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ICP–OES Analysis of Vedigarasilasathu Parpam: Establishing Elemental Profile and Safety in Relation to UTI Management

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ABSTRACT
Urinary tract infection (UTI), known in Siddha terminology as Azhal Neerchurukku Noi, continues to be a common infectious disorder affecting a wide population and contributing to significant morbidity. The limitations of conventional antibiotics, particularly due to antimicrobial resistance, have generated interest in traditional herbo-mineral formulations for effective management. In this context, Vedigarasilasathu Parpam, a classical Siddha herbo-mineral preparation, was explored for its therapeutic potential in UTI. The drug was subjected to preliminary preclinical evaluation to establish safety and efficacy. Characterization of the formulation was carried out using Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) to identify elemental constituents and ensure safety margins. The pharmacological assessment indicated beneficial effects consistent with antimicrobial and anti-inflammatory properties relevant to UTI management. The study supports the traditional claims on Vedigarasilasathu Parpam and provides preliminary evidence for its use in urinary tract infections. Further detailed toxicological and clinical studies are warranted to validate its efficacy and safety in human populations.

Key words: Vedigarasilasathu parpam(VSP), Urinary tract infection, Siddha herbo mineral formulation, ICP-OES.

I. INTRODUCTION

Urinary tract infection (UTI) is one of the most prevalent bacterial infections worldwide, affecting both community and hospital populations. It occurs due to colonization and invasion of the urinary tract by pathogenic microorganisms, most commonly Escherichia coli. Globally, UTIs account for an estimated 150–200 million cases annually, with a higher incidence reported among women due to anatomical and physiological factors. Recurrent UTIs, antimicrobial resistance, and rising healthcare costs make this condition a major public health concern. In clinical practice, UTIs manifest with symptoms such as dysuria, frequency, urgency, suprapubic discomfort, and, in complicated cases, fever and flank pain. Standard management typically relies on antibiotic therapy, but the growing emergence of multidrug-resistant (MDR) uropathogens limits therapeutic options and increases the risk of treatment failure. This highlights the urgent need for safe, effective, and alternative treatment modalities. Traditional medical systems, including Siddha medicine, describe Azhal Neerchurukku Noi as a condition that closely correlates with urinary tract disorders characterized by burning micturition, urgency, and inflammation. Several herbo-mineral formulations have been prescribed for centuries in Siddha practice for urinary complaints. Among them, Vedigarasilasathu Parpam is a classical preparation was mentioned in Kannusamy paramparai vaithiyam(pg.no374,375) indicated for Azhal neerchurukku Noi(UTI).Scientific validation of such formulations using modern analytical tools is essential to bridge traditional knowledge with contemporary medicine. In the present study, Vedigarasilasathu Parpam was subjected to preclinical evaluation, including elemental analysis through Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES), to establish its safety profile and provide evidence for its therapeutic potential in the management of urinary tract infection.

II. MATERIALS AND METHODS

Medicine preparation: Vedigarasilasathu parpam was prepared as per siddha classical guidelines of kannusamy paramparai vaithiyam.

Purification of the raw drugs: Required raw drugs were collected from a well reputed indigenous naattu marunthukadai from kanniyakumari district, Tamilnadu. The raw drugs

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were analyzed and authenticated by PG Gunapadam at Government Siddha Medical College and Hospital, Palayamkottai - 672 002.The ingredients of the trial drug was purified according to the proper traditional procedure methods described in siddha classical literatures.

METHOD OF PREPARATION: Take purified karpoora silasathu, venkaram and vediuppu each iru palam (35gms) and grind them with chunnampu thelineer for 3 samam/day (2days), make it one villai in melugu patham and after that dryed under moonlight (ravimugam) and calcinate with 20-25 cow dungs.

ICP-OES Study of Vedigarasilasathu parpam(VSP)

Principle of ICP Optical Emission Spectrometry (ICP-OES)

ICP, abbreviation for Inductively Coupled Plasma, is one method of optical emission spectrometry. When plasma energy is given to an analysis sample from outside, the component elements (atoms) are excited. When the excited atoms return to low energy position, emission rays (spectrum rays) are released and the emission rays that correspond to the photon wavelength are measured. The element type is determined based on the position of the photon rays, and the content of each element is determined based on the rays' intensity.

To generate plasma, first, argon gas is supplied to torch coil, and high frequency electric current is applied to the work coil at the tip of the torch tube. Using the electromagnetic field created in the torch tube by the high frequency current, argon gas is ionized and plasma is generated. This plasma has high electron density and temperature (10000K) and this energy is used in the excitation-emission of the sample. Solution samples are introduced into the plasma in an atomized state through the narrow tube in the center of the torch tube.

EQUIPMENT

Equipment for ICP optical emission spectrometry consists of a light source unit, a spectrophotometer, a detector and a data processing unit. There are several types of equipment based on differences in the Spectrophotometer and the detector. The most common type is shown in Figure 1.

1) Sequential type

A spectrophotometer with a Czerny-Turner monochrometor, and a detector with a photomultiplier is most common for this type. With this equipment, programmed wavelength of the spectrophotometer is consecutively varied to measure multiple elements. This causes rather long measuring time, however, with its high-resolution spectrophotometers, it is favorable for measurement of high-matrix samples.

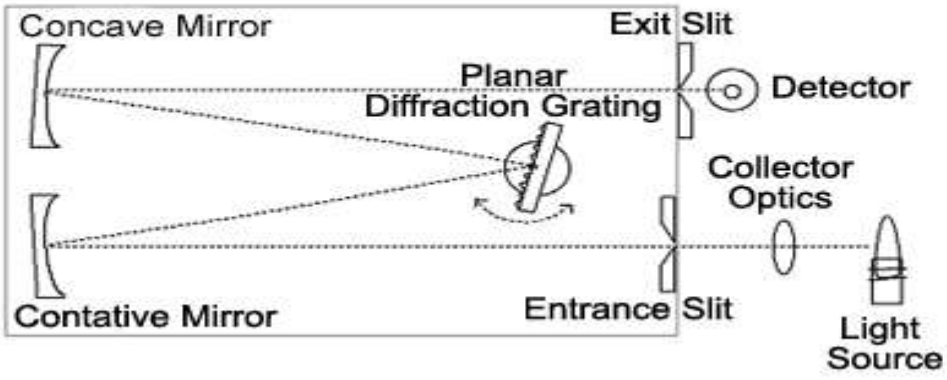

Figure 1: Sequential Type ICP-OES

2) Simultaneous Type

This type typically uses an echelle cross disperser in spectrophotometers and semi-conductor detector such as CCD for the detector. Echelle cross disperser disperses light of measurable wavelength range two-dimensionally

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by combining prism and echelle diffraction grating. Combination of echelle cross disperser and a CCD detector enables multi-element measurement at any wavelength. The most notable feature of this equipment is the high-speed measurement, providing information on all 72 measurable elements in measurements of 1 to 2 minutes normally.

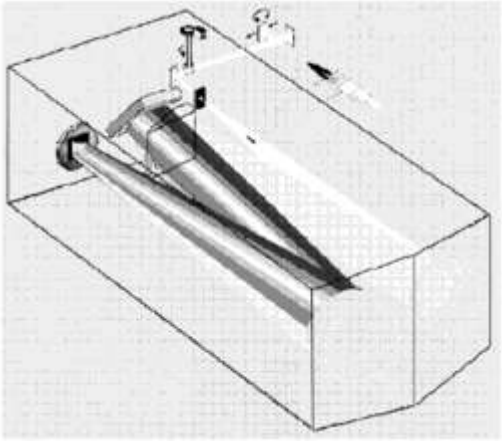

Figure 2: Simultaneous ICP-OES

VSP analysis

VSP has attracted attention because it is thought to contain a person's health history on some level and is thought to act as an excretory organ for heavy metal in the body. However, there are problems because there are few usable samples and knowledge about multiple elements is required. With simultaneous analysis equipment, we can collect useful information with a small amount of sample.

Equipment: Simultaneous ICP-OES, PERKIN ELMER OPTIMA 5300 DV

Sample: 0.5g of vsp drug is measured, and then dissolved in a decomposition vessel with nitric acid into 10ml solution. Partial spectral profile and analysis results shown below.

III. RESULTS:

ICP-OES ANALYSIS OF VSP:

V.S.PARPAM (wt:0.430130g)

As 188.979	BDL
B 249.772	540.125 mg/L
C 193.030	175.150 mg/L
Ca 315.807	201.163 mg/L
Cd 228.802	BDL
Cu 327.393	BDL
Fe 238.204	BDL
Hg 253.652	BDL
K 766.491	221.110 mg/L
Mg 285.213	BDL
Na 589.592	271.390 mg/L
Pb 220.353	BDL
P 213.617	.300 mg/L
S 180.731	301.101 mg/L
Zn 206.200	BDL

BDL-Below detection limit

IV. DISSCUSSION

Interpretation of ICP–OES Results of Vedigarasilasathu Parpam in relation to UTI

The elemental analysis of Vedigarasilasathu Parpam (weight: 0.430130 g) by Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP–OES) reveals the following:

Absence of Toxic Heavy Metals

(As), Cadmium (Cd), Mercury (Hg), Lead (Pb), Copper (Cu), Iron (Fe), Magnesium (Mg), Zinc (Zn) were below detectable limits (BDL).

This indicates the preparation is free from major toxic contaminants, supporting its safety profile for therapeutic use.

2. Presence of Beneficial Elements: Calcium (Ca) – 201.163 mg/L Plays a vital role in smooth muscle contraction and maintaining the structural integrity of urinary tract tissues. Adequate calcium may support mucosal repair during infection. **Potassium (K) – 221.110 mg/L and Sodium (Na) – 271.390 mg/L**. Both are key electrolytes regulating fluid balance and urinary output. Their presence suggests a potential diuretic action, which helps in flushing out pathogens from the urinary tract. **Sulphur (S) – 301.101 mg/L** Sulphur compounds are known to possess antimicrobial and detoxifying properties. Their presence may contribute to the traditional claims of anti-infective action in urinary disorders. **Boron (B) – 540.125 mg/L.** Boron is reported to have antioxidant, anti-inflammatory, and antimicrobial effects. This element could support host defense against uropathogens and reduce inflammation in the urinary tract. **Carbon (C) – 175.150 mg/L** Suggests the presence of organic moieties in the formulation, possibly indicating stability of the parpam matrix and contribution to biocompatibility. **Phosphorus (P) – 1.300 mg/L** Plays a role in energy metabolism (ATP) and may indirectly support cellular recovery during infection.

Clinical Relevance for UTI The electrolyte balance (Na, K, Ca) supports diuresis, which is beneficial in reducing bacterial load in

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UTIs.Sulphur and Boron provide antimicrobial and anti-inflammatory actions, which correlate with symptom relief (burning micturition, urgency, dysuria). The absence of toxic heavy metals makes the formulation relatively safe for internal use.

V. CONCLUSION

The ICP–OES analysis of Vedigarasilasathu Parpam demonstrates the absence of toxic metals and the presence of essential trace elements with pharmacological relevance. The diuretic, antimicrobial, and anti-inflammatory potentials supported by its elemental composition provide a scientific rationale for its traditional use in Azhal Neerchurukku Noi (UTI). These findings strengthen the evidence base for the safe application of Siddha herbo-mineral formulations in urinary tract infections.

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