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NOTE

Monitoring of Nine Trace Elements in Chinese Herbal Medicine *Tinospora sinensis* (Lour.) *Merr* by ICP-MS

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ICP-MS is the most efficient method to determine simultaneously the content of trace elements, heavy metals and rare earths in Chinese herbal medicines. The results proved that the Chinese herbal medicine *Tinospora sinensis* (Lour.) *Merr* contains great amount of trace elements, in which human-body-needed trace elements but rare earths elements and the heavy metals are very little. A method using ICP-MS with microwave digestion was studied for the determination of 29 elements including wholesome microelements, heavy metals and rare earth elements. There are five kinds of elements whose concentrations are more than 15 μg/g, they are Ca, Zn, Fe, Mn and B, especially the concentration of Ca is above 18192.35 μg/g, concentration of Mn is more than 1301.42 μg/g, Fe is more than 65.57 μg/g, whose high complexing ability can enhance treatment effects of Chinese herbal medicines. Most heavy metals and rare earth elements are lower than 0.1 μg/g, only the concentrations of Pb, Cr, La and Ce are more than 1 μg/g, so heavy metals and rare earth elements could have no effects on the treatment effects.

Key Words: ICP-MS, *Tinospora sinensis* (Lour.) *Merr*, Trace elements.

The effective constituents of herbal medicines were focus on the organic compounds mostly[1-3], but the roles of inorganic elements were neglected. Many researches proved that the efficacy of herbal medicine was significantly relative to the content of some trace elements[4]. The researches of Liang and Shengxu[5] and GAO's[6] proved the efficacy of many organic constituents in herbal medicines will increase combined with trace elements, even these complex compounds have some new medicinal efficacies. So it is important to investigate the contents of trace elements in Chinese herbal medicine for revealing the efficacy of a Chinese herbal medicine.

The most important methods for determining trace elements have been atomic absorption spectrometry and atomic fluorescence spectrometry. But the effects of Chinese herbal medicine usually depends on the interaction of many elements and

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organic component, so inductively coupled plasma atomic emission spectrometry (ICP-AES) and inductively coupled plasma mass spectrometry (ICP-MS) become the first choice. ICP-MS has more advantages than ICP-AES, such as the ability to detect more than 60 kinds of elements simultaneously and high accuracy. In this study, we selected the ICP-MS method to determine trace elements in *Tinospora sinensis* (Lour.) *Merr*, which is a good herbal medicine for eliminating wind dampness, stimulating the circulation of the blood, relaxing muscles and joints, easing pain and decreasing swelling[7].

Treatments of the samples: *Tinospora sinensis* (Lour.) *Merr* were collected from Yunnan province and Guizhou province of China. All the *Tinospora sinensis* (Lour.) *Merr* were washed with distilled water to remove the dust, washed with deionized water 3-5 times and grinded with stainless steel grinder, lastly sieve with 100 mesh sieve. The extracting methods referred to Wang *et al.* method[8]. Inductively coupled plasma mass spectrometry apparatus (ELAN DRCI). The parameters of instruments referred to references[9,10].

Limits of detection of all detected trace elements (Ca, Fe, Mn, Zn, B, Cu, Li, Mo and I) were mostly lower than 5 μg/L, only limits of detection of Li and I were higher than 5 μg/L, but still lower than 10 μg/L and the relative standard deviations ranged from 1.80-8.60 % for all elements and mostly lower than 5.0 %, B and I were 5.80 and 8.60 % (Table-1). These results showed that this method can simultaneously detect the above trace elements and this method was simple and precise.

TABLE-1
LIMITS OF DETECTION AND RELATIVE STANDARD DEVIATIONS OF THIS METHOD TO DETECT 9 TRACE ELEMENTS

Heavy metals	Limits of detection (μg/mL)	Relative standard deviations (RSD) (%)
Ca	2.10	3.30
Fe	1.23	4.25
Mn	0.98	2.20
Zn	0.78	1.80
B	0.65	5.80
Cu	1.37	2.25
Li	5.21	3.20
Mo	3.72	2.96
I	8.38	8.60

The results should that wild *Tinospora sinensis* (Lour.) *Merr* contains many important wholesome trace elements, they are Ca > Mn > Fe > Zn > B > Cu > I > Li > Mo, especially contents of Ca, Mn, Fe and Zn are 18192.35, 1301.42, 65.57 and 24.88 μg/g, respectively (Table-2). All these elements have high complexing capacity, which could be the factor that *Tinospora sinensis* (Lour.) *Merr* have the efficacy of Chinese traditional medicine. But the relationship of efficacy of *Tinospora sinensis* (Lour.) *Merr* with the contents of these trace elements require further

research.

TABLE-2
CONTENT OF WHOLESOME ELEMENTS IN *Tinospora sinensis* (Lour.) *Merr* (μg/g)

Elements	Content
Ca	18192.35
Fe	65.57
B	17.13
Cu	4.08
I	0.64
Zn	24.88
Mn	1301.42
Li	0.57
Mo	0.38

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REFERENCES

1. J.L. Sun, Y.L. Hu, D.Y. Wang, B.K. Zhang and J.G. Liu, *Vaccine*, **24**, 2343 (2006).
2. J.L. Zhou, L.W. Qi and P. Li, *J. Chromatogr. A*, **1216**, 7582 (2009).
3. S.-C. Hsieh, M.F. Huang, B.S. Lin and H.T. Chang, *J. Chromatogr. A*, **1105**, 127 (2006).
4. L. Wang, *Henan Traditional Chin. Med*., **6**, 19 (1989).
5. L. Wu and S. Luo, *J. Hainan Med. College*, **14**, 474 (2008).
6. G. Gao, *Studies Trace Elements Health*, **15**, 50 (1998).
7. W. Duan, L.-W. Bi and W.-H. Li, *Chin. J. Radiol. Health*, **17**, 138 (2008).
8. B. Wang, Y.-F. Xu, G.-Q. Li and H.-S. Guan, *Spectro. Spectral Anal*., **29**, 3138 (2009).
9. Y.-K. Rui and G.-Q. Qu, *Spectro. Spectral Anal*., **29**, 819 (2009).
10. Y.-K. Rui, H.X. Zhang, J. Guo, K.L. Huang, B.Z. Zhu and Y. Luo, *Agro Food Ind. Hi-Tech*., **17**, 35 (2006).

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