The Major, Minor and Trace Elements in Henna Leaves

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Summary: The major, minor and trace elements in Henna leaves of Faisalabad District, Pakistan present in the form of inorganic compounds or orgametallic complexes have been determined and the results are discsused.

Introduction

Henna (*Lawsonia intermis*) is a shurb with opposite leaves, commonly cultivated in tropical regions of Africa and Asia. The dried leaves are used as a dye for nails, hands, hair and clothing [1]. It is also used as a medicinal plant for treatment of skin problems, headache, jaundice and cancers etc. [2,3]. Much work has been done on its organic constituents [4-8] but little attention has been paid towards its inorganic elements. Inorganic elements in plants play an important role in physiological process when present in ionic form or as constituents of organic molecules [9]. No data is available for the inorganic elements in "Henna" shrubs. Dried "Henna" leaf samples grown in Faisalabad District, Pakistan were analysed for the major elements K, Ca, Mg, minor elements Na, Fe, Mn, Cu, Zn, Sr and trace elements, Co, Ni, Pb, Mo. Atomic absorption spectrometry has been successful for determination of nutrient elements in food and plant materials [10,11] and has been used in the present work.

The possibility of transfer of these elements into water at room temperature from Henna leaf samples has also been determined as ground Henna leaves in the form of paste or emulsion with water is applied on the human skin. For the evaluation of accuracy of the analytical results by A. A. spectrometry, Standard Reference material Citrus leaves, SRM No. 1572 (12) was also analysed with the Henna samples.

Results and Discussion

The analytical results determined by A. A. spectrometry of SRM No. 1572 Citrus leaves, its certified value and recovery and that of the Henna leaf samples are summarized in Table 1. The concentration of elements in water extract at room

Table -1:

Element	SRM 1572 Certificate Value	Determined Value	% Recovery	Henna Samples
K %	1.82 ± 0.06	1.80	98.90	1.70
Ca%	3.15 ± 0.10	3.08	97.77	1.47
Mg%	0.58 ± 0.03	0.58	100.00	0.70
Na%	160.00 ± 20.00	180.00	112.5	0.140
Fe µg/gm	90.00 ± 10.00	89.00	98.88	1121.00
Mn	23.00 ± 2.00	23.00	100.00	137.50
Zn	29.00 ± 2.00	31.00	106.89	40.00
Cu	16.5 ± 1.00	15.30	92.72	22.5
Sr	100.00 ± 2.00	101.00	101.00	38.00
Co	0.02 -	-	-	0.17
Ni	0.60 ± 3.00	0.50	83.33	0.450
Pi	13.30 ± 2.40	12.00	90.22	0.157
Mo	0.17 ± 0.09	0.16	94.11	0.038

temperature of the Henna leaf samples are given in Table 2. The values listed in the table are the average of three determinations which agreed with one another to within ± 2% for the elements expressed in µg/gm and to within ± 5% for the elements expressed in % concentrations. As revealed by the analytical results, the most abundant element after K, Ca and Mg was found to be Fe i.e. [12] µg/gm in Henna leaves. Iron and nickel are vigorous complex forming agents which give rise to stable complexes with ligands containing sulfur, nitrogen and oxygen. Haem derivatives are known to which iron is associated with nitrogen containing groups of phosphorous. Iron is a constituent of the active sites of various reductases and hydrogenases, most frequently being associated with sulfur containing ligands. The iron + haemoglobin and ferrodoxin play a central role in metabolism. Deficiency of iron in plants produces chlorosis disease [14]. Higher amounts of iron i.e. 730 µg/gm and 840 µg/gm has been reported in tomato leaves and spinach samples respectively [15]. The higher concentration of iron in Henna leaves indicates that it may be iron accumulating plants, the concentration of elements in plants may also depend upon geochemical position of the region where they are grown.

Table - 2:

Element	Amount extractd in water from 100 gm Henna	% Extraction
K	0.825 g	70.50
Ca	0.812 g	52.30
Mg	0.162 g	23.21
Ma	0.019 g	14.14
Fe	0.6 mg	0.53
Mn	3.0 mg	21.81
Zn	0.55 mg	13.75
Cu	1.25 mg	5.55
Sr	1.20 mg	31.57
Co	0.009 mg	20.00
Ni	0.018 mg	40.00
Pb	0.015 mg	95.54
Mo	0.0021 mg	55.26

The 0.53% transfer of iron in water at room temperature from the henna leaf samples indicates that iron is present in stable complex form. While K and Ca are present mostly in ionic form or water soluble complexes as revealed by the solubility data (Table 2). The low concentration of Zn and its low extractability in water (Table 2) reveals that this element may not be much effective towards antibacterial activities and that the healing effect of henna would be due to the active ingredient lawsone present. Lawsone is present up to 1.0% in Henna leaves and plays a principal part in pharmacological and colouring activity. The presence of lead (Pb) is probably from environmental pollution and absorbed on the leaves rather than taken as a constituent in the growth of henna.

Experimental

Atomic absorption standard solutions of K, Ca, Mg, Na, Fe, Mn, Cu, Zn, Sr, Co, Ni, Pb and Mo were prepared from pure metal in A.R. HNO_3. A.R. HNO_3, A.R. H_2O_2 (30%) and deionized water were used for digesting the henna leaves and making solutions. All working solutions were prepared from the stock solution after appropriate dilutions with deionized water. Buchi (Germany) Model 430 Digestion apparatus was used for wet digestion of the samples. The digestion apparatus is capable of handling eight samples at a time.

Atomis absorption spectrometer safas monaco model 1900G, (France) equipped with Air-Acetylene burner and hollow cathode lamps for single element determination were used. Henna leaf samples were ground and dried in oven at 150 °C over night. SRM citrus leaves No. 1572 were also dried according to the instructions laid down in the certificate. One gram each of dried samples and SRM leaves were placed in the Pyrex glass tubes of the digestion apparatus. The samples were digested with HNO_3 and H_2O_2 according to the method of Haung and Schutle [13] with slight variation in temperature and time of digestions. This digestion method eliminates the hazards associated with perchloric acid. The digestion was continued until all the organic matter had been destroyed, with 1.5 ml solution being left behind. Finally the solution was taken into deionized water, filtered, and diluted to a volume of suitable concentration. Blank was also obtained by the same method but without sample.

To determine the water extractable elements in the Henna leaves, 5 gm of dried sample leaves were placed in 250 ml pyrex glass beakers. 50 ml of deionized water was added to each sample. The slurry was stirred for a few minutes and allowed to standard over night. Then the solution was filtered. The solution was evaporated on a hot plate until 2 ml were left behind. The solution was digested with HNO_3 and H_2O_2 as described previously. The solution was

taken into deionized water, filtered and diluted to a volume of suitable concentration. The water extract solutions were analysed under similar operational conditions of Atomic Absorption Spectrometer as were used for Henna leaves and the standard citrus leaves (SRM No. 1572).

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