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Research Article

Instrumental Analysis of Siddha Antidote Surai Karuppu

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ABSTRACT

Background: *Lagenaria siceraria* (Mol.) Standl., commonly known as bottle gourd, is a medicinal plant from the Cucurbitaceae family with established therapeutic potential. In Siddha medicine, purified Lagenaria siceraria rind is traditionally used as an antidote for mercury poisoning, particularly targeting renal manifestations. Surai Karuppu, prepared by charring the dry shell of bottle gourd into activated charcoal, is believed to act on renal cells and exhibit therapeutic efficacy in treating chronic kidney disease and uremic toxins. **Objectives:** This study aimed to assess the functional groups and particle characteristics of Surai Karuppu using instrumental analysis to provide scientific evidence supporting its traditional therapeutic claims. **Materials and Methods:** Surai Karuppu was prepared by burning dry bottle gourd shell to activated charcoal. Fourier Transform Infrared (FT-IR) spectroscopy was performed using a BRUKER Optik GmbH TENSOR 27 spectrometer in the range of 4000-400 cm^{-1}. Scanning Electron Microscopy (SEM) analysis was conducted using CARL ZEISS microscope at 20k magnification to evaluate morphological characteristics and particle size. **Results:** FT-IR analysis revealed characteristic absorption bands at 3428 cm^{-1} (O-H stretching), 2929 cm^{-1} (C-H stretching), 1744 cm^{-1} (C=O stretching), and bands at 1618, 1370, and 1047 cm^{-1} indicating presence of phenolic compounds, alkanes, carbonyl groups, alcohols, and ethers. SEM images showed well-aggregated nanoflakes-like morphology with smooth surface and average particle size ranging 4-5.5 µm. **Conclusion:** Instrumental analysis confirmed the presence of functional groups crucial for therapeutic activity, supporting the traditional use of Surai Karuppu as an antidote with potential antioxidant properties.

Key words: Surai Karuppu, SEM, FTIR, Mercury Antidote.

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INTRODUCTION

Lagenaria siceraria (Mol.) Standl. From Cucurbitaceae family is a medicinal plant whose diverse sections have been identified for their therapeutic potential.[1] Bottle gourd *Lagenaria siceraria* (Mol.) Standl also known as Bottle gourd is valued in traditional and modern medicine for its many health benefits. It exhibits various pharmacological potency including anti-inflammatory, antioxidant, antidiabetic, hepatoprotective, and wound-healing effects.[1] The fruit is known to be nutritionally and pharmacologically rich, containing a variety of compounds such as vitamins (including vitamin C and members of the B-complex group), triterpenes, minerals, choline, amino acids, cucurbitacins (notably B, D, H, G, and their 22-deoxy derivative), enzymes like β-glycosidase-elasterase, flavonoids, sterols, and carbohydrates. In addition, studies have identified the presence of bitter cucurbitacins typical of the Cucurbitaceae family, flavone-C glycosides with ribosome-inactivating activity, sterols such as fucosterol and campesterol, the terpene byonolic acid, which is reported to cause allergic responses, and the protein lagenin.[2]

Traditionally, Purified *Lagenaria siceraria* (Mol.) Standl. Rind is used in the treatment of mercury poisoning. Mercury toxicity is commonly associated with renal manifestations such as edema, altered urine output, proteinuria, and, in some cases nephrotic syndrome, along with characteristic clinical features including irritability, gingival inflammation, and tremors.[3] It is believed that the purified *Lagenaria siceraria* (Mol.) Standl. Acts on the renal cells and exhibit the efficacy. Even though the drug is being traditionally used, there is a lack of evidence in supporting the claim. Thus, this article aims to assess the functional group and particle size of the drug.[4]

MATERIALS AND METHODS

Source of sample

The medicine Surai Karuppu was purchased from Abdullah Sahib Pharmaceuticals.

Ingredients

Dry shell of bottle gourd (*surai oodu*) - 100%.

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Method of preparation

The dry shell of bottle guard was burn to activated charcoal.

Methodology

FT-IR

FT-IR analysis was carried out using a BRUKER Optik GmbH TENSOR 27 spectrometer equipped with OPUS version 6.5 software. Spectra were recorded in the range of 4000-400 cm^{-1} with a resolution of 4 cm^{-1}, using 64 scans each for the sample and background. The instrument was configured with a MIR source, Ge-coated KBr beam splitter, 6 mm aperture, and RT DLaTGS detector, covering a spectral range of 370-7500 cm^{-1} at a spectral resolution of 0.125 cm^{-1}. Data acquisition employed an interferogram size of 14,220 points and FT size of 16K, with scanner velocity set at 10 kHz and automatic signal gain adjustment. The resulting spectra were obtained in transmittance mode and processed using automatic baseline correction, 25-point smoothing, and normalization.[5]

SEM

In Scanning Electron Microscopy (SEM), accelerated electrons interact with the sample, releasing their kinetic energy as various signals such as secondary electrons, backscattered electrons, X-rays, visible light, and heat. Secondary electrons are mainly used to reveal surface morphology and topography, while backscattered electrons highlight compositional differences in multiphase samples. Characteristic X-rays are generated through inelastic collisions when excited electrons return to lower energy states, providing element-specific information for analysis. Since SEM is essentially non-destructive, repeated examinations of the same material can be carried out without loss of sample volume.[6]

RESULTS

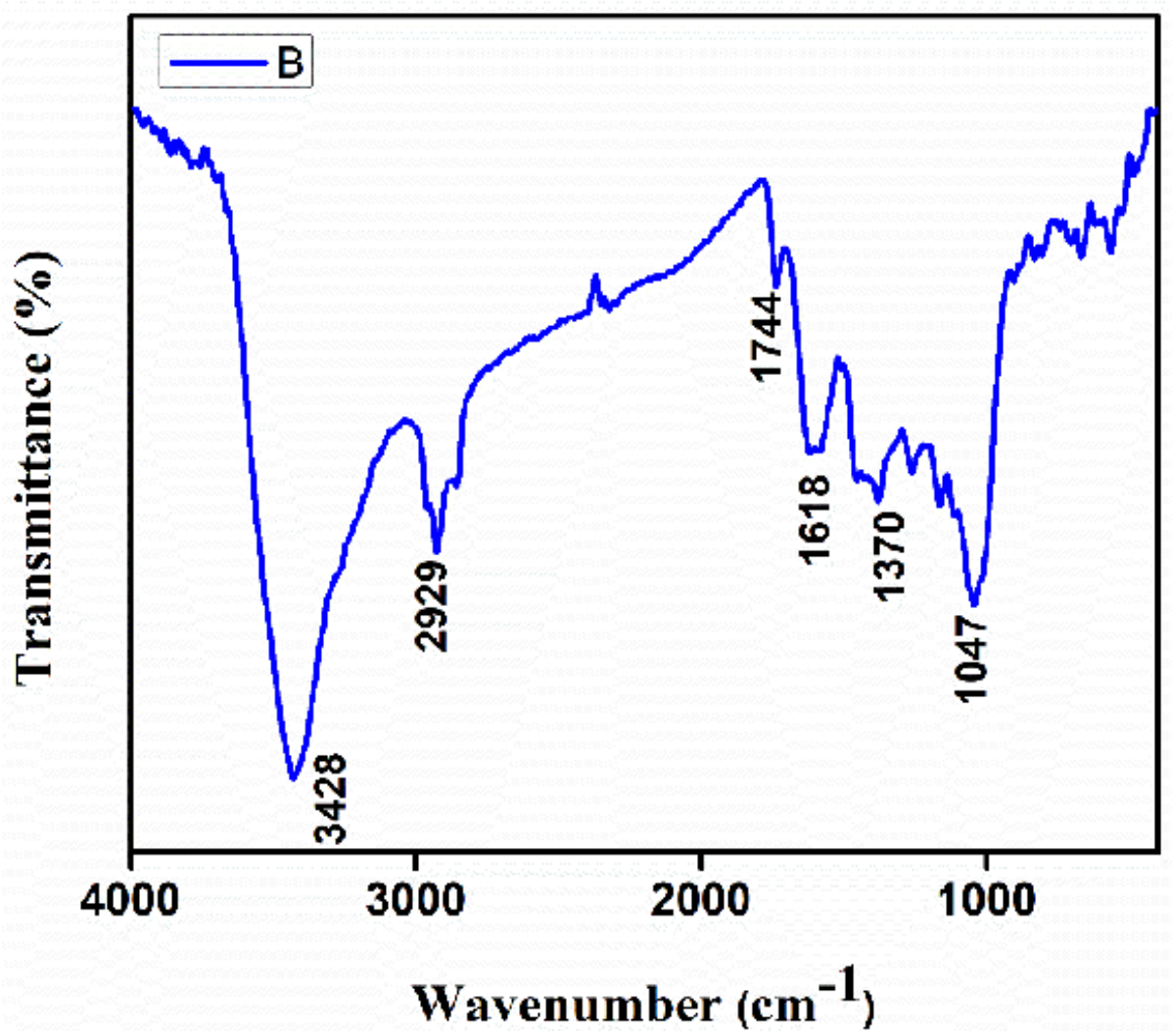

Figure 1: FT-IR Spectrum of Surai Karuppu.

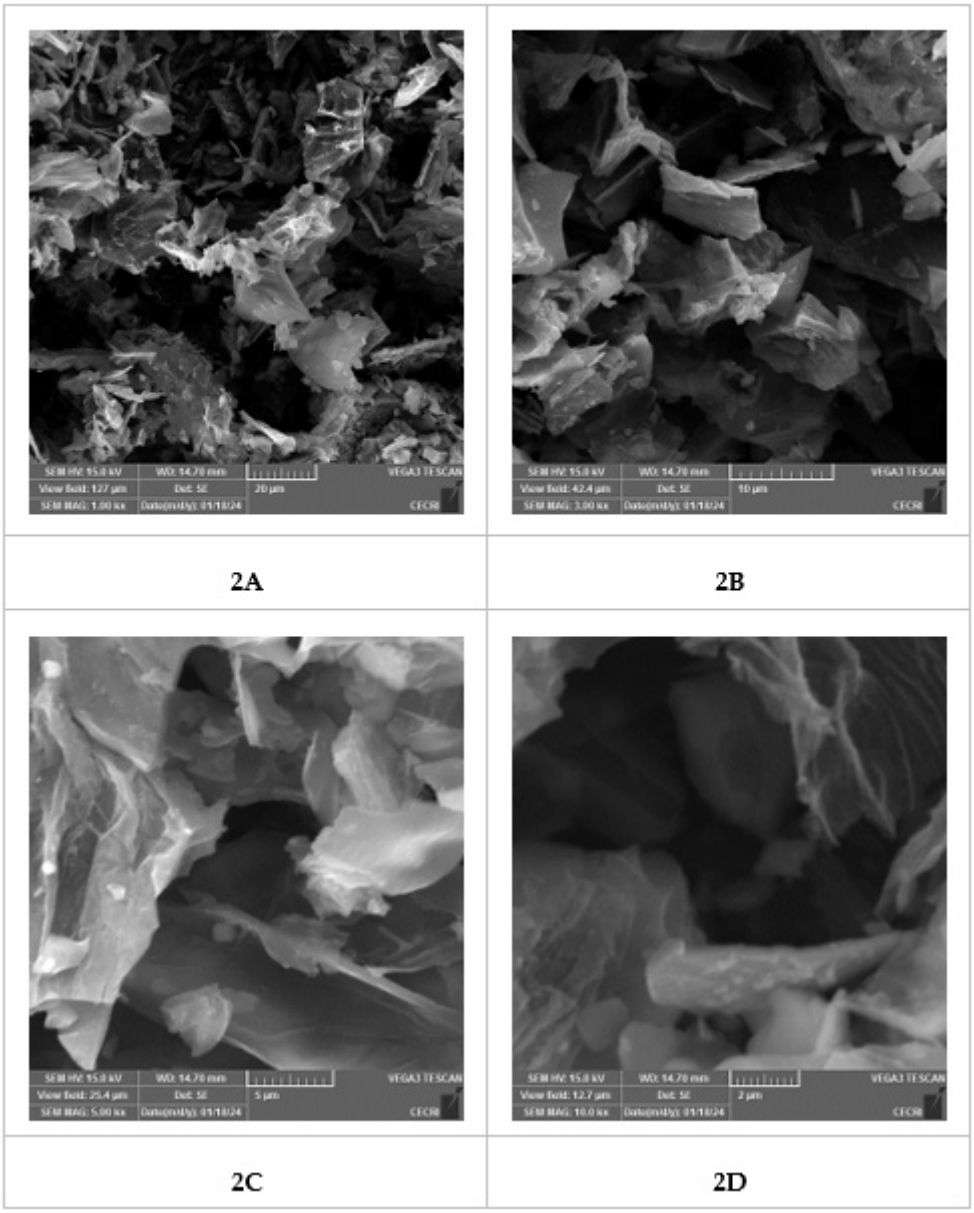

Figure 2: Sem Analysis of Surai Karuppu.

DISCUSSION

Chronic Kidney Disease (CKD) is a long-term, irreversible condition in which the kidneys progressively lose their ability to regulate metabolism, fluids, and electrolytes, leading to complications such as uremia or azotemia. It involves permanent structural injury to the nephrons and is clinically defined by persistent abnormalities in albumin excretion or a reduction in Glomerular Filtration Rate (GFR) lasting for at least three months.[7] Previous study showed that oral activated charcoal has proven to reduce uremic toxins.[8] According to literature, *Surai* has bitter taste with cold potency.[9] According to the siddha taste philosophy, bitter taste purifies blood removing toxins.[10] *Surai* contains some toxic compounds which is to be purified before use.[11] *Surai Karuppu* is charred and made as carbon (charcoal) which is activated in mixing with sour buttermilk.[12] Thus, this will act as activated charcoal and help in relieving renal diseases. Thus, it was preliminarily assessed for functional group and particle size using FT-IR and SEM analysis.

FTIR spectroscopy is a powerful analytical tool that rapidly captures detailed infrared spectra of solids, liquids, and gases, providing valuable insights into molecular structure and composition. FT-IR spectrum analysis of *Surai Karuppu* showed various absorption bands representing the presence of various functional groups with their respective modes of vibrations in the prepared *Surai Karuppu*. From Figure1, the broad peak centered at 3428 cm^{-1} indicates the presence of O-H stretching vibrations, indicating the presence of phenolic compounds. The peak at 2929 cm^{-1} belongs to C-H stretching vibration,

representing the presence of Alkanes. The peak at 1744 cm^{-1} belongs to C=O stretching vibration representing the presence of Carbonyl groups. Further, the band appears at 1618, 1370, and 1047 cm^{-1} is attributed to the C=C stretching, C-H bending, and C-O-C stretching vibrations respectively suggesting the presence of alcohols and ethers. From this study, the presence of phenolic compounds, Alkanes and carbonyl groups indicates the antioxidant potential of the drug.[13]

The morphology of the prepared SK was visualized in Figures 2A-D by using CARL ZEISS Scanning Electron Microscope at 20k magnification. From Figure 2, the SEM images of *Surai Karuppu* show the formation of well-aggregated nanoflakes like morphology with smooth surface. The average size of the particle was in the range 4 to 5.5 µm.

CONCLUSION

Instrumental analysis via FT-IR and SEM confirms functional groups crucial for therapeutic activity and the particle, necessitating additional studies to validate efficacy and safety through rigorous standardization, facilitating the identification of active constituents.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization: CY; Medicine Preparation, Data collection and compilation, Manuscript Writing: CY, RV, KA; Proofreading and editing: CY, RV, KA, PS, RM.

ABBREVIATIONS

FT-IR: Fourier Transform Infrared Spectroscopy; **CKD:** Chronic Kidney Disease; **GFR:** Glomerular Filteration Rate; **SEM:** Scanning Electron Microscopy.

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