Abstract

Analysis of some medicinal plants from Maharashtra for Phytochemicals, Antioxidant activity, elemental content and their bioaccessibility

In different parts of the world, the use of medicinal plants has always been important in the therapeutic armory of mankind and remains an important source for the discovery of new bio-active compounds. These protective effects have been attributed to the presence of phytochemicals and various elements in these plants. The present study was undertaken to evaluate the phytochemicals, antioxidant activity, elemental content and their bioaccessibility in medicinal plants from Maharashtra.

The thesis is divided into five chapters. Chapter 1 is introductory. Chapter 2 describes experimental methodology and Chapters 3 to 5 present the obtained results and discussion thereon.

Chapter 1 begins with importance of medicinal plants and basic information about phytochemicals, free radicals and antioxidants. This is followed by various techniques used for analysis of medicinal plants. A literature review on the medicinal plants is given at the end followed by scope of the work.

Chapter 2 deals with the experimental methodology followed in the present work. In the beginning seven medicinal plants and their importance are listed. The procedures for the extraction, determination of phytochemicals and antioxidant activity are described in details. This is followed by the procedure for estimation of mineral content, Se speciation and bioaccessibility of essential elements by in-vitro gastric and gastro-intestinal digestion method. At the end, the detailed extraction procedure for phenolic acid, flavonoids and amino acids is explained followed by the analytical procedure for HPLC and HPTLC techniques.

Chapter 3 deals with phytochemical screening, Antioxidant activity and effect of gamma irradiation on antioxidant activity of different medicinal plants. The major findings of the work are:

- Phytochemical analysis of ethanol extracts of medicinal plants showed the presence of terpenoid, flavonoids, saponins, tannins and reducing sugars in all the plants.
The lowest moisture content (7 %) was observed in *Malaxis acuminate* indicating the high storage life.

Total ash content was found to be in the range of 6.4 % to 10.5 %.

Highest fiber content (76 %) was observed in the plant *Amoora rohitaka*.

Ethanol extract of *Amoora rohitaka* (*Roxb.*) exhibited the highest ABTS scavenging activity (84 %) with corresponding value of IC$_{50}$, 0.240 mg/ml.

The IC$_{50}$ values for DPPH radical assay showed significant variation from 0.211 mg/ml to 0.700 mg/ml.

 Radical scavenging activity increased with irradiation and found to be maximum at dose of 5 kGy. This increase is due to the formation of MRPs during irradiation.

**Chapter 4** provides baseline data on concentration of Cu, Zn, Mn, Fe, Ca, Co, K, Na, Ni and Mg and their in-vitro bioaccessibility using ICP-AES and AAS techniques. Following are important conclusions drawn from this study:

- The elemental concentration in medicinal plants roughly follows the order: Ca > K > Mg > Fe > Na > Mn > Zn > Cu > Ni > Co.
- Ca was the most abundant element with highest concentration of 57.55 mg/g.
- Statistical analysis showed that, the Pearson correlation coefficient for K and Co is 0.847 indicating very good correlation between them, the PCA score plot also supports this observation.
- Highest % bioaccessibility for Fe was observed in *Adiantum capillus veneris* in gastro-intestinal digestion (80.00 %).
- The bioaccessibility during gastro-intestinal digestion was found to be greater than gastric digestion, as expected.
- Highly sensitive and simple spectrophotometric method for the speciation of selenium was developed. The measured concentrations of total Se ranged from 12 µg/g to 32 µg/g and amount of selenium in selenite (IV) form is higher than selenate (VI) in all samples.
Chapter 5 describes identification and quantification of 16 phenolic acids and flavonoids and 10 amino acids using HPLC and HPTLC techniques. The major findings of the work are:

- Total phenolic acids and flavonoids content was observed in the range of 761.74 µg/g (Amoora rohitaka) to 7623.66 µg/g (Sphaeranthus hirtus Linn).
- *Sphaeranthus hirtus* contains highest amount of phenolic acids and flavonoids content, of which 4248.31 µg/g was present in ester bound form, 1776.62 µg/g was present in bound form and 1598.73 µg/g was present in free form.
- Among the medicinal plants under study *Adiantum capillus veneris* contains the highest amount of amino acid (3253.29 ng/spot).
- *Sphaeranthus hirtus* Wild. (Asteraceae) showed the presence of Lysine (123.35 ng/spot), Threonine (268.37 ng/spot), Tryptophane (29.93 ng/spot), Proline (201.22 ng/spot) and Leucine (168.51 ng/spot) along with some other unidentified amino acids.
- *Prunus cerasoides* showed the presence of Threonine, Tryptophane, Aspartic acid and Leucine of which Threonine is present in highest amount (381.56 ng/spot).
- Medicinal plants under study are good source of phenolic acids and amino acids.

Present study reveals that studied medicinal plants are potential sources of natural antioxidants and nutrients, which contribute to its medicinal property.