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RESEARCH ARTICLE

Chemical Characterization of Siddha Herbo Mineral Drug Kirubakara Shanmuga Chenduram

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ABSTRACT

Alchemy plays a predominant role in siddha medicine. Mercury used in siddha medicine are completely converted into inert compounds or ores i.e Bashmas or Chenduram. Since present drug Kirubakara Shanmuga Chenduram (KSC) contains mostly mercurial compounds such as mercury metal-rasam, mercuric chloride-veeram, mercuric subchloride-pooram, red sulphide of mercury-lingam, padanams like arsenic, sulphur. The present study evaluated the physicochemical properties of KSC by sophisticated analytical instruments like FTIR, ICP OES, SEM, XRF. In FTIR analysis C-H stretching and bend, C-O stretching, O-H stretching, C-Br stretching were found as functional groups. In ICP OES the heavy elements like lead, cadmium, arsenic was found in BDL and mercury was found in 0.317 ppm. In SEM analysis the nano particle size of KSC ranges from 50 to 100nm reveals its better absorption and fast action in the body. The XRF analysis showed the absence of mercurial compounds and presence of oxide forms of Fe, Ca, S. The above analysis proves KSC as the safe drug for long term usage for chronic diseases.

KEYWORDS

Siddha, Kirubakara Shanmuga Chenduram, FTIR, ICP-OES, SEM, XRF

INTRODUCTION

Siddha system of medicine is one of the most antiquated traditional medicine systems. Siddha system activates and strengthens the inner sources of the body. Though natural system of medicine dealt mostly with herbal drugs, siddha is essentially elemental in nature. It is based on five elements. Every created and evolved matter in the world being it an animal, plant or mineral falls under this category.

The body should be preserved from decomposing by materials that should not decompose easily.

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So the siddhars used metallic preparations apart from herbs. They convert the inorganic substances into atomic and ionic form which can be easily absorbed by the body when it is ground with herbal juices and put on fire. It exerts only therapeutic properties without leaving metallic traces.

Since Kirubakara shanmuga chenduram (KSC) is a sasthric preparation being in use still today practice. This preparation of KSC contains 7 purified inorganic compounds such as vaalai rasam (mercury), lingam (cinnabar), veeram (hydrargyrum per chloride), pooram (calomel), thalagam (arsenic trisulphide), gandhagam (sulphur), two herbals and common salt (Nacl).[1]

Standardization of herbo-mineral drug KSC is essential to assess the purity and safety of the drug. The scientific study on Siddha medicines to validate these chemical properties seems to be very minimal. Hence an attempt was taken to establish the chemical characterization of the KSC by using modern techniques.

MATERIAL AND METHODS

Procurement and Authentication of Raw Drugs

Raw drugs were collected from raw drug store in Chennai. Identified and authenticated from the department of Pharmacognosy in Siddha Central Research Institute, Chennai.

Ingredients of KSC

Vaalai Rasam (Mercury) - 1 palam(35 gm),

Purified Lingam (Cinnabar) - 1 palam (35 gm),

Purified Veeram(Hydrargyrum per chloride)- 1palam (35 gm),

Purified Pooram (Calomel) - 1 palam (35 gm),

Purified Thalagam (Arsenic trisulphide) - 1 palam (35 gm),

Purified Gandhagam (Sulphur)- 1 palam (35 gm),

Purified Manosilai (Arsenic disulphide)-1/4 palam (8.75 gm)

Betle leaf juice (Piper beetle) - Required amount

Common salt (Nacl) - Required amount

Pirandai(Cissus quadrangularis) - Required amount

Preparation of the Drug

The raw drugs were purified as per gunapadam thathu vagupu text and prepared sasthrically according to the text Pathartha guna vilakkam (thathu vadupu) as mentioned with the therapeutic dose of 202 mg twice daily with the adjuvant honey[1,2].

The above fore mentioned drugs except vaalai rasam and gandhagam were ground in kalvam. Gandhagam was made like paste by grinding it with bettle leaf juice and it was applied on the inner surface of an earthern vessel and its lid, then dried. Inside this ¾ of the above ground drugs were added and in its centre a small pit was made and vaalai rasam was poured into it and again remaining ground drugs were added and sealed seven times with mud cloth.

Then take two padi (2.6 lit) common salt and ten palam(350 gm) of pirandai and both were mixed and this mixture taken in a mud pot up to three finger depth and above prepared earthern vessel was kept and remaining mixture was spreaded over it. The mouth of the mud pot was closed with suitable lid and sealed it with cloth and dried. Then it was burnt for one samam (three hours) as deepakini (mild fire), one samam as kamalakini (moderate fire), two samam (six hours) with katakini (severe fire) and bring cooled the final product was seen under the mud pot as melted form in red colour. This is drained and kept in a glass container.

FTIR Analysis

Fourier transform - Infra red (FTIR) spectroscopy study was carried out in SAIF, IIT Madras. A small amount (2-4mg) of KSC sample was mixed with 7 drops of distilled water. After dilution, the solution was taken in a small test tube and transferred this solution with a pipette into the IR plates[3].

ICP-OES Analysis

The ICP- OES study done at SAIF, IIT Madras using Perkin Elmer Optima 5300 DV. Sample was prepared by weight of 0.25 gm of KSC and 9 ml of sulphuric acid was slowly added and mixed thoroughly. Allow it to react for few minutes. Quantitative analysis was achieved by measuring the intensity of specific wavelength and after performing the calibration using known standards[4,5].

SEM Analysis

Evaluation of topography (surface features), morphology (shape and size of the particles)[7 of KSC done by SEM at SAIF, IIT Madras. A small quantity of the KSC was sprinkled on a carbon tape mounted on a stub and sputter coated with gold for best images and to avoid charging of instances, in order to get a higher quality secondary electron image for SEM examination[6].

XRF Analysis

XRF (X-Ray Fluorescence Spectroscopy) analysis of KSC was done at Sastra University, Tanjore, Tamilnadu. X-ray fluorescence was used to determine the chemical elements both qualitatively and quantitatively by measuring their characteristic radiation of the sample. The sample holder was filled with 2gm of boric acid and 1 gm of the KSC was topped over it for achieving better accuracy and precision. This was pelletized by a 25-tonne hydraulic press to achieve 34 mm diameter pellets[6].

RESULTS AND DISCUSSION

FTIR

FTIR analysis results in absorption spectra which provide information about the functional group and molecular structure of the drug KSC. The results showed in Table 1 and Figure 1 shown the presence of functional groups.

Table 1: FTIR Result of KSC

Frequency	Bond	Compounds
3413	O–H stretch, H–bonded	alcohols, phenols
2920	O–H stretch C–H stretch	carboxylic acids alkanes
2131	–C≡C– stretch	alkynes
1621	N–H bend	1° amines
1437	C–C stretch (in–ring)	aromatics
1152	C–O stretch C–H wag (–CH_2X) C–N stretch	Alcohols, carboxylic acids, esters, ethers. alkyl halides aliphatic amines
676	=C–H bend –C≡C–H: C–H bend	Alkenes alkynes
594	C–Br stretch	alkyl halides
474	S-S, Disulfide	-

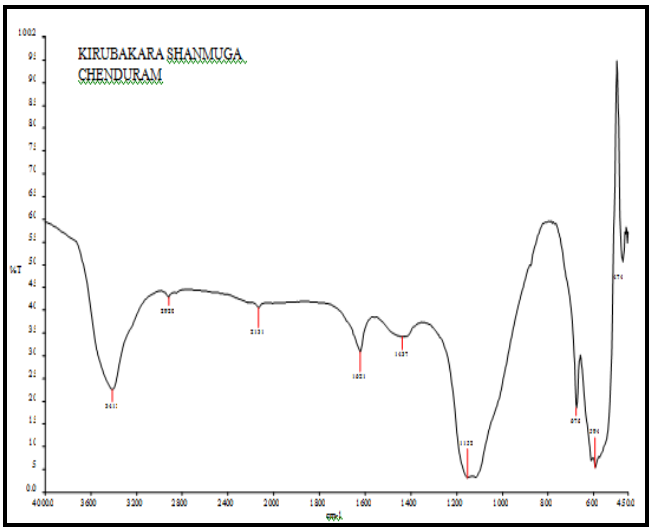

Figure 1: FTIR Image of KSC

The FTIR spectrum of graph shows alcohols, phenols, carboxylic acids, alkanes, alkynes, 1° amines, aromatics, esters, ethers, alkyl halides, aliphatic amines, alkenes, disulfides as functional groups in Kirubakara Shanmuga Chenduram[7].

ICP-OES

The drug KSC sample was analyzed by the Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) to detect the trace elements and other elements quantitatively. It contains the presence of mercury in ppm and arsenic, cadmium, lead were present in below detectable limit showed in Table 2.

Table 2: Heavy Metals Analysis of KSC by ICP-OES

S.No.	Elements (Inorganic Compounds)	Wave Length (nm)	Observation (KSC)
1	Arsenic (As)	193.696	BDL
2	Calcium (Ca)	317.933	8.99 mg/L
3	Cadmium (Cd)	226.502	BDL
4	Mercury (Hg)	253.652	0.317 ppm
5	Phosphorus (P)	214.914	7.44 mg/L
6	Lead (Pb)	230.204	BDL

SEM

The particle size was assessed by SEM. SEM analysis is one of the most widely used instruments in quantitative analysis. The SEM picture of KSC showed in the Figure 2 below.

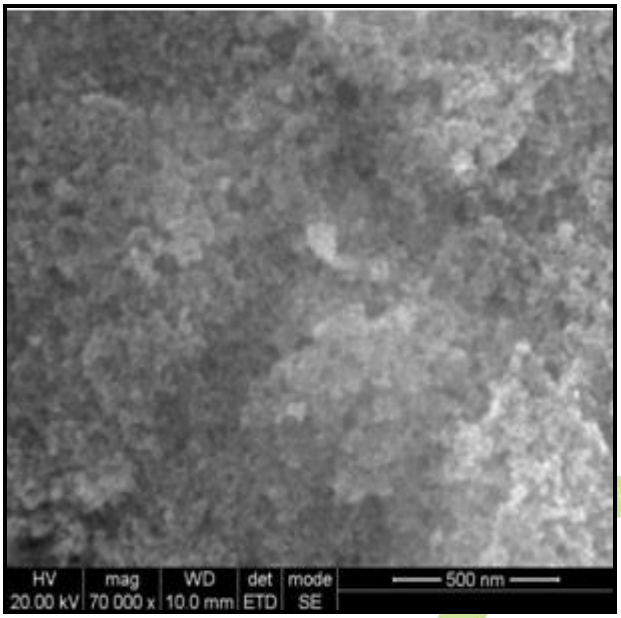

Figure 2: SEM picture shows nano particles in KSC

Distribution : Overall Distributed

Shape : Mixed (Rectangle and Spherical)

Size : 50 to 100 nm

Surface : Smooth

Flowability : Normal

SEM analysis picture showed the presence of nano particles in KSC. The particle size of Kirubakara Shanmuga Chenduram was 50 to 100 nm, mixed (Rectangle and Spherical) in shape. The extremely small size of nano particles allow them to penetrate the cells and interact with cellular molecules[8]. Surface was found smooth so the flowability was normal. The pH level was 8.9 to 9.1. It reveals the foremost preparation of the medicine KSC was done as per literature.

XRF (X-RAY Fluorescence Spectroscopy)

XRF results of KSC shown in Table 3 below. The table showed the majority of the elements in oxide form and Cl in elemental form which is in minimal amount.

Table 3: XRF results of KSC

S. No.	Formula	Z	Concentration
1	Fe_2O_3	26	62.96 %
2	SO_3	16	18.44 %
3	CaO	20	13.76 %
4	MgO	12	2.04 %
5	SiO_2	14	0.89 %
6	$Al2O_3$	13	0.39 %
7	MnO	25	0.38 %
8	P_2O_5	15	0.35 %
9	Na_2O	11	0.26 %
10	Cl	17	0.14 %
11	SrO	38	0.10 %
12	K_2O	19	0.10 %
13	Cr_2O_3	24	0.07 %
14	NiO	28	0.03 %
15	V_2O_5	23	0.03 %
16	TiO_2	22	0.03 %
17	As_2O_3	33	0.01 %

XRF study has shown the presence of Fe_2O_3. KSC contains elements of CaO, SO_3, MgO, SiO_2, $Al2O_3$, MnO, P_2O_5, Na_2O, Cl, SrO, K_2O, Cr_2O_3, NiO, V_2O_5, TiO_2, As_2O_3. All the metallic forms of elements are converted into its oxide form by the heating process. The macro particle size of KSC by heating process was converted into its oxide form which shows there was no existence of natural raw material. Since KSC contains mostly mercury and mercurial salts, the XRF reveals the non existence of mercury indicates the long term usage of the drug for chronic

diseases. The presence of oxide forms of iron, calcium, sulphur and other element elevates its therapeutic value.

CONCLUSION

In the present study it is concluded that the chemical characteristics of KSC viewed through sophisticated instruments like FTIR, ICP-OES, SEM, XRF. The FTIR spectrum of graph shows the presence of functional groups like alcohols, phenols, carboxylic acids, alkanes, alkynes, 1°amines, aromatics, esters, ethers, alkylhalides, aliphatic amines, alkenes, disulphides in KSC reveals its easy bioavailability. In ICP-OES the heavy metals like arsenic, cadmium, and lead were found in below detectable limits and mercury also was found in permissible limit, which proves the ingredients of KSC were purified and prepared as per the sasthric text.

The SEM analysis showed the particle size ranges from 50 to 100nm which proves the minimal dose of KSC can treat many chronic and threatful diseases. XRF study shows the absence of heavy elements and biologically important elements were found in oxide form like Fe_2O_3, SO3, CaO and other elements were found only in minimal level. It is concluded that KSC by proper purification and preparation as per the literature and chemical evaluation shows KSC with least toxicity, minimal dose level and easy bio availability make it a therapeutically efficient medicine to treat many challenging and chronic diseases.

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