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Determination of Metal Content in *Lawsonia Inermis* Linn by Flame Atomic Absorption Spectroscopy

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Abstract: **The present study was conducted to determine the metal content of *Lawsonia inermis* Linn leaves for medicinal and cosmetic purposes. Flame Atomic Absorption Spectroscopy was used to determine the metal content of leaves of *Lawsonia inermis* Linn. The results reveal that the metals Na, K, Mn, Cr, Fe, Cu, Ni, Cd, Zn, and Pb are present in 1ppm, 16ppm, 25ppm, 1.9ppm, 26ppm, 13ppm, 11ppm, 17ppm, 33ppm and 0.019ppm quantities respectively. Most of metals are found below the recommended tolerance limit of world health organization. *Lawsonia inermis* Linn leaves contain metals which are within the recommendation ranges and can be used for curative purposes.**

Keywords: ***Lawsonia inermis*** **Linn, FAAS, Ash, Metals.**

I. INTRODUCTION

Lawsonia inermis Linn is used both for its medicinal and cosmetic purposes. This plant is traditionally used for the treatment of various disorders such as oedema, bronchitis, and hemorrhoids [1]. Metals have an important role in our lives, as they facilitate growth and development of our bodies [2].

The presence of metals in the *Lawsonia inermis* Linn can justify many of its medicinal properties, such as; its wound healing property is due to the presence of iron so its paste is applied on scars for centuries. Presence of sodium and potassium reveals its use as gargle in the sore throat. Its leaves are also being used for the treatment of many problems such as spleen disorders, bronchitis, and eye infection [3]. *Lawsonia inermis* Linn can destroy cancer cells due to its oxidative effect by induction of apoptosis [4].

Presence of metals in the plant beyond the tolerance limit than those certified by the World Health Organization (WHO) can cause severe problems. The plants today are cultivated in the soil containing pollutants. The air from where they take oxygen contains millions of pathogens. The water given to them for their nourishment is also contaminated. So when the plants grow under these circumstances it will contain polluted species besides essentials [5].

The present study is carried out to estimate the metals (Na, K, Cd, Mn, Cr, Fe, Cu, Ni, Zn and Pb) present in the *Lawsonia inermis* Linn leaves and to compare its value with the standard recommended values.

II. EXPERIMENTATION

A. Sample collection:

Lawsonia inermis Linn leaves were collected, dried and then powdered for the analysis. Nitric acid was used for the digestion which was of pure laboratory grade (50% HNO3).

B. Preparation of Ash:

A clean dry crucible was weighed. Powdered leaves of *Lawsonia inermis* Linn (5 grams) was taken in the crucible and weighed again. The crucible was then heated with 5N HCL (1ml) to 150 °C for 6 hours. After heating it was cooled to

room temperature and weighed again. The crucible is then transferred to the muffle furnace at 750 °C for three hours and reweighed. The percentage of ash was calculated using the following equation:

$$\%Ash = \frac{weight\ of\ sample\ remaining}{weight\ of\ original\ sample} \times 100$$

C. Digestion of Ash:

The ash so formulated was transferred to the china dish. Then it was placed on the water bath. Nitric acid was added to the ash for its complete digestion with constant stirring. The ash was digested in 3.9 mL nitric acid. The solution was then filtered and transferred to the 250 mL volumetric flask and the flask was filled with distilled water up to the mark [6]. The sample solution was then transferred to FAAS (Perkin Elmer A Analyst 100 FAAS) for the determination of metals against the standards.

III. RESULTS AND DISCUSSION

Ash of the *Lawsonia inermis* Linn obtained was of white colour containing metal content. The estimation is shown in the table.

TABEL 1: Statistical data for ash

Standard		**Sample**	
Percent Mass fraction as received	Percent mass fraction dried weight	Percent Mass fraction as received	Percent mass fraction dried weight
14.66 ±0.38	15.18±0.38	9.66± 0.62	11.18±0.62

Table shows statistical data for calibration of standards of different metals by atomic spectrophotometry. The data shows good coefficient of correlation.

TABLE 2: Statistical data for standard of elements

Element	**Concentration range, x**	**Absorbance range, Y**	**Y= mx+c**		**Correlation coefficient. R**
			M	C	
K	0-20	0-0.061	0.0614	1.107	18.883
Cd	0-20	0-0.033	0.0334	0.635	19.365
Cu	0-20	0-0.093	0.0940	1.787	18.213
Ni	0-20	0-0.039	0.0390	0.741	19.209
Mn	0-30	0-0.066	0.0668	1.923	28.077
Cr	0-1	0-0.004	0.0044	0.0004	0.9996
Pb	0-0.2	0-0.036	0.0364	0.0028723	0.171277
Zn	0-40	0-0.025	0.0264	1.033	38.97
Fe	0-30	0-0.072	0.0724	2.1	27.9

A total of nine metals were determined by FAAS. The presence of the metals can be correlated with the medicinal application of *Lawsonia inermis* Linn.

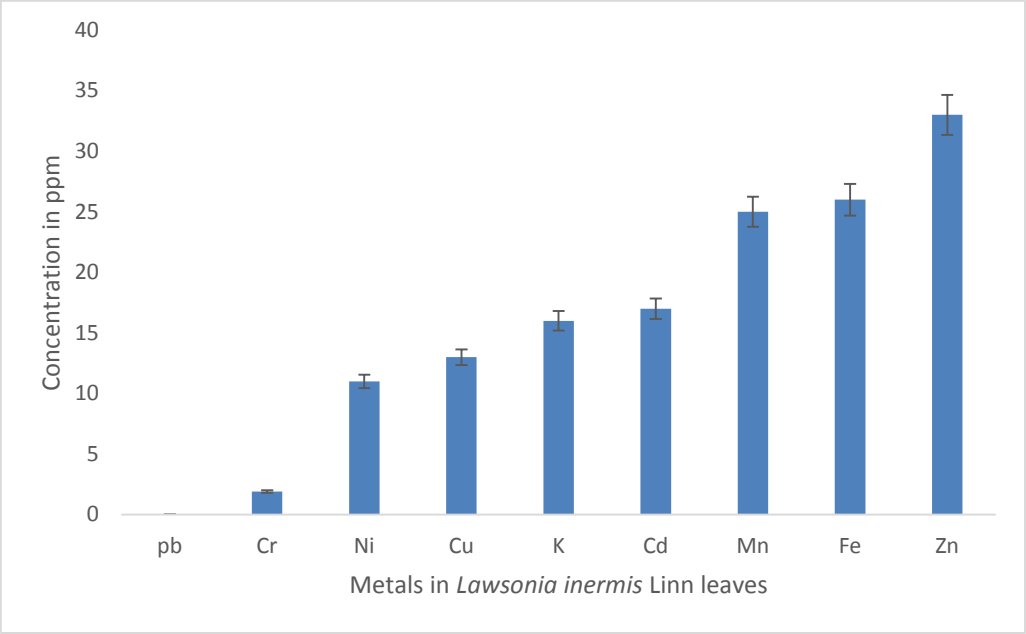

Fig. 1: Metals in *Lawsonia inermis* Linn leaves

i. Cadmium:

Lawsonia inermis Linn leaves has reported cadmium 17µg/gm. The critical cadmium concentration in the renal cortex is about 200mg/gm. IARC has classified cadmium in group 2A [7]. Absorption of cadmium into the skin is dependent upon the solubility of compounds present on the membrane. The chemical composition of skin membrane consists mainly of proteins and phospholipids. The cadmium can penetrate into the skin by virtue of its solubility in non- proteinases part. The kidney is main organ of cadmium toxicity [8].

ii. Chromium:

In the present study the amount of 1.9µg/gm of cadmium was detected in the leaves of *Lawsonia inermis* Linn. The absorption of chromium depends upon oxidation state. Chromium (VI) readily penetrates into cell membrane than chromium (III). Chromium (III) is an essential element and chromium (VI) is toxic causing gastrointestinal disorders [9].

iii. Iron:

Lawsonia inermis Linn leaves contain 26µg/g. Iron is a potent antioxidant [10] responsible for wound healing properties of *Lawsonia inermis* Linn leaves.

iv. Copper

The amount of copper in *Lawsonia inermis* Linn leaves was 13µg/gm. Copper is an essential element having role in the regulatory and in hormone action [11]. Hyper concentration of copper can give rise to liver cirrhosis. Copper penetration occurs through phospholipid part of the cell membrane.

v. Lead:

The amount of lead in *Lawsonia inermis* Linn leaves was 0.19µg/g. Lead is one of the toxic metals which can cause damage to nervous system. Long term exposure to the environment contaminated with lead can give rise to the various respiratory diseases. Lead is the final product of many radioactive reactions, and hence is one of the major causes of skin cancer [12]. Penetration power of lead is high that other metals, and is able to seep through the membrane in relatively less time and can accumulate in the blood capillaries [13].

vi. Manganese:

In the present study, 25µg/g of manganese was detected. Its absorption rate depends upon the presence of other metals like copper and iron [14]. Evidence of neurotoxicity has been reported in the miners due to prolonged working in the environment containing manganese dust [15].

vii. Zinc:

The amount of zinc in *Lawsonia inermis* Linn leaves was 33µg/g. Zinc is available in the soil in the form of salts. It has a vital role in the antioxidant activity of the compounds. It is an essential element require for many metabolic reactions although high levels of zinc can be harmful and JECFA has recommended a PMTDI for zinc of 1.0mg/kg bodyweight [16].

viii. Nickel:

Concentration of nickel was 11µg/g. Long term contact, for instance wearing jewelry made of nickel, can cause dermatitis in sensitized individuals [17].

ix. Potassium:

The amount of potassium detected was 16µg/g. The soil comprises of inorganic salts of potassium. Potassium is essential element, an active ingredient in sodium potassium pump [18]. The values are compared with NIST standard reference material (SRM) 1570a trace elements in spinach leaves and 1515 apple leaves from national institute of standards and technology, USA were used to obtain data quality objectives (DQO).

TABEL 3: Comparison of certified values of 1515 with Sample values

Metal	Certified values of 1515			Sample values		
	Mean	Standard deviation	Present relative standard deviation	Mean	Standard deviation	Present relative standard deviation
K	1.64±0.04		2.4	16±6,30		39
Cd	0.013±0.002		15	17±6.206		36
Cu	5.64±0.240		4.2	13±6.7		39
Mn	54.0±3		5.5	23±5.05		21
Ni	0.91±0.12		13	11±7.07		64
Zn	12.4±0.6		4.8	33±5.05		15
Fe	84±10		11	23±5.3		23
Cr	-		-	1.9±0.59		31
Pb	0.47±0.024		5.1	0.091±0.05		263

TABLE 4: Comparison of certified values of 1570a with Sample values

Metal	Certified values of 1570a			Sample values		
	Mean	Standard deviation	Present relative standard deviation	Mean	Standard deviation	Present relative standard deviation
K	2.903±0.052		1.8	16±6,30		39
Cd	2.89±0.07		2.4	17±6.206		36
Cu	12.2±0.6		20	13±6.7		39
Mn	75.9±1.9		2.5	23±5.05		21
Ni	2.14±0.10		4.6	11±7.07		64
Zn	82±3		3.6	33±5.05		15
Fe	-		-	23±5.3		23
Cr	-		-	1.9±0.59		31
Pb	0.2 mg/kg		-	0.019		263

IV. CONCLUSION

Diversity in the topology causes introduction of different metals in the plants which have both adverse and curative effects on organisms as well as on environment. The preceding study revealed that *Lawsonia inermis* Linn leaves contain metals which are within the recommendation ranges and can be used for curative purposes. Moreover, it is safer to be used for the skin as decorative ingredient.

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