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Detection and Quantification of Mineral and Heavy Metals Analysis in Leaf of Cleistanthus Collinus for Toxicity

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ABSTRACT

It is a poisonous and toxic plant but they are sources of many bioactive compounds i.e. aryl naphthalene, alkaloids and some terpenoids. The plant is made in different region of Maharashtra, India and across the world. It contaminates the water in affected area for digestion metabolism. Along with that they may also contain some substances as pesticides, heavy metals and which have harmful effect on the body. In this work, Cleistanthus collinus were studied to determine Pb , Cd , As, Mn , Cu , Co , Ni contents in them .This was analyzed using Inductively coupled plasma Spectroscopy (ICP-OES). The results were compared with the safety standards of world Health Organization (WHO). The average concentrations of heavy metals detected are ranged higher than the permissible limits. Pb (18.20 ppm) is not ranges from 3.3ppm-4.59 ppm, Cd (0.60 ppm) is not ranged from 0.04pm-0.4 ppm . Concentration of As (2.00ppm) was not ranges from 0.7ppm -1.5 ppm, Ni (27.40 ppm) was not found to range between 2.82 ppm – 5.76 ppm , in clasthnthus collinus and most of them were well higher than maximum permissible limits (MPL).

Keywords: Heavy metals, Minerals, Aryl naphthalene, Maximum Permissible limit (MPL), ICP-OES.

I. INTRODUCTION

An ancient day there is huge contribution of vaidhya in India for making drugs from varieties of plants[1]. In recent study Cleistanthus collinus is toxic and highly poisonous plant among in plantae-kingdom, locally this plant is known as “Garari”. The toxicity concept is reformatting of consumption of concentration in water, soil, etc to Maximum permissible limit (MPL) of World health organization (WHO). In the literature study confirms that 1-phenyl naphthalene and their derivatives are present in given plant [2].

Cleistanthus collinus have been perceived to have some therapeutic properties due to antileshmanial, anticancer, hostile to HIV, antimicrobial, mitigating, and against excessively touchy limit[3]. Despite the fact that plat contain numerous lethal compound and minerals as aggregation of substantial metals. The plant is in charge of defiled with follow and substantial metals to nourishment as a propensity may bring about aggregation of these in human organs and prompt distinctive medical issues[4]. The across the board sullying of flavors and herbs with substantial metals in most recent two decades has expanded the logical enthusiasm as it has the hurtful impact on human wellbeing. This has lead the specialists to ponder the impact of overwhelming metals on nourishment, air and water and to decide their possibility for human utilization [5]. A few examinations were done to decide the grouping of overwhelming metals in given plants and to contemplate their hurtful impacts. Substantial metals past as far as possible influences the human wellbeing and my prompt sickness of human hatchling, preterm work and mental hindrance in kids[6]. Grown-ups may experience the ill effects of weakness, hypertension, kidney inconveniences and direct contact to cause uncertain death [7-8].

The objective of this work is to assess the levels of substantial metals that are Lead, Cadmium, Arsenic, Selenium, Cobalt, Manganese, Nickel and Copper that

might be available in the Cleistanthus collinus. The levels of explored overwhelming metals were contrasted and the suggested levels by the worldwide associations as FAO and WHO for assigning optimum concentration present in plant.

II. EXPERIMENTAL

2.1 Materials:

Cleistanthus collinus plant leaves were collected from the selected region near Koradi in Nagpur District, Vidarbha Maharashtra, India and authenticated, Department of Botany, Rastrasant Tuukadoji Maharaj Nagpur University Nagpur (MH), India where a voucher specimen is 10057 preserved. All the chemicals used were obtained from Aldrich (Sigma-Aldrich, St.louis, MO, USA), Lancaster (Alfa Aesar Johnson Matthey company, Ward Hill, MA, USA).

2.2 Methods for Preparation of samples

2.2.1 Conventional Method:

The plant leaves of Cleistanthus collinus were taken for heavy metal analysis. The shade dried sample was converted into a finely powdered form by crushing, grinding. Take 10 gm of crude C. collinus plant leaves sample was placed in an Erlenmeyer flask and for Leaching of minerals and heavy metals by 60 ml aquresia solution [conc. HCl and HNO3 (3:1)] was added to it. It was allowed to stand overnight and the solution was heated carefully in a water bath until red nitrous oxide fumes ceased and allowed to cool yellowish solution obtained. The resulting solution was filtered through a Whatman filter paper No. 42 and transferred into a 100 ml polypropylene vial and diluted to 100 ml with distilled water.

2.2.2 Modern Method:

The plant leaves of Cleistanthus collinus were taken for heavy metal analysis. The shade dried sample was converted into a finely powdered form crushing, grinding. Take 10 gm of crude Cleistanthus collinus plant leaves sample and calcinations by muffle furnace at 10000C to remove all the organic impurities to obtained 0.5 gm of ash. Calcimined plant leaves ash was placed in an Erlenmeyer flask and for Leaching of minerals and heavy metals by 9 ml aquresia solution [conc. HCl and HNO3 (3:1)] was added to it. It was allowed to stand overnight and the solution was irridiated carefully in a microwave until red nitrous oxide fumes ceased and allowed to cool yellowish solution obtained. The resulting solution was filtered through a Whatman filter paper No. 42 and transferred into a 100 ml polypropylene vial and diluted to 100 ml with distilled water Figure 1.

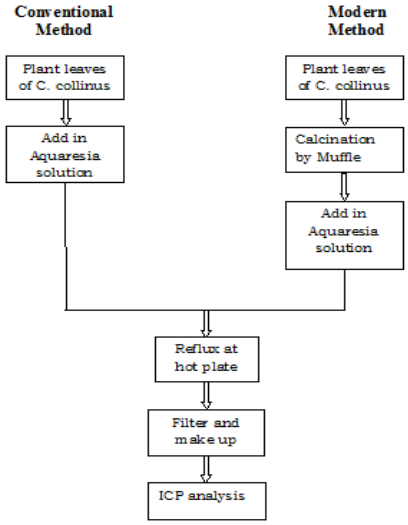

Figure 1. Flowchart for detection and quantification of leaves of C. Collinus

2.3 Detection and quantification of samples:

2.3.1 Quantitative analysis by ICP-OES:

Standard operation condition of the ICP-OES was achieved by carrying out number of repeat analysis using single wavelength. Sample in duplicate and same were used for instrumental analysis for mineral and heavy metals.

2.3.2 Optimized operating conditions (ICP-OES)

Parameters for Optimized operating conditions (ICP-OES) achieved for Cleistanthus. Collinus after number of trial experiments are as below Table 1.

Table 1. Optimized operating conditions (ICP-OES) for detection and quantification of inerals and heavy metals

Optimized operating parameters	Unit
Power	950 W
Plasma gas flow	12.0 L/min
Auxillary gas flow	050 L/min.
Nebulizer concentric	Glass-High Flow
Nebulizer gas flow	0.50 Lmin.
Pump Speed	120 rpm
Sample Delay	10 Sec
Rinse time	10 sec.
Sample replicate time	10 sec
Stabilization time	1 Sec
Replicates	3 Nos.

2.3.3 Analytical wavelength selection:

The wavelength selection is always play big role in chemistry of light which is some time an individual choice may varies from one user to other. However, most of the time agreement regarding the wavelength suitable for an extracting minerals and heavy metals in view of sample matrix and interfering elements.

2.3.4 Detection of minerals and heavy metals:

The analytical reagent blanks were prepared. Wavelength is fixed between 150 to 900 nm inductively coupled plasma Spectroscopy (ICP) Spectrophotometer was equipped with high intensity hollow cathode. The sodium element detect by flame photometer as Burner Head is 10 cm and temperature is 700-8500C. The test samples were analyzed against the standard for measuring the concentration of the desired data. All measurements were run in triplicate for the samples and standard solutions. Standard operating parameters for working elements were set. All the metals were extracted into the HNO3 in the form of metal nitrites. Heavy Metals selected for this study in the Cleistanthus. Collinus plant was found, Cadmium, Lead, Mercury, Zinc, Copper, Chromium, Manganese, iron, etc were analyzed and the results shown below Table 2.

Table 2. Detection and quantification of trace elements in Leaf Extract Cleistanthus Collinus (in ppm)

Constituents (Metals)	**Wavelength (nm)**	**ICP Reading**		**Dilution**		**Concentration (ppm)**	
		Without calcinations	**Calcination**	**Without calcinations**	**Calcination**	**Without calcinations**	**Calcination**
Ca	184	405.244	493.868	10	200	4052.44	98773.60
Mg	285	ND	ND	10	200	ND	ND
P	177	20.7	40.8	10	200	207.00	8160.00
Ga	294	0.005	0.005	10	200	0.05	1.00
V	292	0.018	0.029	10	200	0.18	5.80
Co	228	0.007	0.007	10	200	0.07	1.40
Cd	226	0.02	0.003	10	200	0.20	0.60
Cu	324	0.284	0.121	10	200	2.84	24.20
Mn	257	0.93	1.69	10	200	9.30	338.00
Sb	206	0.012	0.006	10	200	0.12	1.20
As	189	0.022	0.01	10	200	0.22	2.00
Pb	220	0.129	0.091	10	200	1.29	18.20
Ni	231	0.266	0.137	10	200	2.66	27.40
Mo	202	0.069	0.023	10	200	0.69	4.60
Zn	206	1.36	1.59	10	200	13.60	318.00
La	333	0.058	0.02	10	200	0.58	4.00
Ti	334	0.45	1.184	10	200	4.50	236.80
K	766	ND	6.082	10	200	ND	1216.40
Fe	259	16.78	11.454	10	200	167.80	2290.80
Al	396	6.267	11.189	10	200	62.67	2237.80
Na	-	18.84	13.08	10	200	188.40	2616.00

III. RESULT AND DISCUSSION

The contents of Pb , Cd, As, Hg, Cu, Mn ,Ni , Cu in above mentioned Cleistanthus. Collinus is compared with the maximum permissible limit (MPL) on the basis of the WHO Standards. It is a group of condiments, so the levels of

minerals and heavy metals were compared with the suitable safety standards as determined by the Maximum Permissible Limit (MPL), applied to "plantae-kingdom consumption in water" Figure 2a and b Table 3.

Table 3. Maximum Permissible Limit values for Pb , Cd ,As , Se , Mn , Ni , Cu (in ppm)

Metals	Symbol	Wavelength (nm)	Concentration (ppm)		Maximum Permissible limit (MXL) (ppm)
			Without calcinations	Calcination	
Calcium	Ca	184	4052.44	98773.60	1-3.675
Magnesium	Mg	285	ND	ND	-
Phosphorous	P	177	207.00	8160.00	-
Gallium	Ga	294	0.05	1.00	-
Vanadium	V	292	0.18	5.80	-
Cobalt	Co	228	0.07	1.40	0.002-0.05
Cadmium	Cd	226	0.20	0.60	0.00-0.06
Cupper	Cu	324	2.84	24.20	0.1-3.00
Manganese	Mn	257	9.30	338.00	27.75-200
Antimony	Sb	206	0.12	1.20	-
Arsenic	As	189	0.22	2.00	0.0006-1.0
Lead	Pb	220	1.29	18.20	1.11-5.29
Nickel	Ni	231	2.66	27.40	1.51-4.96
Molybdenum	Mo	202	0.69	4.60	-
Zinc	Zn	206	13.60	318.00	4.8-35.5
Lanthanum	La	333	0.58	4.00	-
Titanium	Ti	334	4.50	236.80	-
Potassium	K	766	ND	1216.40	-
Iron	Fe	259	167.80	2290.80	32-490
Aluminum	Al	396	62.67	2237.80	-
Sodium	Na	-	188.40	2616.00	-

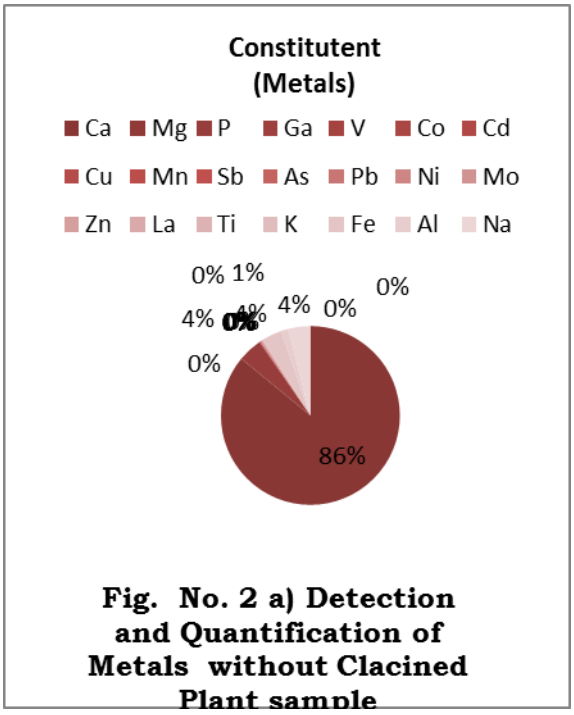

Fig. No. 2 a) Detection and Quantification of Metals without Clacined Plant sample

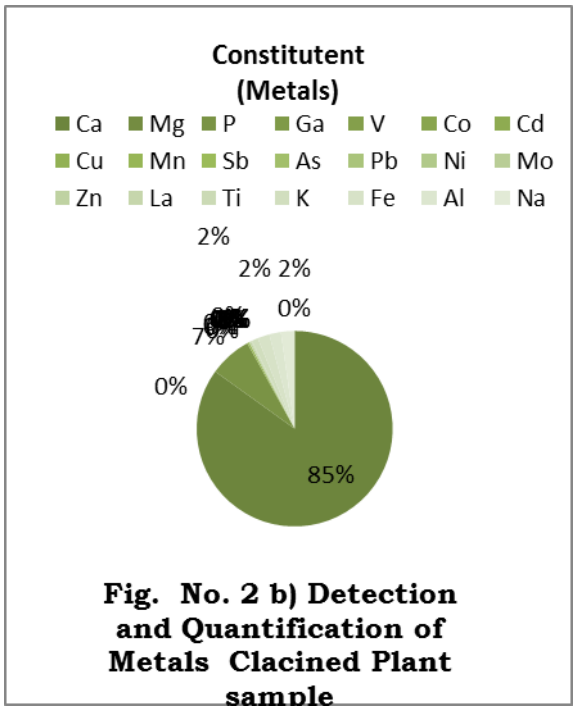

Fig. No. 2 b) Detection and Quantification of Metals Clacined Plant sample

Arsenic- Higher concentration of Arsenic in plant As table No. 3 shows arsenic in without clacined 0.22 and calcined 2.00 ppm level. It can cause harmful effect on skin, lungs, liver and bladder. Its lower effects can cause nausea, vomiting or even damage to the blood vessels.

Copper- The copper content in without clacined 2.84 and calcined 24.20 ppm level in given plant materials. The MPL set by FAO/ WHO (1984) in plants was 3.00ppm.

Lead – It is found to be the most poisonous environmental pollutant. It reacts with many biomolecules and severely affects the central nervous system, reproductive, gastrointestinal, renal, and cardiovascular. It shows concentration of lead for without clacined 1.29 and calcined 18.20 ppm level in given plant materials and astounding than MPL.

Cadmium- Upcoming investigation, second most dangerous component in water utilization to human wellbeing. As table No. 3 shows Cd concentration in without clacined 0.20 and calcined 0.60 ppm level in given plant materials as highest than MPL.

Nickel:- As table No. 3 shows nickel concentration in without clacined 2.66 and calcined 27.40 ppm level in given plant materials. The MPL set by FAO/WHO (1984) in plants was 1.51-4.96 ppm.

Manganese: - The range of Mn content in without clacined 9.30 and calcined 338 ppm level in given plant materials.. The MPL set by FAO/WHO (1984) in plants was 27.75-200 ppm.

Cobalt - In recent study it is observed that cobalt is act as environmental toxic elements. As table No. 3 shows without clacined 0.07 and calcined 1.40 ppm level in given plant materials. It contains highest concentration than maximum permissible limit.

IV. CONCLUSION

In above results showed that there is risk from plants like Cleistanthus collinus is toxic in nature. If taken in limited quantity consumption in per day humans are ultimately increasing level of foxiness up to death. On heavy metals detection and quantification result obtained indicates that Cleistanthus collinus used in water consumption contaminate in relatively high level. Therefore they should be under continuous monitoring. In modern method the relative quantity of minerals and heavy metals is higher than conventional method. Hence we conclude that modern method, leaching of all heavy metals in dilution of auresia [conc. HCl and HNO_3 (3:1)] shows equivalent concentration than conventional method.

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