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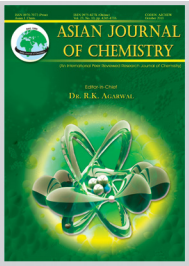

NOTE

Heavy Metal Pollution in Water of Rivers and Lake in Tibet by ICP-MS

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Tibet has been called the roof of the world, the third of the earth, snowy region and so on. It is not only the rivers source and ecological source for South Asia and Southeast Asia, so environment of Tibet should be paid more attention. In this paper, the concentration of heavy metal elements (Fe, Cu, Fe, Zn, Se, Mo, Cd, Pb, V, Cr, Mn) of the different rivers in Tibet was detected totally by water sample analysis in high-flow period by inductive coupled plasma-mass spectrometer. The concentrations of Fe, Cu, Zn, As, Se, Mo, Cd, Pb, V, Cr and Mn were 0 μg/mL-0.06 μg/mL, 0.41 ng/mL-1.11 ng/mL, 0-1.90 ng/mL, 0.16 ng/mL-3.71 ng/mL, 0.01 ng/mL-0.17 ng/mL, 0.69 ng/mL-1.49 ng/mL, 0 ng/mL-0.02 ng/mL, 0 ng/mL-0.06 ng/mL, 0.06 ng/mL-0.47 ng/mL, 0.05 ng/mL-0.19 ng/mL and 0.05 ng/mL-1.52 ng/mL respectively. The results showed that Lhasa river contained the highest concentration of Cu, As and Pb in the four kinds of water, Pearl lake cotained the highest concentration of Fe, Zn, V, Cd and Mn, Nyang river and Brahmaputra river contained lower heavy metals, which should be relative to higher population density around Lhasa river and Pearl lake. Overall, heavy metal pollution in rivers in Tibet is not serious, but densely populated areas should pay more attention to environmental problems.

Key Words: Water pollution, Heavy mental, ICP-MS, Water pollution index.

Water is one of the main natural resources for human survival, an important part of the human ecological environment and the substance reservoirs in physical biogeochemical cycles, but water is vulnerable to the environment[1]. Under the influence of human activities, more and more of pollutants are emitted into water which can cause many problems environment and human health[2]. Heavy metal is a typical accumulative contaminants in the environment, which is difficult to degrade, once the environment is polluted by heavy metal, it is difficult to remove and reinstate[3].

Brahmaputra is the longest river in Tibet, is highest river in the world, originates within Pierre Yangzom Glacier on the north of Himalayan Mountains in Zhongba county. Lhasa river, Nyang are two main tributaries of the middle of the Brahmaputra, these tributaries not only provides a wealth of water and raising a wide valley plains, such as Lhasa plains and Shigatse plains. Pearl Lake is located in the territory of Tibet, which is over 5100 meters above sea level.

In recent years, with the rapid development of society and economy of Tibet Autonomous region, people's living standards has been improved, but according to emissions of wastewater and major pollutants from Tibet in recent years (Table-1) , the discharge volume of Tibet industrial wastewater and urban sewage increased year by year, so environmental issues in Tibet are increasingly apparent at the same time.

TABLE-1
EMISSIONS OF WASTEWATER AND MAJOR POLLUTANTS IN TIBET FROM 2005-2009

Years	Industrial waste water emissions (10000t)	COD in industrial waste water (t)	Emissions of municipal waste water (10000t)
2005	1008.54	1071.57	3563.6
2006	790.45	948.34	2462.44
2007	869.77	917.82	2479.08
2008	924.49	741.44	2496.16
2009	941.55	14663.15	2513.68

Note: All data from Tibet autonomous region state of the environment 2005-2009 [4-8]

Inductive coupled plasma-mass spectro-meter (ICP-MS), PQ Excell made in TJA solutions (USA). The operating parameters were showed in Table-2[9,10].

Sampling time: Aug. 8th, 2010 (high-flow period), samples are from Brahmaputra river, the Lhasa river, Nyang river and Pearl lake.

Eleven kinds of heavy metals were determined in water from Brahmaputra river, the Lhasa river, Nyang river and Pearl lake, Fe, Cu, Zn, As, Se, Mo, Cd, Pb, V, Cr and Mn. Measured values of Fe ranged from 0 μg/mL to 0.06 μg/mL, Cu 0.41 ng/mL to 1.11 ng/mL, Zn 0 to 1.90 ng/mL, As 0.16 ng/mL to 3.71 ng/mL, Se 0.01 ng/mL to 0.17 ng/mL, Mo 0.69 ng/mL to

1.49 ng/mL, Cd 0 ng/mL to 0.02 ng/mL, Pb 0 ng/mL to 0.06 ng/mL, V 0.06 ng/mL to 0.47 ng/mL, Cr 0.05 ng/mL to 0.19 ng/mL and Mn 0.05 ng/mL to 1.52 ng/mL (Table-3).

TABLE-2
OPERATING PARAMETERS OF ICP-MS

Operating parameters	Value
Power (W)	1350
Cooling air flow (Ar) dm^3*min^{-1}	13.0
Auxiliary gas flow (Ar) dm^3*min^{-1}	0.7
Atomization gas flow (Ar) dm^3*min^{-1}	0.98
Sampling cone (mm)	1.0
Intercepting cone (mm)	0.7
Measurement mode	Peak jump
Scanning frequency	200
Residence time* (ms)	10
Channels of each quality	3
Total sampling time (s)	18

TABLE-3
CONTENTS OF HEAVY METALS IN THREE RIVERS AND PEARL LAKE

Elements	Pearl lake	Lhasa river	Nyang river	Brahmaputra river
Fe (μg/mL)	0.06	0.02	0.03	NIL
Cu (ng/mL)	1.10	1.11	0.41	0.48
Zn (ng/mL)	1.90	0.95	0.48	NIL
As (ng/mL)	0.81	3.71	0.986	0.16
Se (ng/mL)	0.06	0.01	0.09	0.17
Mo (ng/mL)	0.69	1.22	1.49	0.69
Cd (ng/mL)	0.01	0.01	0.02	NIL
Pb (ng/mL)	NIL	0.06	NIL	NIL
V (ng/mL)	0.47	0.14	0.06	0.13
Cr (ng/mL)	0.19	0.11	0.05	0.15
Mn (ng/mL)	1.52	0.56	1.12	0.05

Note: Values in bold represent the highest concentrations in four kinds of water.

The results showed that Lhasa river contained the highest concentration of Cu, As and Pb in the four kinds of water, Pearl lake cotained the highest concentration of Fe, Zn, V, Cd and Mn, Nyang river and Brahmaputra river contained lower heavy metals, which should be relative to higher population density around Lhasa river and Pearl lake. Overall, heavy metal pollution in rivers in Tibet is not serious, but densely populated areas should pay more attention to environmental problems.

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