Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2015, 7(8): 191-194

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Determination multi-element concentrations in *Suaeda vera* by ICP OES

Narges Chamkouri[*a], Tohid Asgari[b] and Marzie Ghasemi[a]

[a]*Abadan School of Medical Sciences, Abadan, Iran*
[b]*Department of Parasitology and Mycology, Jundishapur University of Medical Sciences, Ahwaz. Iran*
Student Research Committee Jundishapur University of Medical Sciences, Ahwaz, Iran

---

ABSTRACT

A new, simple, and highly sensitive method was proposed for measuring 10 elements (Na, K, Mg, Ca, Al, Mn, Fe, Co, Cr, and P)in the leaves and stems of Suaeda vera in three different regions of South of Iran by Inductively coupled plasma optical emission spectrometry (ICP OES)after microwave-assisted acid digestion. Limit of detection (LOD) was below 6 mg kg^{-1}, relative standard deviations were below 8%.

Key words: *Suaeda vera*, Multi-element determination, ICP OES

INTRODUCTION

Rapid growth of population has increased the demand for agricultural crops. Halophytes are plants that can live in highly saline conditions containing around 200 mM NaCl. They can store inorganic ions and produce a high osmotic potential to absorb water [1-2]. Vegetables are an important part of a healthy and balanced diet. The consumption of vegetables and fruits provides adequate minerals and vitamins supply [2].

Suaeda vera is a common species of the Chenopodiaand used for vegetable in South of Iran. It grows high and low tides, from April to October. The effect of *S.vera* enriched diet on blood physiology, innate immune response. *S. vera* decreased after July and the species increase in the growth rate of the plant after August[3-4].

Elemental food composition data are important for both consumers and health professionals [5].Several analytical techniques, such as inductively coupled plasma optical emission spectrometry (ICP OES)[5–10], inductively coupled plasma mass spectrometry (ICP-MS), flame atomic absorption spectrometry (FAAS), and electrothermal atomic absorption spectrometry (ETAAS) are used for determining trace element contents in food samples [11–27]. Inductively coupled plasma optical emission spectrometry (ICP OES) that can provide a rapid program for multi-element analysis [5].Microwave acid digestion is powerful, very simple and fast method, followed by an ICP OES and ICP-MS analysis for determination of metals in food samples [28-31]. *Sveraa* has been traditionally used as a medicine for hepatitis and enriched diet on blood physiology, and innate immune response. The aim of this study was to develop multi-element ICP OES methods to analyze *S.vera* samples after microwave assisted acid digestion. Finally, the proposed method could be applied for determining some elements of *S. vera*. Finally to the best of our knowledge there are no published research studies about determination of elements in S.vera.

EXPERIMENTAL SECTION

Instrumentation
Concentrations of 10 elements containing Na, K, Mg, Ca, Al, Mn, Fe, Co, Cr, and P were determined in *S.veraa* samples by inductively coupled plasma optical emission spectrometer ICP OES (Varian 730-ES Axial ICP-OES) and Argon (99.99%) as the carrier gas. Samples digestion was carried out in a microwave oven (Milestone MLS 1200 Mega model (Sorisole, Italy).

Materials and reagents
All the reagents were purchased from Merck (purity of higher than 99%). Water used in all the experiments was ultrapure water. High purity ultrapure water was obtained from Millipore, Milli-Q (Bedford, MA, USA). All the stock solutions and working standards were stored at 4^0C and brought to room temperature (25^0C) before use.

Sample preparation and digestion procedure
For the microwave assisted digestion the samples were macerated and homogenized in an agatamortar. Subsequently, approximately 0.5 g of the dried sample was weighed directly into polytetrafluorethylene (PTFE) flasks. After adding 4 mL HNO_3 (6 M) and 1 mL of H_2O_2 (1 M), the mixture was subjected to the following digestion program: 100 W (3 min), 0 W (2 min), 250 W (2 min), 0 (2 min), 500 W (2 min), 0 W (2 min), 400 W (2 min), 0 W (3 min) and 450 W (2.5 min).

Six different mixtures of reagents using HNO_3 and H_2O_2 were tested. Mixture I is 5 mL HNO3 (6 M), mixture II is 4 mL HNO_3(6 M), mixture III is 3 mL HNO_3(6 M), mixture IV (mixture of 4 mL HNO_3 (6 M) and 0.5 mL H_2O_2 (1 M), mixture V (mixture of 4 mL HNO_3 (6 M) and 1 mL H2O2 (1 M), mixture VI (5 mL HNO_3 (6 M) and 2 mL H_2O_2 (1 M). Further dilution to 1:50 v/v ultrapure water was necessary for elements analysis. Features of the sample preparation method include:(a) microwave assisted dissolution of the samples (b) addition of 4 mL HNO_3(6 M) and 1 mL of H_2O_2(1 M) and (c) ultrasonic 20°C and of 3 min, filtration and dilution of the solution to a predetermined volume before being subjected to analysis by ICP-OES Fig 1.

RESULTS

ICP OES determination of element concentrations in samples
Results showed a lower level of Nain stem than leaves in *S. vera*. But, Mg, Si, and Ba contents in leaves and stem were approximately equal. Among the studied elements, Cahad maximum concentration in *S. vera* stem, twice of the Ca content in leaves. Na content in *S. veraa* leaves was ten times higher than that of stem. Concentration of 10 elements in leaves and stem of *S. vera* is shown in Table 1.

Figures of merit
Figures of merit for the elements are shown in Table 1. Limit of detection (LOD) was obtained as 3 times of the standard deviation of ten measurements of the blank divided by the slope of the calibration curve. LOD value was lower than 6 mg kg^{-1} and precision estimated by relative standard deviations (RSD) was lower than 8. The linear correlation coefficients for ICP OES was R=0.999.

DISCUSSION

The proposed method was applied to the determination of 10 elements in S. *veraa*in Iran.

Na content of all the species was higher than those of K, Mg, Ca, Al, Mn, Fe, Co, Cr, and P. Na content in *S. veraa* leaves was ten times higher than that of stem. Results showed that halophytic *S. veraa* contained high levels of Na and K.*S. vera* grew under high Na concentration. Asri et al. (1997) studied minerals of halophytes and concluded that accumulation of Na was higher than those of K, Ca, and Mg in halophytes [32]. Results of the present study were consistent with those by Asri. This plant starts to grow in spring and summer and high levels of Na and K help to maintain body's water balance, given the high temperature in summer.Ca contents in the plant organs of *S. vera* were higher than Mg contents.Ca content decreased as the soil salinity increased, probably because of competitive effect with Na. Ca had maximum concentration in *S. vera* stem, twice of the Ca content of the leaves in this study. Grattan et al. (1988) indicated that salinity may cause an excessive accumulation of phosphate, hence inducing P

toxicity [33]. Silberbush et al. (1989) showed that salinity had no effect on P uptake and P content increased with increasing magnesium concentration [34].

Population of *S. vera* is more densely distributed in the region with higher ion contents of Mg, K, and Na and, as noted previously. Halophytes have the mechanisms that can select these ions from the soil. Riasi et al. (2007) studied four halophytes and found that Na, K, and Cl in these plants were above the critical level, while Ca and Mg concentrations were below the critical level. In fact, Na was the only element, the concentrations of which in plant tissues could vary as much as those of Si[35]. Concentration Co, Cr, and Mn were the same in the stem and leaves of *S. vera*. Effect of *S. vera* enriched diet on blood physiology, innate immune response, because the amount of Fe in leaves of *S. vera* was twice of the stem [36]. The mineral elements in halophytes significantly changed during the growth in different weather conditions. Halophytes such as *S. vera* have the mechanisms that can adapt and select the critical ions from the soil.

Fig.1.sample preparation method

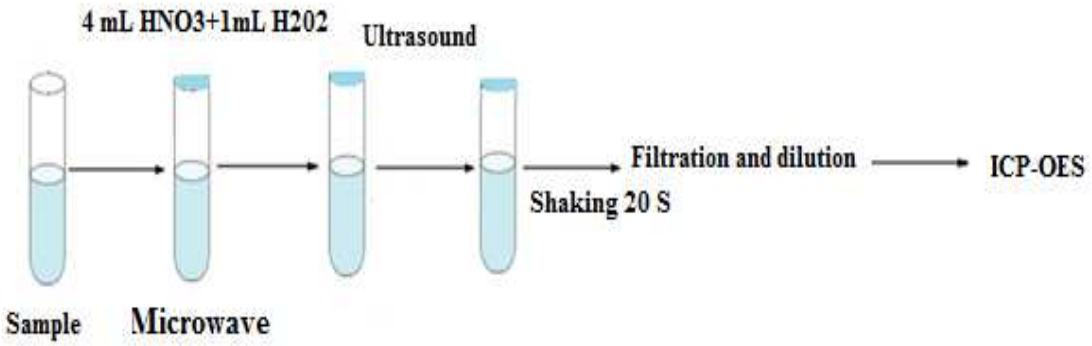

Table 1.Figures of merit and concentration analysis of S. vera for the determination of elements by ICP OES(mg kg^{-1}, n=3)

Element	R	LOD(mgkg^{-1})	RSD(%)	Stem(mgkg^{-1})	Leave(mgkg^{-1})
Na	0.9998	2.7	3.4	91670±2.2	12370±.1.4
K	0.9997	4.3	5.9	15302±1.3	16960±2.2
Mg	0.9997	1.5	2.3	3578±.2.5	3664±2.8
Ca	0.9994	5.4	3.6	8439±2.3	9363±1.4
Al	0.9996	4.6	3.9	58200±3.3	72763±2.6
Cr	0.9991	2.7	2.6	58200±3.3	72763±2.6
Mn	0.9992	2.9	3.1	162±0.2	161±0.3
Fe	0.9991	3.2	3.9	46123±0.3	37318±0.4
Co	0.9995	3.1	4.7	157±0.2	152±0.2
P	0.9997	4.3	5.3	1598±3.1	2345±2.1

CONCLUSION

In this study, concentrations of 10 elements (Na, K, Mg, Ca, Al, Mn, Fe, Co, Cr, and P) were determined in the leaves and stems of *S. vera* in three different regions of South of Iran using ICP OES after microwave-assisted acid digestion. ICP OES and ICP-MS techniques were demonstrated to be suitable for element determinations in *S. vera* samples following microwave-assisted acid digestion. The samples were conveniently smashed and homogenized in an agate mortar, avoiding oil loss before digestion. Among the elements determined by ICP OES, Na, K, Ca, Fe, Al, and P were showed higher concentrations. Evaluation of the element composition of various *S. vera* can be used to achieve the levels and importance of ions in different weather conditions and also obtain the organs of plant that can be used to prepare an extract of important and useful ions for humans. Leaves of the plant have been traditionally used as a medicine for hepatitis and it has been reported to possess antiviral, antibacterial, antioxidant activities, etc.

REFERENCES

[1] Alhdad GM, Seal Charlotte E, Al-Azzawi Mohammed J, T *Environmental and ExperimentalBotany* 87(**2013**)120–125.
[2] Chamkouri N, *Advances in Environmental Biology* **2014** (13) 911-915.
[3] Chamkouri N, *Advances in Environmental Biology* **2014** (16) 92-96.
[4] Jeddi Y, Fasihi M, Sameri A, Maraghi Sh, Chamkouri N, Sameri S, A Retrospective Study Of The Frequency Of Intestinal Parasites In The Patients Referring To Ayatollah Taleghani And Abadan Oil Hospitals. GAZI Univertesi Gazi Egitim Fakultesi Dergisi **2015** (4) 1-5.
[5] Chamkouri N, Deris J, MonjeziS, *Llgemeine Forst Und Jagdzeitung* **2015**(1) 1-8.
[6] Chamkouri N, Sameri A, *Advances in Environmental Biology* **2015** (2) 903-907.
[7] Chamkouri N, jeddi Y, Determination Some Elements in Salicornia by ICP-OES. Gazi Univertesi Gazi Egitim Fakultesi Dergisi **2015**.
[8] Chamkouri, N, Deris J. *Journal of Renewable Natural Resources Bhutan* **2015**(1) 1608, 4330.
[9] M.A. Hamilton, P.W. Rode, M.E. Merchanj, J. Sneddon, *Microchem. J.* 88 (**2008**) 52–55.
[10] A. Meche, M.C. Martins, B.E.S.N. Lofrano, C.J. Hardaway, M. Merchant, L. Verdade, *Microchem. J.* 94 (**2010**) 171–174.
[11] I.J. Cindric, M. Zeiner, M. Kröppl, G. Stingeder, *Microchem. J.* 99 (**2011**) 364–369.
[12] A.A. Fallah, S.S. Saei-Dehkordi, A. Nematollahi, T. Jafari, *Microchem J.* 98 (**2011**) 275–279.
[13] J.T. Castro, E.C. Santos, W.P.C. Santos, L.M. Costa, M. Korn, J.A. Nóbrega, M.G.A. Korn, *Talanta* 78 (**2009**) 1378–1382.
[14] E.P. Nardi, F.S. Evangelista, L. Tormen, T.D. Saint'Pierre, A.J. Curtius, S.S. Souza, F. Barbosa Jr., F*ood Chem.* 112 (**2009**) 727–732.
[15] G.L. Feudo, A. Naccarato, G. Sindona, A. Tagarelli, I *J. Agric. Food Chem.* 58 (**2010**) 3801–3807.
[16] E.J. Llorent-Martínez, P. Ortega-Barrales, M.L. Fernández-de Córdova, A. Domínguez-Vidal, A. Ruiz-Medina, *Food Chem.* 127 (**2011**) 1257–1262.
[17] A. Demirbas, *Food Chem.* 118 (**2010**) 504–507.
[18] J. Naozuka, S.R. Marana, P.V. Oliveira, *J. Food Compos. Anal*. 23 (**2010**) 78–85.
[19] J.T. Castro, E.C. Santos, W.P.C. Santos, L.M. Costa, M. Korn, J.A. Nóbrega, M.G.A. Korn, *Talanta* 78 (**2009**) 1378–1382.
[20] E.P. Nardi, F.S. Evangelista, L. Tormen, T.D. Saint'Pierre, A.J. Curtius, S.S. Souza, F. Barbosa Jr., T F*ood Chem.* 112 (**2009**) 727–732.
[21] G.L. Feudo, A. Naccarato, G. Sindona, A. Tagarelli, I *J. Agric. Food Chem.* 58(**2010**) 3801–3807.
[22] E.J. Llorent-Martínez, P. Ortega-Barrales, M.L. Fernández-de Córdova, A. Domínguez-Vidal, A. Ruiz-Medina, *Food Chem.* 127 (**2011**) 1257–1262.
[23] A. Demirbas, *Food Chem*.118 (**2010**) 504–507.
[24] K. Bakkali, N.R. Martos, B. Souhail, E. Ballesteros, *Food Chem.* 116 (**2009**) 590–594.
[25] J. Naozuka, S.R. Marana, P.V. Oliveira, *J. Food Compos. Anal. 2*3 (**2010**) 78–85.
[26] L.S. Nunes, J.T.P. Barbosa, A.P. Fernandes, V.A. Lemos, W.N.L. Santos, M.G.A. Korn, L.S.G. Teixeira, *Food Chem.* 127(**2011**) 780- 783.
[27] M.G.A. Korn, J.T. Castro, J.T.P. Barbosa, E.S.B. Morte, A.P. Teixeira, B. Welz, W.P.C. Santos, A.P. Fernandes, E.B.G.N. Santos, M. Korn, *Appl. Spectrosc. Rev.* 43 (**2008**) 67–92.
[28] L.S. Nunes, J.T.P. Barbosa, A.P. Fernandes, V.A. Lemos, W.N.L. Santos, M.G.A. Korn, L.S.G. Teixeira, *Food Chem.* 127 (**2011**) 780–783.
[29] M.G.A. Korn, J.T. Castro, J.T.P. Barbosa, E.S.B. Morte, A.P. Teixeira, B. Welz, W.P.C. Santos, A.P. Fernandes, E.B.G.N. Santos, M. Korn, *Appl. Spectrosc. Rev*. 43 (**2008**) 67–92.
[30] Eduardo S. Chaves EJdS, Rennan G.O. Araujo, *Microchemical Journal* 96(**2010**)71–76.
[31] Llorent-Martínez E.J, Ortega-Barrales P ,. Fernández-de Córdova M.L , *Food Chemistry* 127(**2011**) 1257–1262.
[32] Asri Y , Ghorbanli M, *Plant Ecol* 132(**1997**)155–170 .
[33] Grattan. S.R GCM, *Ecosystems and Environment* 38(**1992**) 275-300.
[34] Silberbush1. M B-AJEJE, *APlant and Soil* 271(**2005**) 309–319.
[35] Riasi A DMM, Stern M.D , *Animal Feed Science and Technology* 141(**2008**) 209-219.
[36] R. Harikrishnan,k. Ju-Sang, Man-Chul Kim, S. Dharaneedharan, D. Kim, Chang-Young Song, C. Balasundaram, *Experimental Parasitology* 131(**2012**) 195-203.