Academic Sciences International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 4, Suppl 4, 2012

Research Article

PHYSICO-CHEMICAL AND ELEMENTAL ANALYSIS OF ASH OF SOME MEDICINAL PLANTS FROM GARHWAL REGION, UTTARAKHAND, INDIA BY ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

R. K. BACHHETI[1,2*], INDRA RAI[1], ARCHANA JOSHI[2], D.P.PANDEY[3] AND ASHUTOSH SHARMA[1]

[1]Department of Chemistry, Graphic Era University, Dehradun, Uttarakhand, India, [2]College of Natural and Computational Science Haramaya University Ethiopia, [3]Department of Chemistry, Govt. P. G. College, Uttarkashi, Uttarakhand, India. Email: rkbfri @rediffmail.com

Received: 24 April 2012, Revised and Accepted: 30 May 2012

ABSTRACT

Physico-chemical analysis of ash of *Rawolfia serpentine, Asparagus Racemosus, Hedychium spicatum, Nardostachys jatamansi, Clerodendrum indicum, Chlorophytum borivillianum Terminalia arjun, Withania Somnifera*, *Alpinia galangal, Adhatoda vasica, Zingiber officinal* and *Terminalia chebula,* were carried out for present study. In the ash of selected plants the maximum Ca (20900 ppm) and Mg (20500 ppm) was in *Adhatoda vasica* root, P (15100 ppm) and K (8300 ppm) in *Zingiber officinal*, Fe (1840 ppm) in *Nardostachys jatamansi*, Mn (420 ppm) *Zingiber officinal,* Zn (170 ppm) in *Withania Somnifera* and Ni (47 ppm) in *Nardostachys jatamansi*. Total ash value, acid soluble ash, acid insoluble ash, and water soluble ash was determined, which is useful indices for identification of the powdered drugs. Percentage of loss on drying was highest in *Hedychium spicatum* root (0.94%) followed by *Nardostachys jatamansi* rhizome (0.57%). All the samples were found alkaline in pH. Conductivity was higher in *Hedychium spicatum* root (1136µs/cm).

Keywords: Elemental analysis, Medicinal plants, Plant ash, AAS.

INTRODUCTION

Medicinal plants play a significant role in providing primary health care services to rural people and are used by about 80% of the marginal communities around the world[1-4]. Phytochemicals are thus applied as natural anti pathogenic which can be derived from leaves, stems, barks and flowers of plants and thus they will be use in the treatment of pathogenic diseases associated with the infection of the pathogens[5].In recent years, increasing interest has been focused on phytomedicines as safer and more congenial to the human body. Medicinal plants are used for the preparation of various drugs singly or in combination or even are used as the principal source of raw material for the other medicines [6]. More than 40 elements have been considered essential to life systems for the survival of both mammals and plants. An element is considered essential when reduction of its exposure below a certain limit results consistently in a reduction of a physiologically important function, or when the element is an integral part of an organic structure performing a vital function in that organism [7].

Mineral deficiencies have manifested in forms of different disease conditions as goiter, rickets, and one form of metabolic dysfunction or the other. Minerals are divided into two groups: major minerals and trace minerals. The body needs larger amounts of major minerals than trace minerals, although trace minerals can be just as important for good health [8-10].The major minerals include calcium, chloride, phosphorus, potassium, sodium, sulphur, and magnesium, while the trace minerals include iodine, iron, zinc, selenium, fluoride, chromium, copper, molybdenum, and manganese [8- 10]. Leaves are potential sources of minerals and vitamins, and are reportedly inexpensive and easy to cook [11].The objective of the present study is to evaluate the physico-chemical and elemental analysis of ash of some medicinal plants from Garhwal region, Uttarakhand, India by atomic absorption spectrophotometer (AAS).

MATERIAL AND METHODS

Rawolfia serpentina root (Sarpgandha), *Asparagus Racemosus* (Satavari) root, *Hedychium spicatum* (Kapurkachari*)*root, *Nardostachys jatamansi* (Jatamansi) rhizome, *Clerodendrum indicum* (Bharangi) root, *Chlorophytum borivillianum* (swet musli) root, *Terminalia arjun* (Arjun) bark, *Withania Somnifera* (Ashvagandha) root, *Alpinia galanga* wild (Kulanjan) rhizome, *Adhatoda vasica* (Adrusi) root, *Zingiber officinale* (Sunthi) rhizome, and *Terminalia chebula* (Harar) fruitcarp were collected from local market of Haidwar and Dehradun. The Plant parts were identified by Dr. Sumer Chand, Scientist, Forest Research Institute, Dehradun, Uttarakhand (U.K.), India. The glasswares used were cleaned & sterilized in an oven at 150-160°C for 2 hrs. To prepare the samples for mineral analysis, plant material was kept to a constant weight. Dried plant material was ground to fine powder and used for dry ashing. Pre cleaned silica crucible was heated at 600°C until the weight of the crucible became constant. Approximately five gram powdered plant material was taken in the silica crucible and heated in a muffle furnace at 400-500°C till there was no evolution of smoke. The crucible was cooled at room temperature in a desiccators and ash was moistened with concentrated H_2SO_4(0.5ml). Crucible was placed on hot plate until fumes of sulphuric acid ceased to evolve. The crucible with sulphated ash was then heated in a muffle furnace at 600°C till the weight of the content became constant.

The physico-chemical analysis includes number of parameters such as physical state, colour, taste, percentage of loss on drying as per standard method[12-13], ash content as per method[14-15], ash value (water, alcohol and acid soluble or insoluble ash) as per method[16,] pH value and conductivity[17], Chloride and Sulphate[18.]Potassium has been detected by Flame photometer and the elements Mn, Zn, Fe, Ni, Mg, have been detected by AAS. Chloride content and sulphate content were quantified by titrimetric and gravimetric method. The samples in six replicates of selected plants parts were analyzed.

RESULT AND DISCUSSION

The results of physico –chemical analysis of plant ash are given in Table-2. The ash of all the plants was shown as fine powder. The plants taken for the analysis having high medicinal quality due to their chemical composition e.g.chloropytum (swet musli) contains 42% carbohydrate, 80-89% protein, 3-45 fiber and 2-175 saponin.

Ash composition and its amount obtained after combustion of plant material depends upon the age and the part of the plant taken. Ash usually represents the inorganic part of the plant. The percentage of ash content is highest in *N.jatamansi* rhizome (7.37%), *A. vasica* root (7.27%), *H. spicatum* root (6.19%) given in Table-2. It contains high inorganic material of the plant because ashing destroys all the organic material present in the sample. Percentage of loss on drying was highest in *Hedychium spicatum* root (0.94%) followed by *Nardostachys jatamansi* rhizome (0.57%). All the samples were found alkaline in pH while the conductivity was higher in *Hedychium spicatum* root (1136µs/cm).

Table 1: Medicinal uses of selected plants/plant parts

S. No.	Species name Plants (Botnical name)	Local name	Part taken for analysis	Medicinal use
1	*Rawolfia serpentina*	Sarpghangha	Root	Hypertension, used as an antidote to the bites of poisonous reptile like snakes.
2	*Asparagus racemosus*	Satavari	Root	The roots are bitter, sweet, emollient, cooling, nervine, tonic, constipating, opthalimic, anobyne, aphrodisiac. useful in nervous disorders, dyspepsia
3	*Hedychium spicatum*	Kapurkachari	Root	Rhizome is used for the treatment of asthma and internal injury. Powder of rhizome is used as an antiseptic agent, for various aches and pains. The rootstock is useful in the treatment of liver complaints, fever, vomiting diarrhea, inflammation, pains and snake's bite.
4	*Nardostachys jatamansi*	Jatamansi	Rhizome	It helps in cough and asthma, urinary problems and can be used in the treatment of sexual debility and impotence.
5	*Clerodendrum indicum*	Bharangi	Root	It is a good anti-inflammatory agent, helps in healing of wounds, improves blood circulation, improves the digestive activities, cough, cold, asthmatic symptoms and opens the body pores.
6	*Chlorophytum borivillianum*	Musli	Root	Used to prepare nutritive tonic for sexual weakness, improves the quantity and flow of breast milk and control and prevent obesity and its side effects.
7	*Terminalia arjun bark*	Arjun	Bark	Hypertension & Tachycardia, Hypercholesterolemia and cardiac protective
8	*Withania somnifera*	Ashvagandha	Root	Used in Leucoderma, bronchitis and asthma, increases the iron content in the blood. It is used as a tonic, which increases sperm count and sexual potency. It is considered to be one of the seven ayurvedic herbs capable of curing AIDS.
9	*Alpinia galanga*	Kulanjan	Rhizome	Used for skin diseases, indigestion, dysentery, enlarged spleen, respiratory diseases, mouth and stomach cancer.
10	*Adhatoda vasica*	Adrusi	Root	For cough and asthma. it contains durg vasacine, which is brancho-dialator. Most ayurvedic cough mixtures cotain juice extracted from the leaves of this plant. Leaves are used as green manure, and for packing purposes.
11	*Zingiber officinale*	Sunthi	Rhizome	Indigestion, flatulence, pain in the abdomen, hemorrhoids, tastelessness, cough, hiccup, asthma, cold, fever, motion sickness, nausea, heat cramps, heart diseases, inflammation, obesity, scurvy, rheumatoid arthritis.
12	*Terminalia chebul`a*	Harar	Fruitcarp	Useful in chronic constipation, peptic ulcer and mostly in eye-infection.

Minerals and metals are the important part of the inorganic material (ash). In the present study eight elements Ca, P, K, Mg, Fe, Mn, Zn and Ni in all twelve plants have been determined by using Atomic Absorption Spectrophotometer (Model no.–Varian 240FS + GTA120).These inorganic elements plays an important role in physiological processes involved in human health. The elemental composition of ash is given in Table-3. Sodium and Potassium are important constituents of fluids present outside and within the cell. Proper concentration of these electrolytes inside and outside the cell is essential to maintain osmotic balance and keep cells in proper shape. Potassium content in *Zingiber officinal* rhizome (8300 ppm), *Asparagus Racemosus* root (7500ppm), *Hedychium spicatum* root (6600 ppm) are high.

Calcium is an extremely important element in the human body. It is one of the most abundant elements in our bodies and accounts for 2 to 3 pounds of our total body weight. Most of us know that calcium is important in building and maintaining strong bones and teeth, besides this it is also important for many other things. It helps in control things like muscle growth and the electrical impulses in brain. Maximum Ca is present in *Adhatoda vasica* root (20900ppm) and minimum in *Hedychium spicatum* root (3400 ppm).

Magnesium is an element that is required by our bodies for numerous different functions such as for the proper growth, formation and function of bones and muscles. In fact, magnesium and calcium even control the muscles contraction. Magnesium prevents some heart disorders and high blood pressure. Plant roots of *Adhatoda vasica* (20500 ppm), followed by *Zingiber officinal* (20000ppm) *Rawolfia serpentine* (12400ppm), *Asparagus Racemosus* (10200 ppm),etc contains very high amount of magnesium. Their importance has been realized in recent years when sensitive tools for the determination of trace amounts of these elements become available. Zinc is present in sufficient amount in *H. spicatum* root (155ppm), *N. jatamansi* rhizome(126 ppm), *Withania Somnifera* root (170ppm), *Clerodendrum indicum* root (108 ppm). Zn is an essential component of a number of enzymes present in animal tissue including alcohol dehydrogenase, alkaline phosphatase, carbonic anhydrase and procarboxypeptidase. It is also essential for the growth and reproduction and helps in the process of tissue repair and wound healing. Zinc deficiency causes growth retardation and skin lesions [19].

Phosphorus is present in highest amount in *Z. officinallis* (15,100ppm), *and* lowest *in Terminalia arjun* bark (8200ppm). Phosphorus helps in the process of ossification of bones by getting deposits in the form of calcium phosphate. Nickel is present highest in *N. jatamansi* (47 ppm) and lowest in *Alpinia galanga wild* (2ppm).

The element iron has many functions in the body. This element is used by the body to make tendons and ligaments. Certain chemicals in our brain are controlled by the presence or absence of iron. It is also important for maintaining a healthy immune system and for digesting certain things in the food that we eat. The iron is an essential part of haemoglobin which is the part of blood that carries oxygen thus iron is essential for blood to work efficiently. In present study, Iron content is highest in *Nardostachys jatamansi* rhizome (1840ppm) and minimum (440ppm) in *Hedychium spicatum* root.

CONCLUSION

This present study shows that all plants named *Rawolfia serpentine, Asparagus Racemosus,Hedychium spicatum, Nardostachys jatamansi, Clerodendrum indicum, Chlorophytum borivillianum Terminalia arjun, Withania Somnifera*, *Alpinia galangal, Adhatoda vasica, Zingiber officinal* and *Terminalia chebula* are rich source of mineral elements. These plants can be utilized to treat number of diseases that are mainly caused due to the deficiency of these minerals. The data obtained in the present work will be useful in synthesis of new drugs with various combinations of plants, which can be used in the treatment of different diseases.

Table 2: Physicochemical analysis of plants ash

Plants (Botanical name)	Physical state	Colour Of ash	Taste of ash	% of loss on drying	% of ash content	% of ash Value						pH of soln.	Conductivity of as soln. (µs/cm)	Cl Mg/l	So_4 mg/l
						Alcohol		Water		Acid					
						Sol.	Insol.	Sol.	Insol.	Sol.	Insol.				
Rawolfia serpentina root	Fine powder	Greyish brown	**A**lkaline	0.37 ±0.05	1.91 ±0.2	46.42±2.08	53.58±6.96	36.79±3.26	63.21±5.12	97.90±5.51	2.10 ±0.15	7.75	652	84.0 ±2.22	88.0 ±1.22
Asparagus Racemosus root	Fine powder	Greyish brown	**A**lkaline	0.39 ±0.05	4.36 ±0.2	34.77±2.45	65.23±6.62	48.96±2.68	51.04±4.22	97.32±6.89	2.68 ±0.15	8.15	402	75.0 ±2.53	152.0 ±1.68
Hedychium spicatum root	Fine powder	White	**A**lkaline	0.94 ±0.05	6.19 ±0.2	43.87±2.08	56.13±8.22	45.45±3.96	54.55±5.12	97.19±5.68	2.81 ±0.15	7.91	1136	60.0 ±2.12	91.0 ±1.95
Nardostachys jatamansi rhizome	Fine powder	Light brown	**A**lkaline	0.57 ±0.05	7.37 ±0.2	59.37±2.68	40.63±7.98	46.91±3.95	53.11±4.23	97.15±5.96	2.85 ±0.15	9.70	426	93.0 ±2.76	94.0 ±1.56
Clerodendrum indicum root	Fine powder	Light brown	**A**lkaline	0.18 ±0.05	3.92 ±0.2	41.54±2.09	58.46±7.05	39.64±3.68	60.36±5.22	96.12±6.75	3.88 ±0.15	10.8	1076	64.0 ±2.33	131.0 ±1.68
Chlorophytum borivillianum root	Fine powder	Greyish brown	**A**lkaline	0.15 ±0.05	2.37 ±0.2	41.60±2.06	58.40±8.55	48.31±4.81	51.69±5.52	97.44±5.89	2.56 ±0.15	8.11	785	54.0 ±2.14	121.0 ±1.95
Terminalia arjun bark	Fine powder	Light brown	**A**lkaline	0.32 ±0.05	3.92 ±0.2	36.00±3.69	64.0±6.74	56.34±4.25	43.66±2.98	99.44±3.88	0.56 ±0.15	7.55	954	103.0 ±2.62	103.0 ±1.67
Withania Somnifera root	Fine powder	Greyish brown	**A**lkaline	0.42 ±0.05	4.90 ±0.2	60.73±3.67	39.27±7.22	43.17±3.86	56.83±6.22	96.49±6.22	3.51 ±0.15	8.85	533	95.0 ±2.33	120.0 ±1.74
Alpinia galanga wild rhizome	Fine powder	Light brown	**A**lkaline	0.11 ±0.05	4.39 ±0.2	45.12±2.08	54.88±6.64	51.78±3.55	48.22±4.05	96.89±5.63	3.11 ±0.15	9.56	920	101.0 ±2.81	74.0 ±1.86
Adhatoda vasica root	Fine powder	Greyish brown	**A**lkaline	0.31 ±0.05	7.27 ±0.2	60.97±3.09	39.03±5.69	54.38±3.55	45.62±4.61	99.12±5.53	0.88 ±0.15	8.49	683	91.0 ±3.74	95.0 ±1.66
Zingiber officinal rhizome	Fine powder	Light brown	**A**lkaline	0.13 ±0.05	5.15 ±0.2	58.09±2.08	41.91±6.35	33.34±6.12	66.66±4.68	97.19±6.33	2.81 ±0.15	9.46	1136	41.0 ±2.35	100.0 ±1.56
Terminalia chebula fruitcarp	Fine powder	White	**Alkaline**	0.10 ±0.05	2.92 ±0.2	49.87±2.07	50.13±7.12	56.15±5.63	43.99±3.66	95.38±7.11	4.62 ±0.15	7.98	775	65.0 ±3.44	96.0 ±1.42

Table 3: Elemental composition of plants ash

Plants (Botanical Name)	Elements (Plants ash Digested in 5% Hcl)							
	Calcium (Ca),ppm	Phosphorus (P),ppm	Potassium (k),ppm	Magnesium (Mg),ppm	Iron (Fe),ppm	Manganese (Mn),ppm	zinc (zn),ppm	Nickel (Ni),ppm
Rawolfia serpentina root	5300	9800	1300	12400	650	84	112	9
Asparagus Racemosus root	5600	12200	7500	10200	692	150	68	16
Hedychium spicatum root	3400	8800	6600	5700	440	290	155	12
Nardostachys jatamansi rhizome	10200	12100	2600	11500	1840	170	126	47
Clerodendrum indicum root	8800	11100	2600	10200	920	72	108	16
Chlorophytum borivillianum root	4900	10600	2000	7500	1202	165	59	**15**
Terminalia arjun bark	3500	8200	5900	12100	750	86	76	10
Withania Somnifera root	16400	11500	5700	15500	870	99	170	16
Alpinia galanga wild rhizome	11000	11100	2600	6800	1102	56	76	2
Adhatoda vasica root	20900	8600	2000	20500	1250	67	42	14
Zingiber officinal rhizome	9800	15100	8300	20000	650	420	112	7
Terminalia chebula fruitcarp	4400	9300	3500	9500	526	56	59	9

REFERENCES

1. Prajapati ND, Prajapati T 2002. Sustainable cultivation of medicinal plants; Multi tier agriculture system-A new concept. URL www.techno-preneur.net/timeis/technology
2. Latif A, Ahmad H, Begum S, Adnan M, Hussian S, Waseem M 2003. Medicinal and other economic plants as substitute to forest logging inMiandam and Sulatanr valleys, Swat. Proceedings of international workshop on conservation and sustainable use of medicinal and aromatic plants in Pakistan. WWF-Pak. 101-105.
3. Shinwari ZK, Rehman M, Watanabe T, Yoshikawa T 2006. A Pictorial guide to medicinal plants of Pakistan. Kohat University of Science and Technology Pakistan.
4. Bhattacharya A, Debnath S.K., Dey M, and Kar D:Phytochemical and pharmacological evaluation of the seeds of *annova squamosa* Linn. International Journal of Pharmacy and Pharmaceutical Sciences 2012; 4(3): 92-94
5. Yousuf S, Bachheti R.K, Joshi A. And Bhat MUD : In Vitro Antibacterial Screening Of Different Extracts Of *Morina Longifolia* On Pathogenic microorganisms. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(4): 303-306.
6. Mohanta B, Chakraborty A, Sudarshan M, Dutta RK, Baruah M. Elemental profile in some common medicinal plants of India. Its correlation with traditional therapeutic usage. J. Radioanalytical, Nuclear. Chem..2003; 258(1): 175-179.
7. Armah YS, Nyarko BJB, Akaho EHK, Kyere AWK, Osae S, Boachie KO, Osae EK Activation analysis of some essential elements in five medicinal plants used in Ghana. J. Radioanalytical. Nuclear. Chem. 2001.;250(1): 173-176.
8. FC&A.. *Super LifeSpan, Super Health*. Frank W. Cawood and Associates: Los Angeles, CA 1997. ISBN: 0-915099-92-6.
9. Chaney, S.G.. "Principles of Nutrition II: Micronutrients". In: *Textbook of Biochemistry, with Clinical Correlation, 6th ed*. Devlin, T.M. (ed.), John Wiley and Sons: New York, NY 2006. 1091-1120. ISBN: 10 0-471-67808-2.
10. Crook, M.A. *Clinical Chemistry and Metabolic Medicine. 7th ed.* Holder Arnold: London 2006. ISBN-13:978 0 340 90618 7
11. Ejoh, R.A., D.V. Nkonga, G. Inocent, and M.C. Moses.. "Nutritional Components of Some Non-Conventional Leafy Vegetables Consumed in Cameroon". *Pak. J. Nutr.* 2007; 6(6):712-717.
12. Gupta, S. The Ayurvedic system of medicine occurring in Charka, Sushruta. Neeraj Publishing House, New Delhi, India, 1984. Vol-II.
13. The *Indian Pharmacopoeia*. The controller of publication, Delhi (CSIR) 1996. Vol-2, Part II.
14. Gupta, A.K., Quality standards of Indian medicinal plants. Indian Council of Medical Research, India 2003. Vol-I.
15. Indrayan, A.K., Sharma, S., Durgapal, D., Kumar, N. and Kumar, M., Determination of nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal. Current Sci 2005; 89, 1252-1255.
16. Ahmad, R.V. and Sharma, R.K. Evaluation of drug for standardization. Proceedings of WHO trainingcum-workshop, Pharmaceutical lab for Indian medicine, Ministry of health and family welfare, Govt. of India, Ghaziabad, 2001.
17. Sharma, B.K. and Kaur, H.,. Environmental chemistry. Goel Publishing House, unit of Krishna Prakashan Media (P) Ltd, Meerut, India, 1998 Ed 4th.
18. Trivedi, R.K. and Goel, P.K., In chemical and biological methods for water pollution studies. Environmental Pub, Karad, New Delhi, India.,1986.
19. Chatterjee, M. N. and Shinde, R. Text book of medical biochemistry. Jaypee Brother Medical Pub Ltd, New Delhi, India, Ed 2nd, 1995.811-846.