INTRODUCTION

Phyllanthus emblica Linn. (Euphorbiaceae) known as Indian gooseberry is a very richest source of vitamin C found in abundant amount in deciduous forest of Madhya Pradesh. It is common all over tropical and sub-tropical India. It is known as amalaka in Sanskrit, amla in Hindi, olay in Punjabi, aamla in Gujarati, nellikkai in Tamil. It has antiviral, antibacterial, anti-proliferative, anti-platelet anti-HIV-1, hypolipidamic properties. It is used as antioxidant, aphrodisiac, as chelating agent, in constipation, dental problems, diabetes, diarrhea, diuretic fevers, gonorrhea, hair growth, headache, inflammation mouth ulcers, respiratory problems, skin whitening etc. The plant leaves have the antineutrophilic activity. It reduces blood cholesterol, blood glucose as well as triglyceride levels.

Heavy metal distribution in plants is of interest because of their essential or toxic nature. For example, zinc, iron, cobalt, chromium, copper and manganese are essential, while cadmium, lead, nickel are toxic at certain levels. In past few years research of trace element distribution in medicinal plants becomes important. Trace elements are the essential for human health and they prevent several diseases. The atomic absorption spectroscopy is an important method for detection of trace elements.

Studies of Trace Metals in the Leaves of Phyllanthus emblica (L)

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ABSTRACT

The leaves of Phyllanthus emblica were digested with HNO₃ and HClO₄ (4:1) and the contents of trace elements such as Zn, Fe, Ni, Mn, Ca, Mg, Co, Cr, Cu, Cd, Pb, and As were determined by atomic absorption spectroscopy. The experimental results confirmed the presence of Ca, Fe, Zn, Mg, K, Co and Mn which is beneficial to the human body is within the limit but concentration of Ni is high. The heavy trace element which are harmful to human body i.e., Cd, As, within the limit but concentration Cu, Cr, Pb is high.

Key words: Phyllanthus emblica, Atomic absorption spectroscopy, Trace elements.
EXPERIMENTAL

Leaves of Phyllanthus emblica are picked from Agra and Mathura. For fifteen days, the samples were air dried under shade. Then powdered with the help of warming blender, 2.5gm ground dried plant leaves were place in a 250 ml conical flask, 2.5 ml concentrated HNO$_3$ was added slowly with constant shaking. The mixture was heated on a hot plate until the production of brown fumes ceases. The content of beaker was cooled and 10 ml of 70% HClO$_4$ was added. It was heated again very gently until the solution turns colorless and allowed to evaporating to a small volume. Now cooled and added double distilled water and was filtered into a 100 ml flask using Whatmann filter paper and volume was diluted with double distilled water. The total concentrations of Zn, Fe, Ni, Mn, K, Ca, Mg, Co, Cr, Cu, Cd, Pb, As etc. were analyzed by atomic absorption spectroscopy (Model: Perkin Elmer A Analyst 100)

RESULTS AND DISCUSSION

The concentration of cadmium in leaf is 0.005 ppm of Agra but it is absent in sample of Mathura. The permissible limit set by WHO is 0.2 to 0.81 ppm. Thus in Phyllanthus emblica concentration of cadmium is within limit. Cadmium is a non essential trace element. Cadmium biochemically replaces zinc and causes high blood pressure. Cd damages kidney and liver$^{16}$. Cadmium causes a disease known as Itai-Itai.

The concentration of copper is 4.625ppm in leaf sample of Agra and 6.458ppm in leaf sample of Mathura. Copper is required for some essential enzymes such as super oxide dismutase, cytochrome oxidase, lysyl oxidase, etc. Excess of copper results in dermatitis, metallic taste in the mouth, hair and skin decoloration etc. Copper$^{17}$ play role in some neurological conditions like Alzheimer's disease, Wilson's disease. In edible plants permissible limit set by FAO/WHO in 1984 was 3.00 ppm. Thus in Phyllanthus emblica copper is more than permissible limit. Sample of Mathura contains more copper in comparison to sample of Agra.

The concentration of lead in leaf sample of Agra is 22.215ppm and 25.438ppm in leaf sample of Mathura. Lead has no beneficial effects in humans. Lead exposure produces harmful effects$^{16-17}$. Lead poisoning results in anemia, headache, brain damage, chronic nephritis of kidneys. The permissible limit set by WHO is 0.1 to 10 ppm. Thus concentration of lead in Phyllanthus emblica is high.

The concentration of arsenic in leaf sample of Agra is 0.041ppm and 0.031ppm in leaf sample of Mathura. In medicinal plants concentration of arsenic recommended is less than 1.0 ppm$^{20}$. So it is within limit. Excess of arsenic causes metabolic disorder, dermatitis, lung cancer, cardiovascular and neurological effects.

<table>
<thead>
<tr>
<th>Element</th>
<th>Mean (ppm)</th>
<th>Element</th>
<th>Mean (ppm)</th>
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</thead>
<tbody>
<tr>
<td>Phyllanthus emblica (leaves) of Agra</td>
<td>Phyllanthus emblica (leaves) of Mathura</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>12.325 ppm</td>
<td>Zn</td>
<td>9.428 ppm</td>
</tr>
<tr>
<td>Fe</td>
<td>54.965 ppm</td>
<td>Fe</td>
<td>56.983 ppm</td>
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<tr>
<td>Ni</td>
<td>4.532 ppm</td>
<td>Ni</td>
<td>3.862 ppm</td>
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<tr>
<td>Mn</td>
<td>48.157 ppm</td>
<td>Mn</td>
<td>43.024 ppm</td>
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<tr>
<td>K</td>
<td>6.028 ppm</td>
<td>K</td>
<td>5.035 ppm</td>
</tr>
<tr>
<td>Ca</td>
<td>42.842 ppm</td>
<td>Ca</td>
<td>40.627 ppm</td>
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<tr>
<td>Mg</td>
<td>38.774 ppm</td>
<td>Mg</td>
<td>29.374 ppm</td>
</tr>
<tr>
<td>Co</td>
<td>0.066 ppm</td>
<td>Co</td>
<td>0.083 ppm</td>
</tr>
</tbody>
</table>
In *Phyllanthus emblica* concentration of Ni in leaf sample of Agra is 4.532ppm and 3.862ppm in leaf sample of Mathura. In 1984 FAO/WHO set permissible limit for Ni is 1.683 ppm. No limit yet been given by WHO in 2005 for Ni in medicinal plants. Ni plays an important role in the production of insulin. Nickel compounds bind a variety of enzymes, including hepatic microsomal enzymes, as well as enzymes that catalyze carbohydrate metabolism and transport of ions across membranes. Nickel was thought to be essential to plants and some domestic animals but not considered to be a metal of biological importance. But after discovery of urease (nickel enzyme) it is consider as an element of biological importance. Lungs are adversely affected by Ni and it is identified as a suspected carcinogen. Nickel can cause a skin disorder known as nickel–eczema. Thus concentration nickel in *Phyllanthus emblica* is high.

In leaf sample of Agra concentration of iron is 54.965ppm and 56.983ppm in sample of Mathura. For Fe in medicinal plants limits not yet been established by WHO in 2005. For the formation of hemoglobin iron is necessary. For the transfer of oxygen and electron transfer Fe is required in human body. Iron deficiency is the most prevalent nutritional deficiency in humans. Potassium reduces blood pressure. It is moderately toxic to mammals when injected intravenously. Thus potassium is present within limit in *Phyllanthus emblica*.

Concentration of Cr in leaf of *Phyllanthus emblica* is 11.415ppm in the sample of Agra and 12.232ppm in the sample of Mathura. The permissible limit set by FAO/WHO (1984) in edible plants was 27.4ppm. Several biological roles of zinc have been reported and over 200 proteins and enzymes contain zinc. Zn produces important role in DNA synthesis, brain development, steroidogenesis27 bone formation, wound healing28. Thus concentration of zinc is within limit.

Concentration of Ca in the sample of Agra is 42.842ppm and 40.627ppm in the sample of Mathura. Calcium is essential for all organisms, used in cell walls, bones. Calcium helps in transporting of long chain fatty acids which helps in preventing high blood pressure, heart diseases and some other cardiovascular diseases.

Concentration of Mg in the sample of Agra is 38.774ppm and in the sample of Mathura is 29.374ppm. Magnesium works with

<table>
<thead>
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<th>Table 2: harmful heavy metals</th>
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<tbody>
<tr>
<td><strong>Phyllanthus emblica (leafs) of Agra</strong></td>
</tr>
<tr>
<td>Element</td>
</tr>
<tr>
<td>Cu</td>
</tr>
<tr>
<td>Cr</td>
</tr>
<tr>
<td>Cd</td>
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<tr>
<td>Pb</td>
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<tr>
<td>As</td>
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</tbody>
</table>

by WHO (2005) for Cr. In medicinal plants, Canada set 2 ppm permissible limit in raw medicinal plant material. Thus concentration of Cr is very high.
calcium to help transmitting nerve impulse in the brain. Magnesium has calming effect and works on the nervous system of those peoples, suffering from depression. In blood its quantity is 2-4mg/100ml.

The concentration of cobalt in the sample of Agra is 0.066 ppm and in the sample of Mathura is 0.083 ppm. There is no established criteria for cobalt in medicinal plants. In turkey 0.14ppm to 0.48ppm concentration of cobalt was determined in seven herbs. Cobalt activates many metalloenzymes. Cobalt is found in Vitamin-B\textsubscript{12} and plays an important role in the synthesis of hemoglobin and DNA.

Thus on the basis of above results, it is found that Phyllanthus emblica contain useful trace elements Ca, Fe, Zn, Mg, K, Mn, Co with in limit but Ni is high. Harmful heavy metals As, Cd, are also with in limit but concentration of Cu, Cr, Pb is higher.

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