

METAL ANALYSIS OF KAMALA (*NELUMBO NUCIFERA* GAERTN.) SAMVARTIKĀ CŪRṆA AND ITS ROLE IN MŪTRAKṚCCHRA (URINARY TRACT INFECTIONS)

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ABSTRACT

Aim: To assess the Diuretic, Anti-microbial, Anti-oxidant activity with the elements present in Kamala Samvartikā Cūrṇa in Mūtrakṛcchra.

Method: ICP – OES (Inductively Coupled Plasma Optical Emission Spectrometry)

Results: ICP-OES Metal Analysis of the powdered Tender leaf of *Nelumbo nucifera* Gaertn. shows the presence of all these elements in PPM units, Sodium (1104.12), Potassium (18557.45), Calcium (7115.42), Magnesium (1065.32), Copper (5.89), Silver (21.58), Cadmium(0.98), Arsenic (7.36), Chloride (11023).

Discussion: On analysis of the above report it can be noted that the Kamala Samvartikā Cūrṇa has K^+ , Cl^- , Ca^+ in large amounts followed by Na^+ , Mg^+ , Ag^+ . Looking into the K^+ levels this Kamala Samvartikā Cūrṇa can be included in the category of K^+ sparing diuretics. The presence of Silver in the Kamala Samvartikā Cūrṇa proves the Anti bacterial activity on *E.coli* (Nees 1999). The presence of Copper will prove the drug as Anti microbial. It is also noted that copper inhibits *Bacillus* and damages respiratory chains in *E. coli* cells 99.9% (MRSA) in just 1-2 hrs. Cadmium may act on Gram+ve and Gram-ve bacteria. The presence of Arsenic in ppm will acts as Antimicrobial both Gram+ve and Gram-ve bacteria. The presence of Calcium in Kamala Samvartika Cūrṇa will help in the reabsorption of Ca^+ and improvement of Ca^+ levels in the patients. Required amount of Na^+ and Cl^- will be reabsorbrd in the tubules maintaining electrolyte imbalance. The elements like Silver, Arsenic, Chromium have Antibacterial property, Silver, Copper, Magnesium have Antioxidant and Immunomodulatory activity.

Conclusion: Thus all these elements acts as Potent Diuretic, Anti-microbial, Anti-oxidant agents.

KEYWORDS : Diuretic, Kamala, Antimicrobial, Samvartikā Cūrṇa, Antioxidant, UTI.

INTRODUCTION:

ICP – OES (Inductively Coupled Plasma Optical Emission Spectrometry) is a technique in which the composition of the composition of elements in (mostly water dissolved) samples can be determined using plasma and a spectrometer.

The ICP was developed for optical emission spectrometry (OES) by Fassel et al. At Albright and Wilson, Ltd. In the UK in the mid- 1960s. The First Commercially available ICP/OES instrument was introduced in 1974.

AIMS AND OBJECTIVES:

1. To detect the metals present in the Tender leaves of *Nelumbo nucifera* Gaertn. by ICP-OES Technique.
2. Probable Role of the metals present in Kamala Saṁvartikā Cūrṇa as Antioxidant, Antimicrobial, and Diuretic in UTI.

METHODOLOGY:

PRINCIPLE:

ICP/ OES is one of the most powerful and popular analytical tools for the determination of trace elements and heavy metals in a sample types. It is based on the optical emission spectroscopy.

The technique is based upon the spontaneous emission of photons from atoms and ions that have been excited in a radio frequency discharge. Liquid and gas samples may be injected directly into the instrument, while solid samples require extraction or acid digestion so that the analytes will be present in a solution. The sample solution is converted to an aerosol and directed into the central channel of the plasma. At its core the inductively coupled plasma (ICP) sustains a temperature of approximately 10,000 K, so the aerosol is quickly vaporized. Analyte elements are liberated as free atoms in the gaseous state. Further collisional excitation within the plasma imparts additional energy to the atoms, promoting them to excited states. Sufficient energy is often available to convert the atoms to ions and subsequently promote the ions to excited states. Both the atomic and ionic excited state species may then relax to the ground state via the emission of a photon. These photons have characteristic energies that are determined by the quantized energy level structure for the atoms or ions. Thus the wavelength of the photons can be used to identify the elements from which they originated. The total number of photons is directly proportional to the concentration of the originating element in the sample.

The Constituent elements can be identified by their characteristic emission lines and quantified by the intensity of the same lines.

- High sample throughput enabling the efficient analysis of large batches
- Simultaneous determination of multiple elements in each sample
- Complementary analysis to techniques like XRF
- Large dynamic linear range
- Low chemical and matrix interference effects

INSTRUMENTATION:

The instrumentation associated with an ICP/OES system is relatively simple. A portion of the photons emitted by the ICP is collected with a lens or a concave mirror. This focusing optic forms an image of the ICP on the entrance aperture of a wavelength selection device such as a monochromator. The particular wavelength exiting the monochromator is converted to an electrical signal by a photodetector. The signal is amplified and processed by the detector electronics, then displayed and stored by a personal computer.



Fig-1 LOTUS POND

SAMPLE PREPARATION FOR ICP-OES ANALYSIS:

- ❖ 0.2 g of Kamala Samvartikā Cūrṇam was taken in Teflon tubes and added 6.0 ml of Nitric acid and 2.0 ml of Hydrogen peroxide and allowed for 10 minutes in outside for reaction. Then samples were dissolved using Microwave Digestion System (Anton Paar Multiwave 3000). Microwave Digestion System parameters are as follows.
 - Pressure 50 bar
 - Time 90 min
 - Wattage 800
 - Temperature 240⁰C

Then Kamala Samvartikā Cūrṇam solutions were made to 25.0 ml and filtered. These solutions were used for Elemental analysis using ICP-OES instrument (Agilent 725 series). The Agilent ICP-OES instrument is used to detect and analyze trace elements via emission spectroscopy.

Table No. 1 Details of Instrumentation

Name of the Instrument	Agilent 725 ICP-OES, automated switching valve system with 4 channel sample introduction pump & mass flow control of the nebulizer.
Installed & Commissioned at	Centre for material for electronics technology (C-MET), dept. of Electronics and Information technology, March 2019.
Date of analysis	20-03-2019

TYPICAL APPLICATIONS:

- Trace metal analysis of any metal that can be digested into an aqueous matrix
- Assessment of metal ores for mass balances and process control
- Trace analysis of environmental soil and water samples

- Metal release testing of tableware

OBSERVATION AND RESULTS:

The ICP-OES analysis of Kamala Saṁvartikā Cūrṇam showed the following elements present in sample in PPM units. It was noticed that it contains

1. Sodium (1104.12)
2. Potassium (18557.45)
3. Calcium (7115.42)
4. Magnesium (1065.32)
5. Copper (5.89)
6. Silver (21.58)
7. Cadmium (0.98)
8. Arsenic (7.36)
9. Chloride (11023).

DISCUSSION:

Showing the Probable Role of the metals present in Kamala Saṁvartikā Cūrṇa as Antioxidant, Antimicrobial, and Diuretic in UTI

- **SODIUM, POTASSIUM AND CHLORIDE IONS**

DIURETICS:

Diuretics are the drugs that increase the rate of urine, low sodium excretion. Most diuretic drugs have the adverse effect on quality of life including Impotence, Fatigue and weakness, Naturally occurring Diuretics include Caffeine in coffee, tea, cola which inhibit Na^+ reabsorption and alcohol in beer, wine inhibit secretion of Antidiuretic hormone. Still there is a requirement of highly effective and less toxic Diuretics in clinical practice. *Nelumbo nucifera* Gaertn. is one such plants that have been used as a medicine for its Diuretic and Anti microbial property, Antioxidant property etc.. Since ancient times in various ailments.

The increase in the ratio of concentration of Sodium ion and Potassium ions indicate that the extract of *Nelumbo nucifera* Gaertn. increase Sodium ion excretion to a greater extent than Potassium which is an essential quality of Good Diuretic with less hyperkalemic effect. The Chloride excretion was not elevated significantly by the lower dose and the results are indicating that the extract is a potent Natriuretic. **(Diuretic activity of Methanolic seed extract of *Nelumbo nucifera* Gaertn.)**

Diuretics sometimes called Water pills help rid your body salt (Sodium) and water. Most work by making your kidneys release more Sodium into your Urine. The Sodium then takes water with it from your blood. That decreases the amount of fluid flowing through your blood vessels which reduces pressure on your vessels walls.

The amount of fluid retained by the body is controlled primarily by the kidneys. This occurs due to the kidneys ability to control the retention and elimination of Sodium and Chloride, because the amounts of Sodium, Chloride and water in the body are carefully balanced. Thus if Sodium and Chloride are eliminated from the body. Water also is eliminated conversely if Sodium and Chloride are retained by the body so is the water.

In the kidneys Sodium, Chloride and other small molecules are filtered out of the blood and into the tubules of the kidney where urine is formed. Most of the Sodium, Chloride and water are reabsorbed into the blood before the filtered fluid leaves the kidney in the form of urine. To make matters even more complex there are different parts of the tubules that affect the reabsorption of Sodium and Chloride.

It is important to note that there is a delicate balance between dietary Sodium intake and Sodium loss. If the balance is compromised and there is a greater intake of Sodium into the body but not enough removal of Sodium lead to

overload and cause Odema, Pulmonary Odema, High B.P, when there is greater removal of sodium but not enough intake of Sodium complication of fluid depletion may occur such as Renal failure or reduced output of blood from the heart.

The effect of Diuretic use on urinary chloride levels depends on the relationship of the time of urine collection to diuretic effect. It is high while the diuretic is acting, but drops to low levels afterwards, villous adenomas typically excrete bicarbonate and can cause a hyperchloraemic metabolic acidosis.

Continued use of Diuretics will cause Na^+ and Cl^- loss the body however has natural way of compensating. Diuretic are useful in odema caused by Renal dysfunction, Nephrotic syndrome, Acute glomerulonephritis, Chronic renal failure etc. Diuretic are used to remove urinary Calcium excretion, making them useful in preventing Calcium containing. January kidney stones.

Some Diuretic also called water pills decrease K^+ in the blood. Diuretics are commonly used to treat high blood pressure because they lower blood pressure by helping your body eliminate Na^+ and water through your urine, some also eliminate K^+ in the urine. This can lead to low potassium levels (Hypokalemia). Not all the diuresis cause side effects. The potassium sparing diuretics don't lower potassium levels. These include Spironolactone etc. So, increase K^+ supplements. Changing to potassium sparing diuretics. In *Nelumbo nucifera* all these ions are present in large amounts.

- **CALCIUM:**

Most of the Calcium is reabsorbed throughout the Nephron. Calcium reabsorption and urinary Calcium excretion can be effected by the administration of Diuretics. Calcium excretion is increased by loop diuretics and diminished by Thiazide type diuretics and Amiloride.

- **MAGNESIUM:**

Magnesium and Potassium sparing diuretics one of the most common and serious side effects of diuretics therapy is increased urinary loss of K^+ . Another although less well publicized side effect of Diuretic therapy is excessive urinary loss of Mg^+ . Loop blocking diuretic however cause major urinary loss of Mg^+ .

- **SILVER:**

Silver (as well as Gold) is the second most toxic metal to *E coli* (Nies, 1999). The Antibacterial activity of Silver has long been known and has been found that its toxicity to human cells is considerably lower than to bacteria. However the mechanism by which Silver kills cells are not known. It is highly toxic to Bacteria. (Nies, 1999). Information on resistance mechanism is apparently contradictory and even the chemistry of Ag^+ in such system is poorly understood. Silver binds to many cellular components with membrane components probably being more important than Nucleic acids. It is difficult to know whether strong binding reflects toxicity or detoxification. Some sensitive bacterial strains have been reported as accumulating more Silver than the co responding resistant strain in other the reverse apparently occurs. Attempts to find biochemical difference between resistant and sensitive strains have met with limited success. Such as increased cell surface hydrophobicity in a substance *Escherichia coli*. Some of the problems are due to defining conditions in which resistant can be observed Silver has been shown to bind to components of cell culture media and the presence of chloride is necessary to demonstrate resistant.²

COPPER:

Copper is an essential trace mineral necessary for survival. It is found in all body tissues and plays a role in making red blood cells and maintains nerve cells and the immune system. Copper is useful in the formation of collagen / absorb iron / energy production. Copper is found in the body in liver brain heart, kidneys, and skeletal muscles. Too little Copper can lead to Neutropenia. This is a deficiency of white blood cells or Neutrophils which fight off infection. A person with low level of Neutrophils more to get infectious diseases. Copper also have an Antioxidant property, it may help to reduce the production of free radicals which can damage cells and DNA leading to cancer and other disease / Inflammation.

UTI:

Copper is involved in protective against UPEC colonization in the urine in Urinary tract. Copper is a Natural Anti microbial agent. The Antimicrobial effect is shown by ions of Copper, Mercury, Silver, Lead, Gold, Aluminium. In 1973 researches at Battle Columbus laboratories conducted a comprehensive literature, technology and patent search that traced the history of understanding the Bacteriostatic and Sanitizing properties of Copper and Copper alloy surfaces, which demonstrated that Copper in very small quantities has the power to control a wide range of molds of fungi, algae and harmful microbes.

Copper inhibits *Bacillus*. Copper damages the respiratory chain in *E. coli* cells and is associated with impaired cellular m-etabolism Cu^{2+} (Anti microbial Copper efficacy to destroy *E.coli*, Methicillin resisant *Staphylococcus aureus* (MRSA). Recent studies have shown that Copper alloy surface kill *E.coli* over 99.9% killed just 1-2 hrs on Copper.

- **CADMIUM:**

Anti bacterial effect of Cadmium oxide nanoparticles on *Staphylococcus aureus* and *Pseudomonas aerugosa* is detected, more on *staphylococcus* stronger in Gram+ve than Gram-ve.

- **ARSENIC:**

Arsenic has been used for at least 2000 years as a Medicine, Cosmetic, Tonic or Poison. People get scare when they hear the word Arsenic because it can be toxin and carcinogen but the use of Arsenic as Anti microbial and Anti cancer agent is well established says Rosen. Arsenic resistance is very widespread amongst both Gram-ve and Gram+ve bacteria, probably reflecting the wide distribution of Arsenic in the Environment and its use as an Antimicrobial. (Silver & Phung, 2005).

CONCLUSION:

Thus, all these elements which are present in *Nelumbo nucifera* Gaertn. acts as best Diuretics³ and possess Anti microbial activity⁴ and Anti oxidant property⁵ hence plays an important role in treating Mūtrakrcchra (Urinary Tract Infections).

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