Asian Journal of Chemistry; Vol. 25, No. 9 (2013), 5105-5106

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2013.14144

NOTE

Determination of Trace Elements and Heavy Metals in Coconut Meat Simultaneously by ICP-MS

YANBEI ZHANG and YUKUI RUI*

College of Resources and Environmental Sciences,China Agricultural University, Beijing 100193, P.R. China

*Corresponding author: Tel: +86 10 62732574; E-mail: ruiyukui@163.com

(*Received*: 4 June 2012; *Accepted*: 25 March 2013) AJC-13149

With the development of society, a lot of new food are explored, but their nutrition and safety is not very clear. Five macroelements and eight trace elements present in coconut meat were determined by ICP-MS. The results showed coconut meat contained the rich nutrition of macroelements which are helpful to human health. Ti, Cr, Mn, As, Se, Mo, Cd and Pb in coconut meat were exceeded the national standard. So coconut meat are not safe as food.

Key Words: Coconut meat, Trace elements, Heavy metals, ICP-MS.

Coconut is an important tropical plant. Coconut milk is the liquid endosperm of coconut fruit cavity, which is a natural drinks with high nutritional value and high health value. Coconut milk, containing many nutrients including fatty acids and amino acids, can be used for the adjuvant treatment of hepatitis, gastroenteritis[1,2]. Coconut meat is always soaked in coconut milk during the growth course, so it should have the same functions for human health.

In the past coconut meat was often thrown away as waste, but now its value has begun to attract people's attention. Zheng *et al.*[3] studied the antioxidant effects including super oxide radical scavenging activity, reducing power, DPPH radical scavenging activity, hydroxyl radical scavenging activity, which proved that coconut meat has health value. Li *et al.*[4] determined eight mineral elements (K, Ca, Na, Mg, Fe, Mn, Cu, Zn) in the four tender coconut meat of four coconut cultivars by atomic absorption spectrometer[4], but many important trace elements are not be detected, such as Se, Mo, Pb, Cd, As and Cr.

With the development of analytical techniques, determination of trace elements become more and more accurate and convenient, for example, ICP-MS can accurately determine many elements by one injection[5,6].

Fresh coconut shell was cut and the coconut meat was cut down for experiment. The coconut meat was smashed with grinder and dried in oven for 24 h at 100 ºC. Weigh 0.5 g dried sample in 70 % nitric acid 10 mL, digested, the microwave digestion conditions was shown in Table-1. After cooling, the supernatant was filtered for detecting[7].

TABLE-1
MICROWAVE DIGESTION
TEMPERATURE CONTROL PROGRAM

Maximum power (W)	Climb time (min)	Temperature (ºC)	Hold time (min)
1250W	12	180	8

Parameters of apparatus: Parameters of ICP: power, 1250 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 MS: vaccum of analysis room, 5.86×10^{-6} Tor r; impulse voltage, 1150 V.

Ca, Fe, K, P, Zn play important role on biological metabolism. The results showed that coconut meat contained 0.598 μg/mg Ca, 0.088 μg/mg Fe, 0.088 μg/mg K, 0.088 μg/mg P and 0.088 μg/mg Zn, which proved that coconut meat had the rich nutrition of macroelements (Table-2).

TABLE-2
CONCENTRATIONS OF MACROELEMENT AND MIDDLE ELEMENTS IN DRIED COCONUT MEAT (μg/mg)

Elements	Concentration	Elements	Concentration
Ca	0.598	P	1.410
Fe	0.088	Zn	0.031
K	11.106	–	–

Heavy metal is the important index to evaluate the food safety. The results showed that Ti, Cr, Mn, As, Se, Mo, Cd and Pb in coconut meat were 14.909, 1.224, 23.016, 0.249, 0.282, 0.101, 0.981 and 119.641 ng/mg, respectively (Table-3). All

heavy metals in coconut meat exceeded the national standard[8-17]. So coconut meat are not safe as food.

TABLE-3
CONCENTRATIONS OF TRACE ELEMENTS
IN DRIED COCONUT MEAT (ng/mg)

Elements	Concentration	Elements	Concentration
Ti	14.909	Se	0.282
Cr	1.224	Mo	0.101
Mn	23.016	Cd	0.981
As	0.249	Pb	119.641

Conclusion

Coconut meat had the rich nutrition of macroelements, the descending is K > P > Ca > Fe > Zn. Heavy metals in coconut meat exceeded the national standard, especially Pb, Cd, Ti, Cr, Mn, As. So coconut meat are not safe as food.

ACKNOWLEDGEMENTS

This work was funded by the National Science Foundation of China (No. 41130526).

REFERENCES

1. L.J. Cheng, Y.K. Ma, R. Yan, S.L. Ma and L. Zhang, *Food Sci*., **32**, 62 (2011).
2. M.A.Z. Coelho, A.C.P. Duarte and S.G.F. Leite, *Ciencia Y Tecnologia Alimentaria*, **3**, 266 (2002).
3. Y.J. Zheng, W.J. Chen, S.L. Zhao and H. Chen, *J. Chin. Cereals Oils Assoc*., **24**, 79 (2009).
4. Y. Li, P. Wang, S.T. Chen, L.Y. Liu and Z.G. Dong, *Chin. J. Tropical Crops*, **33**, 46 (2012).
5. X.F. Chen, Y.K. Rui and Y. Yu, *Asian J. Chem*., **23**, 5167 (2011).
6. Y.K. Rui, Y.L. Hao and F.S. Zhang, *Spectrosc. Spectral Anal*., **27**, 2111 (2007).
7. H.T. Wang and Z.B. Mou, *Asian J. Chem*., **23**, 4715 (2011).
8. National Standard of the People's Republic of China, Tolerance Limit of Mercury in Foods, No. GB 2762-94.
9. National Standard of the People's Republic of China, Tolerance Limit of Lead in Foods, No. GB 14935-94.
10. National Standard of the People's Republic of China, Tolerance Limit of Chromium in Foods, No. GB 14961-94.
11. National Standard of the People's Republic of China, Tolerance Limit of Cadmium in Foods, No. GB 15201-94.
12. National Standard of the People's Republic of China, Tolerance Limit of Iron in Foods, No. GB 15200-94.
13. National Standard of the People's Republic of China, Tolerance Limit of Copper in Foods, No. GB 15199-94.
14. National Standard of the People's Republic of China, Tolerance Limit of Zinc in Foods, No. GB 13106-1991.
15. National Standard of the People's Republic of China, Tolerance Limit of Selenium in Foods, No. GB 13105-1991.
16. National Standard of the People's Republic of China, Tolerance Limit of Arsenic in Foods, No. GB 4810-94.
17. National Standard of the People's Republic of China, Tolerance Limit of Aluminum in Foods, No. GB 15202-94.