

中文題目：利用電感耦合電漿體質譜法測量科學中藥裡的鉀含量

英文題目：Quantitative determination of potassium in Traditional Chinese herbal medicine using Inductively coupled plasma mass spectrometry (ICP-MS)

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Background:

Traditional Chinese herbal medication (TCHM) has been shown to have therapeutic effects in chronic kidney disease(CKD). The use of TCHM in CKD patients is getting popular, particular in Asian countries. Since most herbs are made from different parts of plants, it is possible that herbs have high potassium content. Hyperkalemia has been shown to be associated with increased mortality in CKD patients and end-stage renal disease (ESRD) patients. Thus, it would be a concern when prescribing TCHM in CKD patients. This study aims to investigate the potassium content in TCHMs by using inductively coupled plasma mass spectrometry (ICP-MS). Considering there are thousands of herbs used in TCHM, this pilot study focuses on concentrated herbal extract formulas commonly used in patients with CKD.

Methods:

An Agilent 7900 ICPMS was used for potassium measurement. The instrument operating conditions are illustrated in Table 1. Concentrated herbal extract formulas, as listed in Table 2, were obtained commercially from qualified Traditional Chinese medicine pharmaceutical factories. All the samples were in powder form, processed by acid digestion methods with 65% nitric acid and then 30% hydrogen peroxide.

Results:

As shown in table 2, in the 16 concentrated herbal extract formulas, the content of potassium was highest in Yin Qiao San (YQS)(1270mg/100g), and lowest in Tao Ren Cheng Qi Tang (TRCQT)(568mg/100g). After adjusted with recommend daily TCHM dosage, the daily accumulation of potassium was highest in Xue-fu-zhu-yu tang(XFZYT)(187.7mg/day), and lowest in TRCQT (34.1mg/day).

Conclusion:

Potassium content was higher in TCHM compared with regular vegetables and fruits. After adjusted with recommend daily TCHM dosage, the daily accumulation of potassium was lower than recommend requirement in CKD patients(2000~4000mg/day). Further comprehensive measurement of potassium content in other TCHMs is needed.

Keywords: Potassium, Traditional Chinese herbal medicine, inductively coupled plasma mass spectrometry

Table 1. Operating conditions for the ICP-MS

Parameter	No Gas Mode		Cell Gas Mode		(High Energy) Collision Mode [†]	
	Value	Range	Value	Range	Value	Range
RF Power [W]	1550	Fixed	1550	Fixed	1550	Fixed
Smpl Depth [mm]	8.0	Fixed	8.0	Fixed	8.0	Fixed
Carrier Gas [L/min]	1.05	1.01 to 1.11	1.05	1.01 to 1.11	1.05	1.01 to 1.11
Makeup Gas [L/min]	0	0 to 0.50	0	0 to 0.50	0	0 to 0.50
Dilution Gas [L/min]	0	Fixed	0	Fixed	0	Fixed
Neb Pump [rps]	0.1	Fixed	0.1	Fixed	0.1	Fixed
S/C Temp [degC]	2	Fixed	2	Fixed	2	Fixed
He or H ₂ gas [ml/min]	0	Fixed	4.3 (He) 6.0 (H ₂)	4.0 to 5.5 (He) 5.0 to 7.0 (H ₂)	10 (He)	8 to 11 (He)
Extract 1 [V]	0	Fixed	0	Fixed	0	Fixed
Extract 2 [V]	-180	-250 to -160	-180	-250 to -160	-180	-250 to -160
Omega Bias [V]	-80	-110 to -70	-80	-110 to -70	-80	-110 to -70
Omega Lens [V]	10	7 to 12	10	7 to 12	10	7 to 12
Cell Entrance [V]	-30	-40 to -30	-40	-40 to -30	-130	-150 to -110
Cell Exit [V]	-50	-60 to -40	-60	-60 to -40	-150	Fixed
Deflect [V]	10	8 to 15	0	-5 to 4	-80	-90 to -70
Plate Bias [V]	-35	-50 to -30	-60	Fixed	-150	Fixed
OctP RF [V]	180	150 to 200	180	150 to 200	190	180 to 200
OctP Bias [V]	-8	-10 to -6	-18	Fixed	-100	Fixed
Energy Discrimination	5	2 to 6	5	3 to 6	7	6 to 9

Table 2. Potassium content in concentrated herbal extract formulas commonly used in patients with CKD

		K ⁺ (mg/100g)	Daily TCHM dosage (g)	K ⁺ in daily TCHM dosage (mg)
Du-Huo-ji-sheng tang	DHJST	995	4	39.8
Tian-ma-gou-teng yin	TMGTY	930	5	46.5
Liu-wei-di-huang wan	LWDHW	1020	13	132.6
Xue-fu-zhu-yu tang	XFZYT	894	21	187.7
Jia Wei Xiao Yao San	JWXYS	1250	10	125
Gui Pi Tang	GPT	668	12	120.2
Hsiao-feng san	HFS	983	10	98.3
Yi Qi Cong Ming Tang	YQCMG	916	10	91.6
Buzhong Yiqi Tang	BZYQT	1100	10	110
Wuling San	WLS	1230	6	73.8
Ban Xia Xie Xin Tang	BXXXT	729	6	43.7
Huo Xiang Zheng Qi San	HXZQS	1530	10	153
Jing Fang Bai Du San	JFBDS	1220	10	122
Yin Qiao San	YQS	1270	6	76.2
Tao Ren Cheng Qi Tang	TRCQT	568	6	34.1
Xiang Sha Liu Jun Zi Tang	XSLJZT	959	12	115.1