Chapter

Trace Element Determination in Medicinal Plant Samples by ED-XRF Analysis

Archana A. Yelmate, Sanjay S. Thonte and Kranti L. Satpute

Abstract

The main objective of this study is to determine the concentration of trace elements in selected medicinal plants which are used for the treatment of dermal diseases. The trace element analysis was carried out in *Trigonella foenum-graecum, Azadirachta indica, Vitex nigundo, and Argemone mexicana,* using ED-X-ray Florescence (XRF) technique. The experiments were carried out using 3MV pelletron accelerator. The elements K, Ca, Cr, Mn, Fe, Cu, Zn, Rb, Sr., and Pb were identified in the sample. The elements K and Ca were present in maximum quantities. The relative concentrations of different elements in these medicinal plants have been given. All four plants contain trace elements of different concentrations in medicinal plants selected for this study. It is believed that the various trace elements present in the plants play an important role in the management of skin diseases. The present information will be helpful to prescribe the type of extract, dose, and mixture of these plants. The results justify that usage of these plants in the traditional systems of medicine for the treatment of skin diseases contains appropriate amounts of Fe, Zn, Cu, etc.

Keywords: ED-XRF, *Argemone Mexicana* Linn, *Trigonella foenum-graecum*, *Azadirachta indica*, *Vitex nigundo*

1. Introduction

Many plants are well known for the medicinal value and are used in herbal formulations. These plants are taken for elemental analysis using XRF. The medicinal action of these medicinal plants totally depends on the chemical constituents present in these plants. Herbal drugs are being used as remedies for various diseases and disorders throughout the world [1].

Nowadays more interest has been focused on phytomedicines or Ayurvedic medicines as they are safe and cost-effective as well as more compatible with the human body. These plants are used for the manufacturing of various synthetic drugs. It has been reported that the trace elements present in the plants are responsible for the development of different chemical constituents. Also, plant nutrients, including potassium (K), phosphorus (P), and sulfur (S), play an

important role in regulating various processes, such as photosynthesis, carbon respiration, tissue building, etc [2]. However, most of the studies have been done on constituents present in plants like essential oils, vitamins, glycosides, and other organic components but very little has been reported about the elemental composition of the plants [3].

A literature survey revealed a significant role played by the trace elements in the treatment of various diseases and disorders. It has been documented that alteration of trace elemental in an organism has a direct relation with different pathological conditions. Hence, the screening of the bioactive elements present in the plants and determination of the elemental composition of widely used medicinal plants is highly essential and also in identifying potentially hazardous trace metals in plants. In this study, attention has been focused on the specific biological significance of these trace elemental compositions of plants, which is crucial for the development of new drugs based on natural sources. The present investigation is an attempt to gain insight into the trace elemental composition analysis of some medicinal plants [4, 5].

For this study, X-Ray Fluorescence (XRF) analysis technique has been employed which is a fast technique for the identification and determination of elements. XRF is a powerful technique for nutrient plant analysis to estimate trace elemental concentrations.

XRF has been successfully applied in studies on the element composition analysis of plants, soil contamination, and agriculture out of which most of them applied pressed powder pellets to perform XRF analysis. The X-ray fluorescence method (EDXRF) uses loose powder, which decreases time and analysis costs [6, 7].

The main objective of this study is to determine the concentration of trace elements in selected medicinal plants, which are used for the treatment of dermal diseases by the tribal people. The four plants were selected for the present study mentioned here *Azardirachta indica, Vitex nigundo, Argemone mexicana,* and *Trigonella fornum graecum.* [5, 6].

2. Toxic effects of heavy metals on plants and the human body

Heavy metal poisoning is caused by the accumulation of certain metals in the body due to exposure through food, water, industrial chemicals, or other sources. While your body needs small amounts of some heavy metals to function normally, such as zinc, copper, chromium, iron, and manganese toxic amounts are harmful. Iron, cobalt, copper, manganese, molybdenum, and zinc are required by humans in adequate amounts. In the human body, these heavy metals are transported and compartmentalized into body cells and tissues binding to proteins, nucleic acids destroying these macromolecules and disrupting their cellular functions. Heavy metals disrupt metabolic functions in two ways: They accumulate and thereby disrupt function in vital organs and glands such as the heart, brain, kidneys, bone, liver, etc. They displace the vital nutritional minerals from their original place, thereby, hindering their biological function. The study on the absorption and accumulation of heavy metals lead, zinc, copper, and cadmium by various plant species around a smelter showed that the accumulation of the metals by plants differed with plant species and their parts [7].

Heavy metals can accumulate and migrate in the soil environment. Metal pollutants in soil may be absorbed by the plants through their roots and vascular system. Once in the body, heavy metals can accumulate over time in your bones, liver, brain, kidneys,

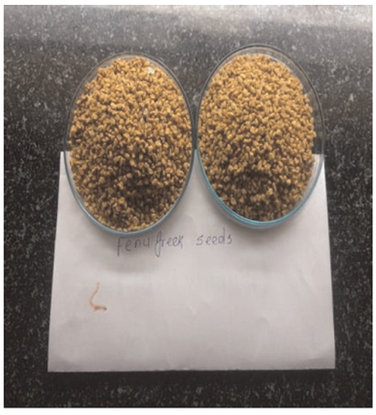
and heart. Having excess heavy metals in the body can damage vital organs, and cause behavioral changes and difficulties with thinking and memory. The heavy metals most commonly associated with the poisoning of humans are lead, mercury, arsenic, and cadmium. Heavy metal poisoning may occur as a result of industrial exposure, air or water pollution, foods, medicines, improperly coated food containers, or the ingestion of lead-based paints. Zinc reduces the amount of copper your body absorbs, and high doses of zinc can cause a copper deficiency. Gastrointestinal and kidney dysfunction, nervous system disorders, skin lesions, vascular damage, immune system dysfunction, birth defects, and cancer are examples of the complications of heavy metals toxic effects. Heavy metal intoxication is another reason for liver disease, it has great importance due to unnoticed intake of heavy metals by humans and because heavy metals can be present in drinking water, food, and the environment or workplace of affected people. A person who lost his vision and even suddenly became color blind turned out to have an unusual cause for the problems: thallium poisoning. Thallium is a metal that can be absorbed through a skin and can cause neurological problems [7, 8].

Essential and non-essential heavy metals generally produce common toxic effects on plants, such as low biomass accumulation, chlorosis, inhibition of growth and photosynthesis, altered water balance and nutrient assimilation, and senescence, which ultimately cause plant death.

To minimize the detrimental effects of heavy metal exposure and its accumulation, plants have evolved detoxification mechanisms. Such mechanisms are mainly based on chelation and subcellular compartmentalization. Chelation of heavy metals is a ubiquitous detoxification strategy described in wide variety of plants. Among the most significant heavy metals from the point of view of health are mercury, lead, cadmium, nickel, and zinc [6, 7].

3. Materials & methods

Medicinal plant samples for the study were collected from different areas of Maharashtra with the help of experts and subjected to authentication at by a botanist. All the samples were washed under running tap water and also rinsed with deionized water to remove any earthy matter before drying in an oven at 60°C for near about 2–3 days. Milling of the plant materials was done in a grinder (**Table 1**). Experiments were performed with dried samples of medicinal plants No. 1 – No. 4, (No. 1 – *Azardirachta indica,* No. 2 – *Vitex nigundo*, No. 3 – *A. mexicana*, No. 4 – *Trigonella fornum graecum*,)



Trigonella foenum graecum

Vitex nigundo linn

Sr.No	Local name	English name	Scientific name	Family	Part used	Medicinal uses
1	Methi	Fenugreek	*Trigonellafoenumgraecum*	Fabaceae	Seed	Diabetes, Asthma, Anemia.
2	nirgudi	Five leaved chaste tree	*Vitexnigundo*Linn	Verbenaceae	Leaves	Anti-inflammatory, analgesic, antihistaminic property, astringent.
3	Satyanashi	Mexican poppy	*Argemonemexicana*	Papaveraceae	Leaves	relieve toothache, skin diseases, Leprosy.
4	Kadunimb	Neem tree	*Azardirachtaindica*	Meliaceae	Leaves	Malaria, tuberculosis, rheumatism, arthritis, jaundice and intestinal worms, and skin diseases.

Table 1.
Selected plants information.

Azardirachta indica

Argemone Mexicana

4. Authentification of plants

According to WHO, the best source of medicines are medicinal plants. The herbs under study are easily available throughout the year and in almost all parts of India. They are cheap and can be easily procured from wild sources also. Since whole plants do not stay stable and potent for a longer duration, they were used freshly dried specific parts of plants. We have selected *A. indica* Linn leaves, *Vitex nigundo* Linn leaves, seeds of *Trigonella foenum graecum* Linn, and A. mexicana Linn leaves. Selection of plants based on an extensive literature survey, the literature reveals that the selected plants were used traditionally for curing various skin diseases. The selected plant parts contain different phytoconstituents responsible for antimicrobial and anti-inflammatory activities. In the ayurvedic system of medicines, these plants are used traditionally. Also, these plants have been reported in CHARAK SAMHITA ancient and authoritative textbook of Ayurveda and Unani [6, 7]. *A. indica* leaves, *Vitex nigundo* Linn leaves were collected from the local region of Latur in the month of July

and August, seeds of *Trigonella foenum graecum* Linn and were collected from the local market of Latur in the month of august, *A. mexicana* Linn leaves, in the month of October respectively and authenticated under the supervision of expert botanist by submitting herbarium of each sample. Authenticated plant parts were evaluated for its morphological characteristics such as color, odor, taste, size, shape, and nature of outer and inner surfaces as per guidelines of WHO. The plant parts were shade dried for a month and powdered in mechanical grinder and stored in airtight container [8].

5. Standardization of plants

In order to produce reproducible quality of final product the quality of starting material is very important. Therefore, standardization of plant samples under study was performed as per the comprehensive guidelines of WHO monographs. World health organization emphasized the need of ensuring quality of herbal drugs by using different modern techniques and by applying suitable standards. The following parameters were used for standardization [8, 9].

6. Extractive values

The extractive value of drug helps to determine the amount of soluble constituents in a medicinal plant material, after extraction with solvents. The extraction of any crude drug with a particular solvent gives a solution containing different chemical constituents, which are soluble in that solvent only. The composition of these chemical constituents in a solvent depends upon the nature of phytoconstituents and their solubility in solvent used for extraction [8, 9].

7. Water soluble extractive

Accurately weighed 5 gm of crude drug sample of *Argemone Mexicana* Linn, *Vitex nigundo* Linn, *Azardirachta indica* Linn leaves and seeds of *Trigonella foenum graecum* Linn taken in a weighing bottle and then transfer it to each different dry 250 ml. conical flask. Each flask was filled to the delivery mark with the chloroform water for water soluble extractives. Tightly packed all flasks and kept a side for 24 hours. Then it was filtered, when sufficient filtrate has collected, takes 25 ml of the filtrate and transferred to a thin porcelain dish. Evaporated to dryness on a water bath and subjected for drying in an oven at 100^0c. Cool in desiccators and of percentage water soluble extractive was calculated (**Table 2**) [8–10].

8. Alcohol soluble extractive

Accurately weighed 5 gm of each *Argemone Mexicana* Linn, *Vitex nigundo* Linn, *Azardirachta indica* Linn leaves, and seeds of *Trigonella foenum graecum* Linn powder drug taken in a weighing bottle and transfer it to separate dry 250 ml. conical flasks.

Each flask was filled to the delivery mark with the solvent (90% alcohol). Tightly packed all flasks and kept aside for 24 hours, then it was filtered rapidly in order to prevent the loss of alcohol. When sufficient filtrate has collected, take 25 ml. of the

Evaluation parameters	Name of plants			
	Azadirachta indica Linn	*Vitex nigundo* Linn	*Trigonella foenum graecum* Linn	*Argemone Mexicana* Linn
Foreign matter	0.2	0.3	0.3	o.2
Ash values	7.9	0.35	9.5	16.7
Acid insoluble ash	1.89	0.29	1.3	2.9
Water soluble ash	16.4	12.45	8.2	4.8
Alcohol soluble extractive	13.21	10.20	10.31	17.3
Water soluble extractive	21.4	33.21	22.32	26.0
Moisture and volatilities	5.4	6.2	9.2	8.2

Table 2.
Results of standardization of plant materials.

filtrate and transferred to thin porcelain dish. Evaporated to dryness on a water bath and subjected for drying in an oven at 100^0c. Cool in desiccators and of Percentage ethanol soluble extractive was calculated [8–10].

Ash values: Ash value means residue remained after incineration of crude drugs. It is inorganic mixture of metallic salts and silica. It helps in determining the quality and purity of crude drugs, especially in the powdered form of crude drugs. The objective of ash value is to remove all traces of organic matter which may interfere in an analytical determination. Ash contains inorganic like phosphates, carbonates, silicates of sodium, potassium, magnesium, calcium, etc. Sometimes, inorganic variables like calcium oxalate carbonate content of drug affects "Total ash value"[(139)].

The different Types of ash values are as follows:

Total Ash: It is the total mixture of physiological ash and non-physiological ash. Water Soluble Ash: If a total ash is treated with chloroform water then the resulting ash is known as water- soluble ash. Sulfated Ash: It involves the treatment of drug with dil. Sulfuric acid before ignition. In this all oxides and carbonates are converted to sulfates and ignition is carried out at a higher temperatures in a muffle furnace. Acid Insoluble Ash: If a total ash is treated with dil. HCL then the resulting ash is known as acid insoluble ash. This value mainly represents contamination with materials like sand. Weighed and ignited flat thin porcelain dish or a tarred silica crucible was taken. 2 g of the powdered drug were weighed and taken in the dish /crucible. Support the dish on a triangle placed on the ring of the retort stand. Heated with a burner using a flame till vapors almost ceases to be evolved then lower the dish and heat more strongly until all the carbon is burnt off and placed the silica crucible in a desiccator for cooling. After cooling weight, the ash and calculated the percentage [8–10].

Acid Insoluble Ash: Using 25 ml of dil. HCL washed the ash obtained from the dish used for determination of total ash value into 100 ml beaker. Boiled for 5 minutes over a Bunsen burner and filtered the above solutions through an ash

less filter paper, washed the residue twice with hot water, ignite a crucible in a flame, cool, and weighed. Cooled the silica crucible in desiccator weighed the residue and calculated the acid insoluble ash value [8–11].

Water soluble ash: Total ash obtained was boiled for five minutes with 25 mL of distilled water. Cooled and collected the insoluble matter on an ash less filter paper, washed with hot water and again ignited for 15 minutes at temperature not exceeding 450°C and percentage of water soluble ash was calculated [12, 13].

Sulfated ash: Heated empty silica crucible to redness for 10 minutes. Allowed to cooled and weighed. Placed one gram of powder of plants in a silica crucible, treated with Sulfuric acid, ignited again moistened with sulfuric acid, and ignited at about 800°C in a muffle furnace, cooled and weighed. The percentage of sulfated ash was calculated.

Moisture and Volatilities: About 5 – 6 g of *A. indica* Linn leaves, *vitex nigundo* Linn leaves, *Argemone Mexicana* Linn leaves, and *Trigonella foenum graecum* Linn seeds were accurately weighed in a petri dish and kept in a hot air oven at 110°C for 4 hours. After cooling in a desiccator, the loss in weight was recorded in each case. This procedure was repeated until a constant weight was obtained.
Moisture and Volatilities (%) = Loss in weight x 100 W, W = Weight of the leaves in grams.

Determination of foreign organic matter in plant samples: Foreign organic matter means the material not collected during collection from an original plant source. Insects, molds, or any other contaminated material is considered as foreign organic matter. Procedure: 500 gm of crude collected drug taken and evenly spread on a clean tile. Then visually inspect the sample with eyes and separate the foreign matter if any [14–17].

Morphologic evaluation: After authentification, all plants are subjected for morphological parameters like color, odor, taste, size, shape, etc. The results are recorded in **Table 3**.

Sr. No	Characters	Name of plant samples			
		***Azadirachta indica* Linn**	***Vitex nigundo* Linn**	***Trigonella foenum graecum* Linn**	***Argemone Mexicana* Linn**
1	Color	Dark green	Green, dark reddish brown.	Yellowish or yellowish brown	Green-brown
2	Odor	Typical, Characteristi cs	None, when crushed strong smell	Characteristi cs, Pungent Spicy	Slightly pleasant
3	Taste	Intensely Bitter	None	Bitter and mucilaginous	Non Characteristics
4	Size	1–3 cm in diameter, 2 – 8 cm in length	Variable	3–6 mm length, 2 – 4 mm width.	1.5–2 cm in diameter, 3–5 cm length
5	Shape	Lanceolate	Ovoid, tears	Rectangular to round	Elliptical ovoid
6	Extra features	Compound	Transparent , glossy	Solid- rhomboidal	Smooth

Table 3.
Morphological observation of selected plants.

Elements	*Trigonella Foenum Graecum* Linn (seed)	*Vitex nigundo*Linn	*Argemone Mexicana* Linn	*Azardirachta indica*
Fe	2.022%	5.387%	2.467%	1.977%
Mn	0.466%	0.561%	0.225%	0.371%
Zn	0.411%	0.204%	0.049%	0.047%
Cu	0.162%	0.054%	0.030%	0.024%
V	0.00%	0.051%	0.076%	0.107%
Si	0.00%	0.227%	0.000%	0.213%
P	4.669%	1.628%	1.195%	0.966%
S	5.184%	1.910%	1.619%	1.733%
Cl	8.138%	2.611%	3.971%	5.733%
K	56.797%	31.975%	35.399%	20.825%
Ca	21.827%	54.418%	54.450%	67.265%
Ti	0.176%	0.842%	0.385%	0.391%
Br	0.033%	0.000%	0.022%	0.186%
Rb	0.074%	0.019%	0.040%	0.007%
Sr	0.042%	0.07%	0.056%	0.154%

Table 4.
Trace element concentrations of the selected medicinal plants.

Experiments were performed with dried samples of medicinal plants No. 1 – No. 4, (No. 1 – *Azardirachta indica,* No. 2 – *Vitex nigundo*, No. 3 – *A. mexicana*, No. 4 – *Trigonella fornum graecum*,)

Total 19 number of elements, such as phosphorus, sulfur, potassium, calcium, scandium, titanium, vanadium, manganese, iron, cadmium, iodine etc. were detected from the four medicinal plant samples of *Arardirachta indica, vitex nigundo* Linn, *Argemone Mexicana* Linn, leaves and *T. foenum-graecum* Linnseed by ED-XRF. The detected concentrations found in the samples are presented in **Table 4** (**Figures 1–5**).

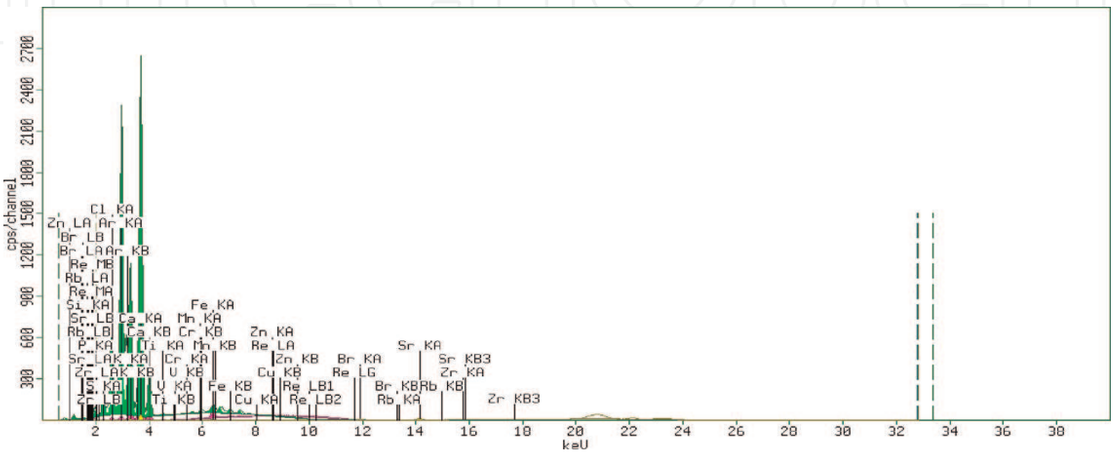


Figure 1.
ED-XRF analysis of Arardirachta indica.

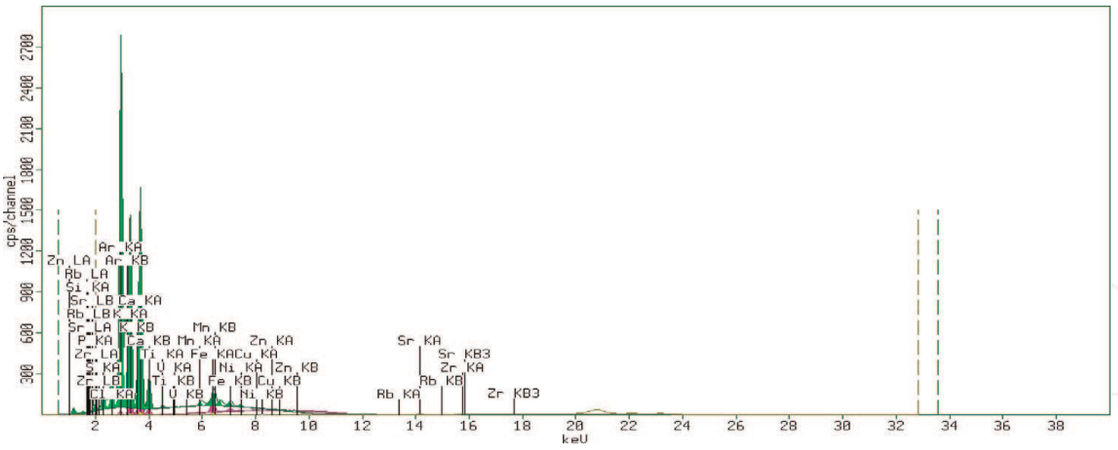


Figure 2.
ED-XRF analysis of vitex nigundo *Linn.*

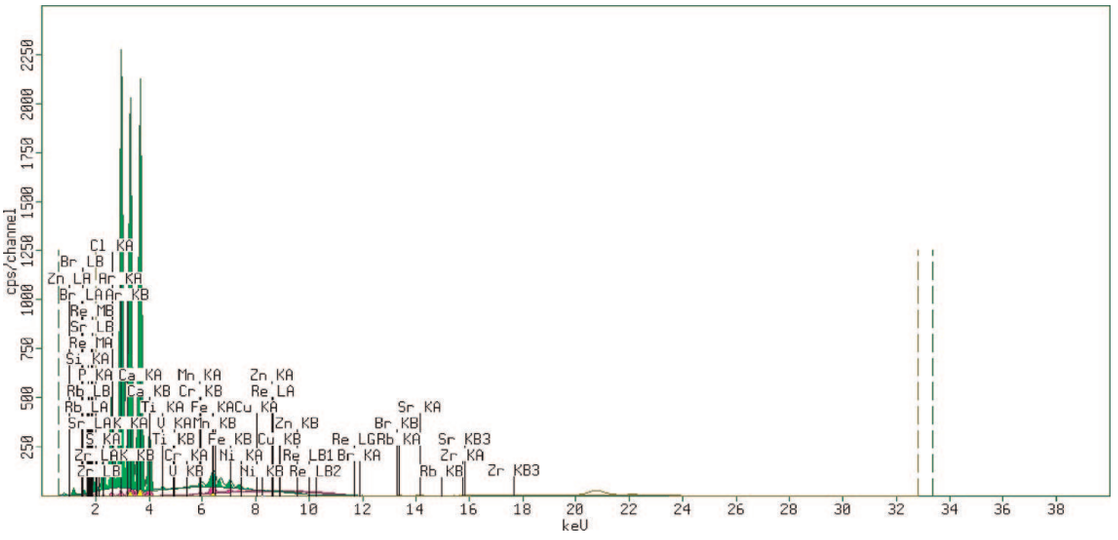


Figure 3.
ED-XRF analysis of Argemone Mexicana *Linn.*

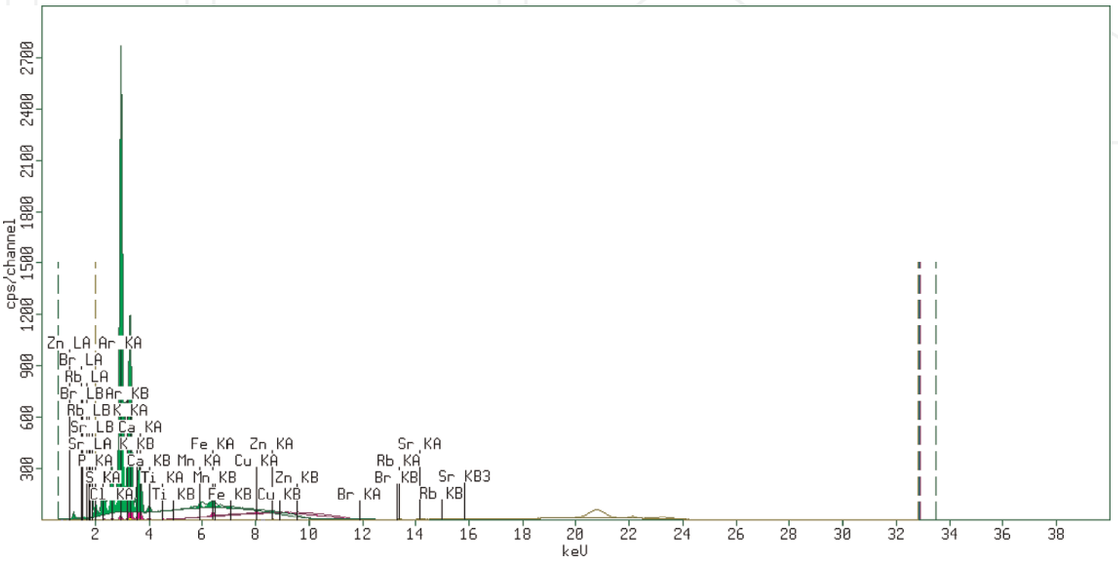


Figure 4.
ED-XRF analysis of T. foenum-graecum *Linn.*

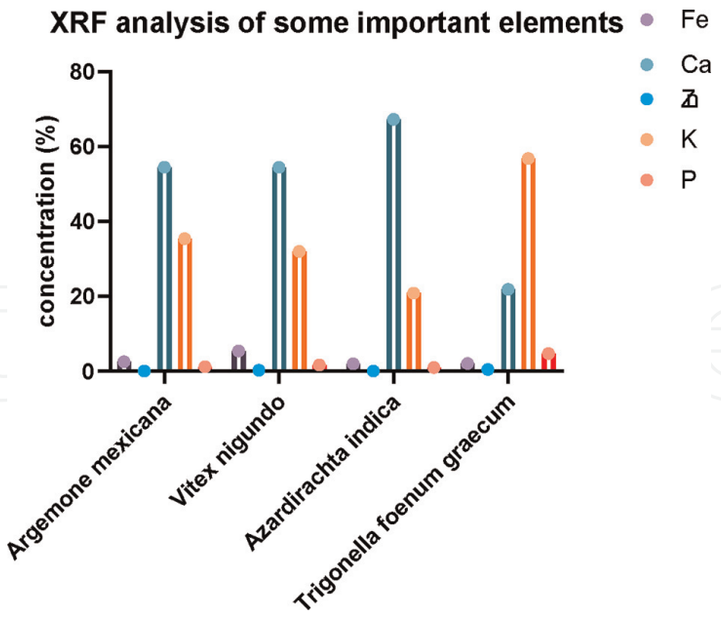


Figure 5.
XRF analysis of plant samples.

9. Results

Elemental analysis of *Vitex negundo* leaves by ED-XRF technique has been confirmed the presence of pharmaceutically active, major, minor, and trace elements. The results of elemental analysis were recorded in **Table 1**, which revealed presence of P (1.628%), K (31.975%), Ca (54.418%), Ti (0.842%), Mn (0.561%), Fe (5.387%), Ni (0.023%), Cu (0.054%), Zn (0.204%), Rb (0.019%) and Zr (0.008%) Si (0.224%), S (1.910%), Cl (2.611%), Sr. (0.087%). Toxic metals like Be, Ag, Sn, Ba, Pb, and Bi were found totally absent in *Vitexnegundo*leaves.

Elemental analysis of *T. foenum-graecum* seed by ED-XRF technique has been confirmed the presence of pharmaceutically active, major, minor, and trace elements. The results of elemental analysis were recorded in **Table 1**, which revealed presence of P (4.669%), K (56.797%), Ca (21.827%), Ti (0.176%), Mn (0.466%), Fe (2.022%), Cu (0.162%), Zn (0.411%), Rb (0.074%), Br (0.033%), Sr. (0.042%), S (5.184%), and Cl (8.138%). Toxic metals like Be, Ag, Sn, Ba, Pb, and Bi were found totally absent in *Trigonella foenum-graecum* seed.

Elemental analysis of *Argemone Mexicana* Linn leaves by ED-XRF technique has been confirmed the presence of pharmaceutically active, major, minor, and trace elements. The results of elemental analysis were recorded in **Table 1**, which revealed presence of P (1.195%), K (35.399%), Ca (54.450%), Ti (0.385%), Mn (0.225%), Fe (2.467%), Ni (0.010%), Cu (0.030%), Zn (0.049%), Rb (0.040%), Zr (0.003%) Br (0.022%), S (1.619%), Cl (3.971%), Re (0.004%), and Sr. (0.056%). Toxic metals like Be, Ag, Sn, Ba, Pb, and Bi were found totally absent in *Argemone Mexicana* Linn.

Elemental analysis of *Azardirachta indica* Linn leaves by ED-XRF technique has been confirmed the presence of pharmaceutically active, major, minor, and trace elements. The results of elemental analysis were recorded in **Table 1**, which revealed presence of P (0.966%), K (20.825%), Ca (67.265%), Ti (0.391%), Mn (0.371%), Fe (1.977%), V (0.107%), Cu (0.024%), Zn (0.047%), Rb (0.007%), Zr (0.001%), Br

(0.186%), S (1.733%), Re (0.000%), Sr. (0.154%), Si (0.213%), and Cl (5.733%). Toxic metals like Be, Ag, Sn, Ba, Pb, and Bi were found totally absent in *Azardirachta indica* Linn.

10. Discussion

Analysis of the present data revealed that Fe was observed with the adequate concentration in all the medicinal plants studied as compared to other trace elements recorded. The highest concentration of the Fe among the studied medicinal plants was found in *vitex nigundo* Linn.

Fe is the trace element plays an important role in the production of hemoglobin and oxygenation of red blood cells. It is also important for healthy immune system as well as energy production.

Fe plays an important role on immune system, the use of the medicinal plants in the treatment of skin diseases in the traditional system of medicine may be based on the amounts of Fe present in the plants.

Also, Mn is the important trace elements in immune system for regulation of immune responses of the body due to the breakdown of amino acids, production of energy, and utilization of foods.

Also, Mn is the component of the metalloenzyme manganese superoxide dismutase in the mitochondria and also the important constituent of the mitochondrial antioxidant defense system to give protection from the free radical, which are generated from the injured cells and are harmful to the skin.

Zn is also important element which is required for the metabolism of biochemical reaction in the body. It is found in tissue of plants and animals and plays an important role in maintaining healthy skin by controlling enzymes that are involved in the renewal of cells in our body. The highest concentration of the Zn among the studied medicinal plants was found in *T. foenum-graecum*, that is, 0.411%. Hence, the possible use of these medicinal plants for treating skin diseases in the traditional system of medicine can be understood.

Cu is very well known for the stimulation of immune system to fight against infection, involved in the repairing of injured tissues and promote healing. In addition, Cu is responsible for the formation of the connective tissues like cross linking of collagen and elastin. As Cu affects our immunity, so possess anti-infectant properties, so the presence of the maximum amount of Cu in all the plant samples studied support their role in curing skin diseases by the traditional practitioners in traditional system of medicine. Further, the role of V is limited and plays an important role in the treatment of diabetes, the main important function to provide protection against injury of tissues.

In the present study, Cu was found to be in varying concentrations in all the medicinal plants samples in the range of 0.024% to 0.162% with the highest concentration of Cu recorded again in the *T. foenum-graecum*.

Further, the role of V is limited and plays an important role in the treatment of diabetes, the main important function to provide protection against injury of tissues. Thus, the trace elements like Fe, Mn, Zn, Cu in addition to Co and V are responsible to defend the serious skin infections and diseases.

In this study, ED-XRF technique was used to trace the elemental composition of all the selected plants. It is evident that the elements present in the plant samples played a direct or indirect role in the control and treatment of the skin diseases and disorders.

The results of the current study suggest that the usage of medicinal plants in the traditional system of medicine for curing skin diseases since they are found to contain adequate amount of the Fe, Zn, Cu, Mn, and V.

11. Conclusion

The objective of the research work is to analyze trace elements present in selected medicinal plants using ED-XRF spectrometer and to estimate their elemental concentrations.

All four plants contain trace elements of different concentrations in medicinal plants selected for this study. It is believed that the various trace elements present in the plants play an important role in the management of skin diseases. The difference in the concentrations of these elements is mainly due to the differences in structure, as well as type of the soil, the cultivated field, age of the plant, climatic conditions, and irrigation facilities provided to the plants. The conventional treatment of dermal disease has many side effects, on the other hand, medicinal plant extracts are possesses similar therapeutic efficacy without any side effects. The present information will be helpful to prescribe the type of extract, dose, and mixture of these plants. The results justify that usage of these plants in traditional systems of medicine for the treatment of skin diseases contains the appropriate amount of Fe, Zn, Cu etc.

However, further research is needed to understand the relation between dermal diseases and trace elements. Finally, the study concluded that this information will be very beneficial for the researcher who would like to conduct research in the area of Herbal medicines. Also, it has been found that no excess quantities of toxic elements are present in selected medicinal plants and not harmful to health.

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Author's contributions

Thonte. s.s analyzed and interpreted the data related to ED-XRF analysis. Yelmate A.A has given a major contribution for conducting the research and writing the manuscript. Both authors read and approved the final manuscript.

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Competing interests

No competing interest to declare here.

Consent for publication

Not applicable.

Availability of data and material

All required data and materials are available upon request.

Ethics approval consent for publication

Not applicable.

Plant Authentification

The plant parts were identified by Dr. C.S. Swami, department of botany, Dayanand science college, Latur. Deposition numbers for the herbarium of these samples were not given so it is not available.

Abbreviations

ED-XRF Energy Dispersive X-ray Fluorescence

Author details

Archana A. Yelmate[1*], Sanjay S. Thonte[2] and Kranti L. Satpute[2]

1 Dayanand College of Pharmacy, Latur, Maharashtra, India

2 Channabasweshwar Pharmacy College, Latur, Maharashtra, India

*Address all correspondence to: archanayelmate1@gmail.com

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