

ANALYSIS OF TRACE ELEMENTS IN MEDICINAL PLANT EXTRACTS BY NEUTRON ACTIVATION ANALYSIS

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ABSTRACT

Instrumental neutron activation analysis was applied to determine Br, Ca, Cl, Co, Cs, Cu, Fe, K, Mg, Mn, Na, Rb, Sb, Sc, Se and Zn in medicinal extracts obtained from the plants *Centella asiatica*, *Tagetes patula* and *Sesbania glandiflora*. Comparisons were made between the elemental concentrations obtained from different parts of a plant or from samples collected in distinct regions. It was also examined if there is a relation between the elemental concentrations and the pharmacological effects of these extracts.

INTRODUCTION

Nowadays, studies concerning the use of medicinal plant extracts constitute one of the subjects of great importance in the several countries. The pharmaceutical industries are interested in using medicines extracted from the plants due to the rising cost of remedies obtained exclusively from synthetic chemical products and also due to the risks of side effects of these products. On the other hand, the specialists in using medicinal plants have warned against the indiscriminate use of natural products without any medical orientation because they can cause serious intoxications.

The knowledge of trace elements in medicinal plants or their extracts has also attracted much interest, since some elements are closely related to human health. Besides the elements may take part of the active constituents and in this case the efficiency of a medicinal plant may depend on the region it was cultivated. Generally, the elemental concentrations in plants depend on the type of the characteristic of the soil.

Following our studies^{1,2} of determination of trace elements in medicinal extracts, this work presents the results obtained in the analyses of the extracts from *Sesbania glandiflora* and *Tagetes patula* with anti-ulcer activity and of extracts from *Centella asiatica* used for slimming and in diseases of skin, nerves and blood.

The analytical method utilized was instrumental neutron activation analysis (INAA) that had been widely used for multielement analysis because of the precision, sensitivity and accuracy of the technique.

EXPERIMENTAL

Samples. Extracts from different parts (bark, seed and flower) of *Sesbania glandiflora* plant and also from flower of *Tagetes patula* were provided from Governmental Science P.G. College, Bilaspur, MP, India. Extracts from *Centella asiatica* were obtained from leaves collected in the city of São Paulo and from Praia Grande, SP.

Instrumental Neutron Activation. About 150 mg of the powdered extracts were placed in pre-cleaned polyethylene envelopes and they were irradiated together with synthetic standards. These standards were prepared from standard elemental solutions pipetted on the sheets of filter paper and then placed in polyethylene bags after drying. The irradiations were performed at the IEA-RI nuclear reactor with thermal neutron flux of about 10^{12} n cm^{-2} s^{-1} . The short irradiation facility (4min) using pneumatic transfer system was used to detect elements whose radionuclides are short-lived (Cl, K, Mg, Mn and Na) whereas in order to detect elements with longer nuclide

half life, the samples were irradiated for 16 h. Radioactivity measurements were carried out using an EG&G Ortec hyperpure Ge detector (GMX20190 Model) coupled to an ADCAM 918A Multichannel Buffer, a microcomputer and electronic accessories. The spectra were analyzed using VISPECT2 computer program and the concentrations were calculated by comparative method of neutron activation analysis.

RESULTS AND DISCUSSION

Table 1 shows the results obtained for Br, Ca, Cl, Cr, Cs, Co, Fe, K, Mg, Mn, Na, Rb, Sb, Sc, Se and Zn obtained in the extracts from *Centella asiatica*, *Tagetes patula* and *Sesbania glandiflora*. From these results it can be seen that several elements found in medicinal extracts are essential for human beings, such as Ca, Fe, K, Mg, Mn, Rb, Se and Zn³.

Table 1. Concentrations of the elements in medicinal plant extracts

Element	<i>Centella asiatica</i> (leaves)		<i>Tagetes patula</i>	<i>Sesbania glandiflora</i>		
	Praia Grande	São Paulo	(flowers)	(barks)	(seeds)	(flowers)
Br (ppm)	121.8 ± 0.3	23.0 ± 0.5	129.4 ± 0.2	39.63 ± 0.09	10.4 ± 0.1	6.61 ± 0.03
Ca (ppm)	2790 ± 75	15000 ± 1000	215 ± 43	418 ± 53	370 ± 56	44 ± 15
Cl (%)	5.5 ± 0.2	3.6 ± 0.3	6.9 ± 0.2	4.2 ± 0.1	1.13 ± 0.03	1.04 ± 0.03
Co (ppb)	94.2 ± 1.5	181 ± 32	707 ± 8	107 ± 2	548 ± 18	200 ± 3
Cr (ppb)	100 ± 10	12.1 ± 0.8	3587 ± 29	435 ± 13	12990 ± 135	1016 ± 28
Cs (ppb)	31.1 ± 1.3	228 ± 7	127 ± 2	123 ± 2	44 ± 7	19.4 ± 1.2
Fe (ppm)	6.5 ± 0.4	431 ± 18	83.1 ± 1.2	13.1 ± 0.5	153 ± 4	8.2 ± 0.7
K (%)	2.9 ± 0.2	4.4 ± 0.1	4.9 ± 0.3	2.4 ± 0.1	0.26 ± 0.08	0.43 ± 0.07
Mg (ppm)	2177 ± 926	2345 ± 129	217 ± 165	982 ± 312	103 ± 25	217 ± 19
Mn (ppm)	76 ± 2	195 ± 2	2.82 ± 0.06	2.6 ± 0.3	9.210 ± 0.004	0.18 ± 0.05
Na (%)	3.00 ± 0.09	0.140 ± 0.013	3.6 ± 0.8	1.61 ± 0.03	0.142 ± 0.008	0.029 ± 0.001
Rb (ppm)	69.3 ± 0.9	134 ± 2	44.8 ± 0.6	8.2 ± 0.1	9.3 ± 0.2	6.9 ± 0.1
Sb (ppb)	48.6 ± 1.5	126 ± 3	480 ± 3	217 ± 1	266 ± 5	9.3 ± 0.7
Sc (ppb)	0.36 ± 0.06	125 ± 7	6.30 ± 0.12	1.36 ± 0.06	12.2 ± 0.4	1.13 ± 0.07
Se (ppb)	39 ± 8	122 ± 12	115 ± 11	45 ± 8	109 ± 37	n.d.
Zn (ppm)	60.9 ± 0.2	577 ± 36	37.2 ± 0.2	7.43 ± 0.06	153 ± 4	9.07 ± 0.07

nd - not detected

From the results obtained for *Centella asiatica* extracts, used for slimming, we can note high concentrations of K whose salts can be responsible for the diuretical and cardiotoxic action⁴. *Centella asiatica* extracts obtained from leaves collected in São Paulo, SP presented higher concentrations of most of elements than those found for samples collected in Praia Grande, SP. Also the extracts from leaves collected in São Paulo presented the highest effect as central nervous system stimulant⁵. In the case of *Sesbania glandiflora*, the bark extracts presented higher concentrations of Br, Ca, Cl, K, Mg and Na and also higher preventive anti-ulcer effect than those obtained for extracts obtained from seeds and flowers. Besides, the pharmacological assays

showed that *Sesbania* extracts are more effective to the preventive anti-ulcer effect than *Tagets patula* extracts. The high concentrations of Ca and Mg present in medicinal extracts can be neutralizing the acidity and avoiding effects of stomach lesions.

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