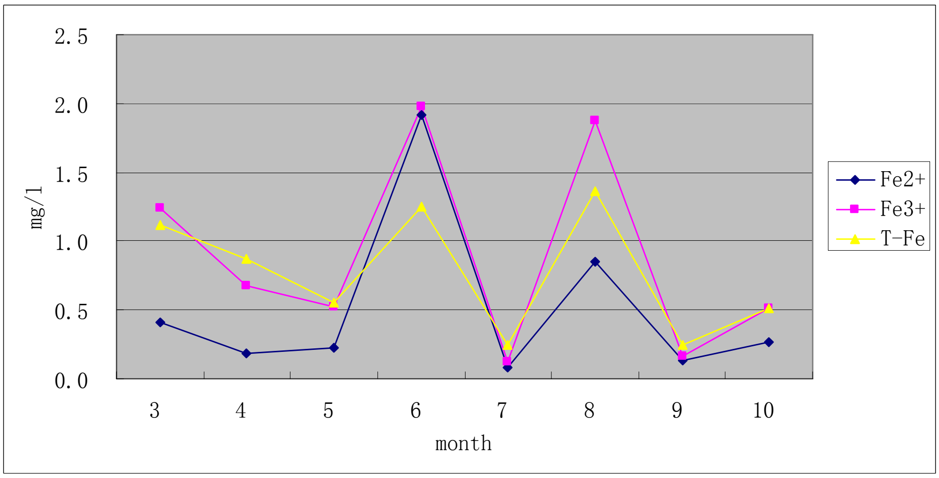

Fig.19 Seasonal variation of Fe^{2+},$Fe^{3+}$and T—Fe in Tongjiang

The concentrations of Fe(Ⅱ), Fe(Ⅲ) and total iron in Tongjiang are vary in seasons.The variation trends of them are same,and the concentrations of them were higher in April and June than in other months.

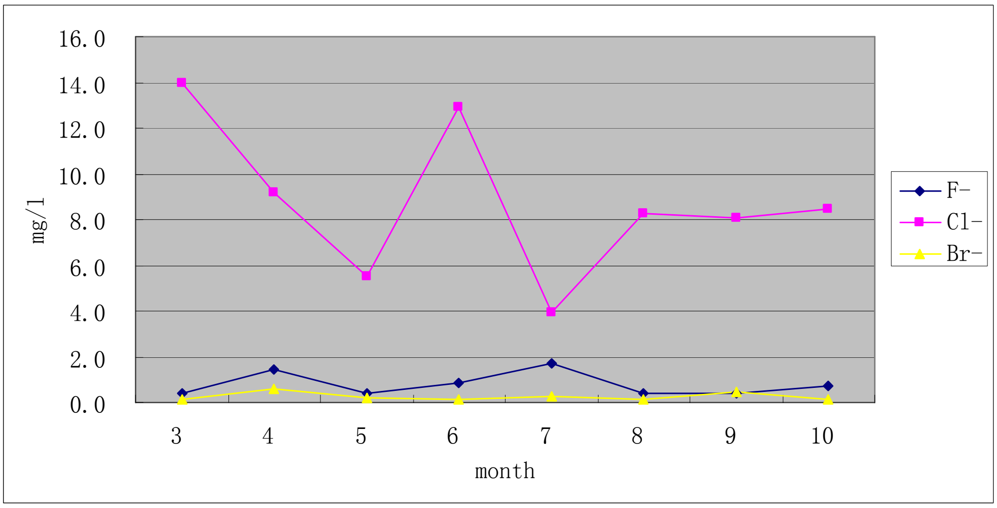

Fig.20 Seasonal variation of F^-,Cl^- and Br^- in Tongjiang

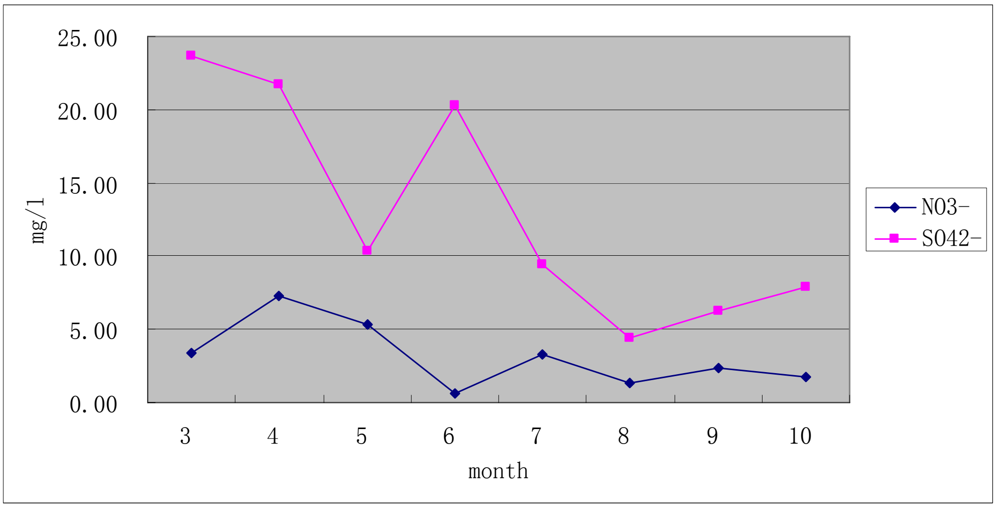

Fig.21 Seasonal variation of NO_3^- and SO_4^{2-} in Tongjiang

Except Br^-,the concentrations of F^- , Cl^-, NO_3^- and SO_4^{2-} in Tongjiang was also varied by seasons. Seasonal variation of Cl^- and SO_4^{2-} was considerable. The concentrations of Cl^- and SO_4^{2-} was highest in June. The concentration of NO_3^- was higher than the concentration of SO_4^{2-}through months(Fig.21).

References:

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