Asian Journal of Chemistry; Vol. 23, No. 4 (2011), 1885-1886

ASIAN JOURNAL OF CHEMISTRY

www.asianjournalofchemistry.co.in

NOTE

Monitoring of Mineral Elements and Heavy Metals in *Camellia oleifera* Seeds by ICP-MS

YE HANG[1,*], JINLIN MA[1,2], GUOCHEN CHEN[1], KAIXIANG LI[1] and NAIYAN ZHANG[1]

[1]Guangxi Forestry Research Institute, Nanning 530002, Guangxi Province, P.R. China
[2]Central South University of Forestry and Technology, Changsha 41004, Hunan Province, P.R. China

*Corresponding author: E-mail: ye_hang2010@163.com

(*Received*: 1 September 2010; *Accepted*: 30 December 2010) AJC-9446

Concentrations of mineral elements Ca, K, Fe, Mn, Zn, Se, Mo, Mg and heavy metals Pb, Cd, Cu, Cr, Al and As in *Camellia oleifera* seeds were determined by inductively coupled-plasma mass spectrometry (ICP-MS). The results showed that there are many and much mineral elements in *Camellia oleifera* seeds, which is essential to human health. *Camellia oleifera* seeds contain little heavy metals. The harmful element Al is the highest why *Camellia oleifera* usually grow in southern red soil. The relative standard deviation (RSD) range from 1.87-4.78 % and the recovery range from 96.78-105.98 %. According to the concentration, *Camellia oleifera* seeds contain much mineral elements which is beneficial to human health as food material, but the concentration of aluminium is high, so we should remove aluminium when produce edible oil with *Camellia oleifera* seeds.

Key Words: *Camellia oleifera* seeds, ICP-MS, Mineral elements, Heavy metals.

Camellia oleifera is a high quality edible oil shrub whose oil is one of the four primary edible tree oils with palm oil, olive oil and coconut oil[1]. Many researches have focused on the composition of fatty acids, vitamins and other organic compounds in *Camellia oleifera*[2,3], but the concentration of mineral elements and heavy metals which are important to human health in *Camellia oleifera* have not been reported.

The common methods for determining mineral elements and heavy metals are atomic absorption spectrometry and atomic fluorescence spectrometry. But these methods can not detect many elements simultaneously, so in this study inductively coupled plasma atomic emission spectrometry (ICP-AES)[4] and inductively coupled plasma mass spectrometry (ICP-MS)[5] become the first choice which have the ability to detect more than 60 kinds of elements simultaneously and high accuracy.

Four major cultivars of *Camellia oleifera* were obtained from GuangXi Forestry Research Institute, they are LCDG, YAYC, CR2 and CR3. Inductively coupled plasma mass spectrometry apparatus. The parameters of instruments referred to references[6,7].

Accuracy and precision of method: Eight kinds of mineral elements (Ca, K, Fe, Mn, Zn, Se, Mo and Mg) and six kinds of harmful elements for human health (Pb, Cd, Cu, Cr, Al and As) were detected by ICP-MS. The correlation coefficients range from 0.9688-0.9999, the recoveries range from 96.87-105.98 %, limits of detection range from 0.007-0.085 ng mL^{-1} and relative standard deviations (RSD) range from 1.87-4.78 % (Table-1), which all showed that this method is simple, accurate and precise method to detecting many elements simultaneously.

TABLE-1
CORRELATION COEFFICIENT, RECOVERY, LIMITS OF DETECTION AND RELATIVE STANDARD DEVIATIONS (RSD) OF DETECTED ELEMENTS

Elements	Correlation coefficient	Recovery (%)	Limits of detection (ng mL^{-1})	RSD (%)
Ca	0.9978	97.66	0.010	2.78
K	0.9899	96.78	0.026	3.66
Fe	0.9990	102.41	0.015	4.19
Mn	0.9999	105.98	0.023	2.85
Zn	0.9999	100.37	0.012	1.97
Se	0.9881	98.17	0.031	3.94
Mo	0.9798	99.93	0.037	2.83
Mg	0.9999	102.38	0.022	2.71
Pb	0.9998	101.55	0.085	1.87
Cd	0.9995	99.17	0.008	3.11
Cu	0.9998	101.99	0.032	2.43
Cr	0.9954	97.27	0.007	2.91
Al	0.9688	96.87	0.042	4.78
As	0.9976	97.83	0.027	3.62

Concentrations of eight mineral elements in *Camellia oleifera* seeds: *Camellia oleifera* seeds contain all the detected mineral elements, Ca, K, Fe, Mn, Zn, Se, Mo and Mg, but K,

Mg, Ca and Mn are the elements whose concentrations are higher than 30 mg kg^{-1}. Concentrations of two important trace elements (Fe and Zn) range from 6.0-15.0 mg kg^{-1}, but *Camellia oleifera* seeds contain little Se and Mo (Table-2).

TABLE-2
CONCENTRATIONS OF MINERAL ELEMENTS
IN *Camellia oleifera* SEEDS mg kg^{-1}

Elements	Cultivars			
	LCDG	CR2	YAYC	CR3
Ca	673.200	1016.940	1084.850	1506.850
K	9807.190	11178.780	9933.330	9672.370
Fe	6.820	8.190	6.640	9.360
Mn	287.110	31.080	37.140	54.090
Zn	11.110	10.470	6.820	14.640
Se	0.024	0.018	0.019	0.059
Mo	0.015	0.028	0.012	0.046
Mg	1049.290	1325.710	1513.130	1375.570

TABLE-3
CONCENTRATIONS OF HEAVY METALS
IN *Camellia oleifera* SEEDS mg kg^{-1}

Metals	Cultivars			
	LCDG	CR2	YAYC	CR3
Pb	nd	nd	0.080	nd
Cd	0.010	0.005	0.005	0.012
Cu	3.990	4.280	4.330	7.310
Cr	0.030	0.030	0.010	0.020
Al	437.340	359.640	316.380	233.800
As	0.010	0.018	0.013	0.022

nd: Showed that the content is lower than the detection limit.

Concentrations of harmful elements in *Camellia oleifera* seeds: *Camellia oleifera* seeds contain little heavy metals, but the concentration of aluminium is much higher than other harmful elements, whose concentration can reach more than 430 mg kg^{-1}. The reason why concentration of aluminium is high should be *Camellia oleifera* is produced in south of China where the soil is southern red soil which is acid and contains many aluminium elements (Table-3). *Camellia oleifera* seeds contain high concentration of aluminium, so we should remove aluminium when we produce edible oil with *Camellia oleifera* seeds.

ACKNOWLEDGEMENTS

The authors appreciated the financial support from the National Project of Scientific and Technical Supporting Programs of the Eleventh 5-year Plan Period Funded by Ministry of Science & Technology of China (No. 2009BADB1B06). and Recommend International Advanced Agricultural Science and Technology Plan (No. 2009-4-08).

REFERENCES

1. D.-Q. Zhang, X.-F. Tan, W.-X. Peng, Q.-M. Liu, Y.-L. Zeng, H.-P. Chen, H. Tian and Q.-Z. Ma, *Acta Scienti. Natural. Universit. Sunyat.*, **46S**, 109 (2007).
2. J. Ma, H. Ye, Y. Rui, G. Chen and N. Zhang, *J. Verbr. Lebensm.*, (2010) (In press).
3. G.-W. Zhang, L.-S. Que, S.-Y. Lai and X.-M. Guo, *Jiangxi Sci*., **25**, 33 (2007).
4. A.D. Mulazimoglu, I.E. Mulazimoglu and E. Ozkan, *E-J. Chem*., **6**, 1176 (2009).
5. H. Zhang, F. Xu and R.Yukui, *Asian J. Chem*., **22**, 4777 (2010).
6. R. Yukui and G.-Q. Qu, *Spectros. Spectral Anal*., **29**, 819 (2009).
7. R. Yukui, H. Zhang, J. Guo, K. Huang, B. Zhu and Y. Luo, *Agro Food Ind. Hi-Tech*., **17**, 35 (2006).