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Electrochemical Analysis of Water Extracts from seeds of *Trachyspermum ammi* and *Nyctanthes arbor-tristis* in Bengal and Determination of Heavy Metals

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Abstract: ***Seeds of Trachyspermum ammi and Nyctanthes arbor-tristis in Bengal have a great medicinal importance in Bengal. They possess immunostimulant, antiviral, antibacterial and antifungal activities in human life. Various parts of plants can absorb metals from soil as well as from deposits on the parts exposed to the air from polluted environments. Heavy metal contamination with the medicinal plants is a serious concern due to its implications on human health. Atomic Absorption Spectroscopy (AAS) is used for determination of content of heavy metals like Cu, Zn, Fe, Cd, Cr, Co, Pb, Ca, K, Mg, Na, Hg and Se from water extract of Trachyspermum ammi seeds and Cu, Zn, Fe, Cd, Cr, Pb, Ca, K, Mg, Na and Se from water extract of Nyctanthes arbor-tristis seeds, were detected in AAS. Cyclic voltammetry (CV) analysis shows the rapid deterioration of reducing strength of antioxidant activities of water extracts.The main objective of this study was to determine nutritional status for heavy metals content and rapid detection of reducing strength as a part of antioxidant activities.***

Keywords: Trachyspermum ammi,Nyctanthes arbor-tristis,immunostimulant, antiviral, antibacterial

1. Introduction

Nyctanthes arbor is commonly known Night Jasmine. The leaves, flowers, seeds and bark of *Nyctanthes arbor* is widely used in traditional remedies and folk medicine in India. It is widely distributed throughout India and also cultivated in gardens for its fragrant flowers. ***Trachyspermum ammi*** is one such plant which is widely used as medicine. Water extracts of seeds of both are subject to following analysis, Chemical assay; Determination of total metal content, *Electrochemical analysis.*

2. Materials and Methods

Samples

The samples were collected from West Bengal during 2013. The collected samples were washed with deionized water and dried at 105°C for 24 hours. Dried samples were homogenized using an agate homogenizer and stored in pre-cleaned polyethylene bottles until the analysis started.

Reagents

All reagents were of analytical reagent grade, 69–72% HNO_3, 30% H_2O_2, and 70% $HClO_4$ were used for digestion of samples. Double deionized water was used for all dilutions. During the experiments,all glasswares and equipment were carefully cleaned starting with 2% HNO3 and ending with repeated rinsing distilled deionized water to prevent contamination. All standard solutions used (0.1, 1, 10, or 100 µg/ml) were prepared by diluting 1 mg/ml stock multi-element standard solutions.

Apparatus

For the elemental analysis, A ICP-AES (Optima 2100 DV, PE, USA) was used in this study. For digestion, a high-performance microwave system (XT-9912, Corp. Xintuo, China) equipped with advanced composite PTFE vessels was used. µ AUTOLAB (FRA2) with commercially available electrodes, Spectrophotometer (JASCO-V-630) and Atomic absorption with Flame Ionization.

Digestion procedure

Samples (0.3 g) were digested with 5 ml of HNO_3 (65%), 1 ml of H_2O_2 (30%), and 1 ml of $HClO_4$ (70%) in microwave digestion system for 32 min and finally diluted to 25ml with 2% nitric acid. All sample solutions were clear. A blank digest was carried out in the same way. Digestion conditions for microwave system were applied as 3 min for 500 W, 4 min for 800 W, 5 min for 1,000 W, 5 min for 1,300 W, 8 min for 550 W, vent 8 min.

Statistical analysis

The whole data were subjected to a statistical analysis, and correlation matrices were produced to examine the interrelationships between the investigated trace element concentrations of the samples. Student's t test was employed to estimate the significance of values.

3. Results and Discussion

The recovery values were nearly quantitative (≥95%) for microwave digestion method. The relative standard deviations were less than 10% for all investigated elements. t test was used to determine significant differences between mean values ($p < 0.05$). In order to validate the method for accuracy and precision, certified reference material (CRM),

namely poplar leaves (GBW07605), was analyzed for corresponding elements. The CRM was approved by State Bureau of Technical Supervision, Langfang, China. A control sample was digested and analyzed with each analytical batch of samples to check the effectiveness of our digestion procedure. The mean and comparison of heavy metal concentrations for the analyzed mushroom species were summarized in Table 3 and Fig. 1. The contents of copper, zinc, iron, manganese, cadmium, chromium, nickel, and lead in samples were found to be 6.8–31.9, 43.5–205, 67.5–843, 13.5–113, 0.06–0.58, 10.7–42.7, 0.76–5.1, and 0.67–12.9 mg/kg, respectively. The order of the levels of heavy metals in the samples was found to be as Fe > Zn > Mn > Cu > Cr > Pb > Ni > Cd. The FAO/WHO has set a limit for heavy metals intakes based on body weight. For an average adult (60 kg body weight), the provisional tolerable daily intake for copper, zinc, iron, and lead are 3 mg, 60 mg, 48 mg, and 214 µg/g, respectively (FAO/WHO 1999). Copper is the third-most abundant trace element in human body, with vitamin-like impact on living systems. Small amount of copper is found in the human body (50–120 mg), but it plays a critical role in a variety of biochemical processes (Yaman and Akdeniz 2004).

4. Observations

Table 1: Total sugar and phenolic content of samples

Sample name	*N. arbor*	*T.ammi*
Total phenolic content	15%	20%
Total sugar content	35%	30%

Table 2: Amount of heavy metals present (µg/g)

Sample	Cu	Zn	Fe	Mn	Cd	Cr	Co	Ni	Pb	Ca	K	Mg	Na	Hg	Se
N arbor	44.2	258.2	201.3	ND	0.1	0.2	ND	ND	15.2	38.5	12	15.1	1.8	ND	5.2
T.ammi	41.6	218	294	ND	0.1	0.5	0.1	ND	10.2	45.2	12	11.9	2.2	0.1	2.5

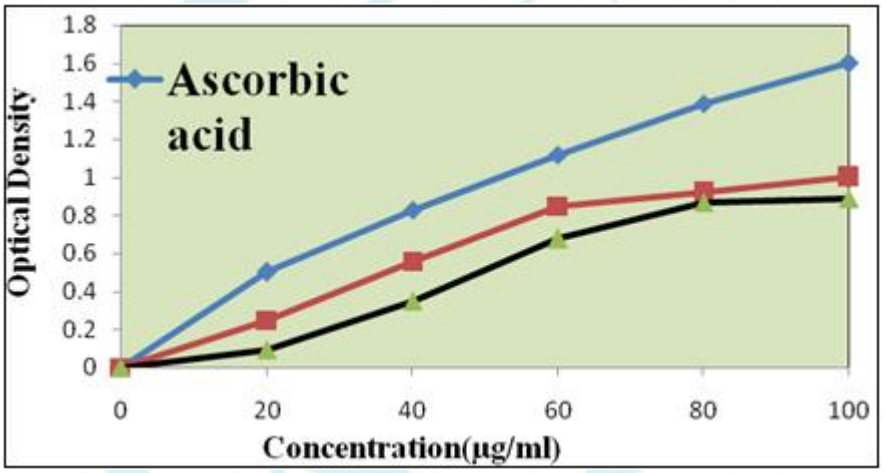

Figure 1: Reducing strength measurement

Statistically significant correlation coefficients ($r > \pm 0.532$ at 0.05 probability level) were established between metal concentrations. The values of correlation coefficients between metal concentrations are given in Table 4. There are good correlations between chromium and nickel ($r = 0.836$), chromium and manganese ($r = 0.546$), chromium and zinc ($r = 0.664$), nickel and manganese ($r = 0.618$), and manganese and zinc ($r = 0.616$). The other correlations between metals were not significant.

There are positive correlations of zinc and iron, zinc and lead, iron and manganese, iron and chromium, iron and nickel, iron and lead, cadmium and copper, chromium and iron, lead and zinc, and chromium and lead. Negative correlations were found between copper and zinc, copper and iron, copper and manganese, copper and chromium, copper and nickel, copper and lead, zinc and cadmium, iron and cadmium, manganese and cadmium, chromium and cadmium, nickel and cadmium, lead and cadmium, lead and manganese, and lead and nickel.

5. Conclusion

- Determination of heavy metals was performed.
- Both have significant Reducing strength
- In conclusion, our study showed that rapid and sensitive detection of reducing strength of aqueous extract of star fruit as deduced from cyclic voltammetry analysis and it is correlated with spectrophotometric technique.

6. Future Plan

(i) Study of other antioxidant properties and
(ii) the minimum detection limit for electrochemical analysis.

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