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## Detection of heavy metals from plants used for female reproductive dysfunction by ICP- OES technique

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### ABSTRACT

Heavy metal content from *Woodfordia fruticosa* (Linn.) Kurz (flowers), *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds). were analyzed with the help of 'Inductively Coupled Plasma- Optical Emission Spectroscopy' which is one of the techniques for analysis of trace elements. These plants are used against female reproductive disorders. The heavy metals determined in three plant powders were Lead (Pb), Arsenic (As), Cadmium (Cd) and Mercury (Hg) as per AYUSH guidelines. Arsenic, Cadmium and mercury were not detected in stem bark of *Symplocos racemosa* Roxb. and seeds of *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell. Concentration of Lead was within the normal range in. *Symplocos racemosa* Roxb.(stem bark) (2.95 mg/kg) and *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds) (7.77 mg/kg). None of these metals were detected in *Woodfordia fruticosa* (Linn.) Kurz. (flowers). © 2009 Trade Science Inc. - INDIA

### KEYWORDS

ICP-OES;  
Heavy metals. *Woodfordia fruticosa* (Linn.) Kurz;  
*Symplocos racemosa* Roxb.;  
*Caesalpinia bonduc* (Linn.)  
Roxb. emend. Dandy & Exell.

### INTRODUCTION

Heavy metals are important environmental pollutants and many of them are toxic even at very low concentrations. Pollution of the biosphere with toxic metals has accelerated dramatically since the beginning of the industrial revolution. The primary sources of this pollution are the burning of fossil fuels, the mining and smelting of metalliferous ores, municipal wastes, fertilizers, pesticides, and sewage<sup>[1]</sup>. Indigenous herbs are used as remedies for a variety of disease in traditional medicine or ethnomedicinal practice. Heavy metals are a matter of concern in herbal drugs; especially as certain plants have the tendency of accumulating heavy metals from soils, polluted water and atmosphere<sup>[2,3]</sup>. The ab-

sorption and incorporation of heavy metals by plants facilitate their entry into the food chains<sup>[4]</sup>. *Woodfordia fruticosa* (Linn.) Kurz (syn. *W. Floribunda* Salisb.), Family Lythraceae, commonly known as Dhataki is a woody shrub distributed throughout India<sup>[5,6]</sup>. The flowers are commonly used as an abortifacient<sup>[7,8]</sup> and in the treatment of menorrhagia<sup>[9,10]</sup>. Several herbal industries have been using Dhataki flowers in their herbal formulations, which are used in managing menstrual disorders, and Uterine disorders. *Symplocos racemosa* Roxb. is considered as uterine tonic, carminative, cool and astringent. It is recommended in case of menorrhagia and leucorrhoea. It affects the contractions of the uterus<sup>[10-13]</sup>. *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell has anti-estrogenic and anti-

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fertility activity<sup>[13]</sup>.

### MATERIALS AND METHODS

*Woodfordia fruticosa* (Linn.) Kurz (flowers), *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds) were collected from (Khandala, Mahabeleshwar, Malvan respectively) Maharashtra, India.) *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds) were authenticated from Agharkar Research Institute and their Authentication numbers are Auth08-69 and Auth08-68 respectively, and *Woodfordia fruticosa* (Linn.) Kurz (flowers) was authenticated from National Botanical Research Institute, NBRI PID (CSIR) R. & S. Cell No. 1894. The plant materials were spread over filter paper for 6 hours in shade away from sunlight. The plant materials were then placed in preset oven at  $45 \pm 2^\circ$  C. The plant materials were allowed to dry for 4 days. Immediately after drying, they were powdered using an electrical mixer-grinder and sieved through a BSS mesh No.85 sieve and stored in an airtight Pearlpet<sup>®</sup> container<sup>[14]</sup>. The sieved powder was stored in commercially available airtight polyethylene containers labeled with details such as date of collection, weight of powder, time of collection and the region of collection. This powdered plant material was analyzed for heavy metal content by using ICP-OES. The plant powders were analyzed for four heavy metals Lead (Pb), Arsenic (As), Cadmium (Cd) and Mercury (Hg).

### RESULTS AND DISCUSSION

The normal range of concentrations of four metal heavy metals, Lead (Pb), Arsenic (As), Cadmium (Cd) and Mercury (Hg). in plants has been presented in TABLE 1. The results of the heavy metal analysis of the plant have been presented in TABLE 2. Arsenic, Cadmium and Mercury were not detected in stem bark of *Symplocos racemosa* Roxb. and seeds of *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell. Concentrations of Pb were within the normal range in *Symplocos racemosa* Roxb. (2.95 mg/kg) and *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (7.77 mg/kg). None of these metals were detected

in *Woodfordia fruticosa* (Linn.) Kurz.

TABLE 1 : Typical concentration of some metals in plant

Metal	Normal range in plant material $\mu\text{g g}^{-1}$ fresh weight	Concentration in contaminated plant $\mu\text{g g}^{-1}$
Copper	4 – 15	20- 100
Lead	0.1 - 10	100- 400
Mercury	0.015	-
Nickel	0.02- 5	30- 300
Zinc	3 - 100	10- 100

Note: The source of readings-Normal range<sup>[3]</sup>

TABLE 2 : Metal concentrations (ppm) in *Woodfordia fruticosa* (Linn.) Kurz (flowers), *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds)

Metal	<i>Woodfordia fruticosa</i> (Linn.) Kurz	<i>Symplocos racemosa</i> Roxb.	<i>Caesalpinia bonduc</i> (Linn.) Roxb. emend. Dandy & Exell
Lead	N.D.	2.95 mg/kg	7.77 mg/kg
Arsenic	N.D.	N.D.	N.D.
Cadmium	N.D.	N.D.	N.D.
Mercury	N.D.	N.D.	N.D.

Note: N.D.: Not detected, Detection limit: 0.625 mg/kg

Flowers of *Woodfordia fruticosa* (Linn.) Kurz. were collected from Khandala, as it is at higher altitude, comparatively less polluted and as the flowering period is short so the flowers remain on the plant for a short period and so there may be less accumulation of Pb.

Stem bark of *Symplocos racemosa* Roxb was collected from Mahabeleshwar, a high altitude region, but the stem is exposed to the pollutants for a longer time so there is more accumulation of Pb as compared to those of flowers of *Woodfordia fruticosa* (Linn.) Kurz.

Seeds of *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell were collected from Kalina University Campus. there is a heavy traffic flow in Kalina, this may be a reason of higher accumulation of lead as compared to *Woodfordia fruticosa* (Linn.) Kurz. flowers and *Symplocos racemosa* Roxb. stem bark.

The effects of Pb are the same whether it enters the body through breathing or swallowing. The main target for its toxicity is the nervous system, both in adults and children. Its long-term exposure to adults at work has resulted in decreased performance in some tests that

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measures the functions of the nervous system, weakness in fingers, wrists, or ankles. Even its exposure small increase in blood pressure, particularly in middle-aged and older people and may also cause anemia. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to Pb may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production<sup>[15]</sup>. Mercury causes serious injuries to the nervous system and developing fetus; common neurological symptoms are impairment of the peripheral vision; numbness and the loss of feeling; tingling sensations along the limbs; lack of coordination of movement; the impairment of speech, hearing, walking; muscle weakness; dramatic mood swings; memory loss; mental disturbance<sup>[16]</sup>. Arsenic is highly carcinogenic, if there is a long term exposure and at very high doses it causes immediate effects like nausea, vomiting, and diarrhea<sup>[17]</sup>. Cd is primarily toxic to the kidney Cd can also cause bone demineralization, either through direct bone damage or indirectly as a result of renal dysfunction. Cd may impair lung function and increase the risk of lung cancer<sup>[18]</sup>.

### CONCLUSION

Heavy metal analysis is a part of the guidelines suggested by WHO and AYUSH for herbal drugs as a safety measure. In the present study heavy metal content in *Woodfordia fruticosa* (Linn.) Kurz (flowers), *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds) which have estrogenic properties, and can be used against female reproductive dysfunction are analyzed. None of the heavy metals analysed were detected in *Woodfordia fruticosa* (Linn.) Kurz (flowers) where as Lead was detected within range in *Symplocos racemosa* Roxb.(stem bark), *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell (seeds). From the above study an attempt has been made to evaluate heavy metal content in herbal combination which will be made in a formulation. If there are small traces of heavy metal in plant extract, it may be absorbed by the blood and can be absorbed by tissues which may be hazardous for health. Thus heavy metal analysis can also

be used as a Quality control method which may help in selection of raw material sites. Nevertheless before finding the site of collection more number of samples of raw material and soil samples are recommended to be analyzed.

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