



## NOTE

### Determination of Trace Elements Content in Mineral Water and its Processed Mineral Water by ICP-MS

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Good natural mineral water has become important strategic resource. The macro and trace elements and five heavy metals were determined in natural mineral water from Emei mountain of Beijing and its processed mineral water by ICP-MS. The results showed that (1) natural mineral water contained many macro elements, especially Ca, Mg, Si Na and K, and the processing course did not significantly reduce the concentration of these elements; (2) natural mineral water contained much trace elements, including Li, Zn, Sr, Se, Mn, Cu and Fe, especially Sr, Fe and Se, and after processing, many trace elements increased significantly, such as Zn, Li and Se; (3) the natural mineral water from Emei mountain of Beijing and its processed mineral water contain much little heavy metals. By contrast with the national standards, the natural mineral water from Emei mountain of Beijing is excellent mineral water and its processed mineral water also meet the national hygiene standards of drinking water.

**Key Words:** Trace elements, Heavy metals, Mineral water, ICP-MS.

Water is the most important nutrition for human health, but with the development of society more and more waters are polluted and less and less water is potable<sup>1,2</sup>. The pollutants include organic pollutants<sup>3</sup> and inorganic pollutants, such as heavy metals<sup>4</sup>. On the another hand, we drink not only for H<sub>2</sub>O but also trace elements, including K, Ca, Mg, Sr, Si and many other elements.

For water safety and water nutrition, there are many mineral water brands, most which named high trace elements content and safety. But natural mineral water must meet the national standards and must be processed before sale as drinking water and the processing course can also be the pollution pathway.

This paper determined the contents of trace elements and heave metals in a spring from Beijing and its processed mineral water to study the nutrition and safety of this mineral water and its processed mineral water.

The natural mineral water was collected from Emei mountain of Pinggu district, Beijing city. Processed mineral water: the natural mineral water was collected from Emei mountain was filtered through quartz sand and almond carbon firstly, then filtered through carbon fiber and finally sterilized by ozone.

#### Method

**Parameters of apparatus:** Parameters of inductively coupled plasma: Referred to Huang *et al.*<sup>5</sup> method: power, 1200

W; rate of flow of cooling gas (Ar), 15.0 L/min; rate of flow of supplemental gas (Ar), 1.80 L/min; rate of flow of carried gas (Ar), 0.90 L/min. Parameters of mass spectrometry: vaccum of analysis room,  $5.90 \times 10^{-6}$  Tor r; impulse voltage, 1100 V. Parameters of detecting: resolution (10 % peak height): 0.8 amu (Nor), 0.6 amu (H); retention period, 100 ms, times of replication, 5; times of circulation, 8; mode of analysis, scanning of mass, period of analysis, 72 s; rate of sample, 1 mL/min.

**Macronutrient:** K, Na, Ca, Mg, Si are essential for human health and play an important role on metabolism of human body. For example, potassium is widely distributed in the muscles, nerves and blood potassium and closely relative to activity of skeletal muscle and nerve conduction, which plays a significant role in the prevention of severe hypertension, stroke, muscular dystrophy, heart disease, rickets and even cancer<sup>6</sup>.

The results (Table-1) showed that natural mineral water contained many macro elements, especially Ca, Mg, Si Na and K and the processing course did not significantly reduce the concentration of these elements.

**Micro-and beneficial elements:** The results showed that natural mineral water contained much trace elements, including Li, Zn, Sr, Se, Mn, Cu and Fe, especially Sr, Fe and Se which are all the essential elements for human health, so we can

TABLE-1  
CONCENTRATIONS OF MACRONUTRIENT IN NATURAL  
MINERAL WATER AND PROCESSED MINERAL WATER

Elements	Natural mineral water ( $\mu\text{g/mL}$ )	Processed mineral water ( $\mu\text{g/mL}$ )
K	1.29a	1.26a
Na	3.72a	3.66a
Ca	40.86a	39.52a
Mg	21.10a	21.11a
Si	4.84a	4.68a

TABLE-2  
CONCENTRATIONS OF MICRO-AND BENEFICIAL  
ELEMENTS IN NATURAL MINERAL WATER AND  
PROCESSED MINERAL WATER

Elements	Natural mineral water (ng/mL)	Processed mineral water (ng/mL)
Li	1.99a	2.16b
Zn	0.54a	45.76b
Sr	117.55a	122.58a
Se	3.56a	4.05b
Mn	0.34a	0.11b
Cu	0.22a	0.22a
Fe	53.46a	38.19b

supplement trace elements by drinking mineral elements. After processing, many trace elements increased significantly, such as Zn, Li and Se; and Mn and Fe decreased significantly. All these elements in natural mineral water and processed mineral water meet the national hygiene standards of drinking water<sup>7</sup> (Table-2).

**Heavy metals:** Today people increasingly focused on the safety of drinking water, especially heavy metals As, Pb, Cd, Cr and Hg which are harmful to human health. The results (Table-3) showed that natural mineral water contained little heavy metals and concentrations of heavy metals had no significant changes after processing. All heavy metals in natural mineral water and processed mineral water meet the national hygiene standards of drinking water<sup>7</sup>.

TABLE-3  
CONCENTRATIONS OF FIVE KINDS OF  
HEAVY METALS IN NATURAL MINERAL  
WATER AND PROCESSED MINERAL WATER

Elements	Natural mineral water (ng/mL)	Processed mineral water (ng/mL)
As	0.54a	0.33a
Hg	0.002a	0.007a
Pb	0.02a	0.03a
Cr	0.82a	0.84a
Cd	0.003a	0.004a

## Conclusion

By contrast with the national standards, the natural mineral water from Emei mountain of Beijing is excellent mineral water and its processed mineral water also meet the national hygiene standards of drinking water. The natural mineral water from Emei mountain of Beijing and its processed mineral water contain many kinds of trace and beneficial elements. The natural mineral water from Emei mountain of Beijing and its processed mineral water contain much little heavy metals.

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