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**Research Article**



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**Physicochemical characterization and instrumental  
analysis of Kusta kaja kesari, A siddha formulation**

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**Abstract**

Siddha formulations are gaining popularity worldwide due to its nano medicine form, increased bioavailability, minimal side effect, longer shelf life period and need less dosage. Till date, lesser studies have been conducted on standardization of such preparations. The aim of the present study was to standardize the physico-chemical traits of the kusta kaja kesari, a Siddha traditional drug for treating diabetes mellitus, skin diseases so as to attain maximum benefit to the mankind. Kusta kaja kesari, a traditional Siddha drug was prepared as per the procedure mentioned in Siddha literature. The physico-chemical characters like as loss on drying, total ash, acid insoluble ash, water soluble ash, alcohol and water soluble extractives were analyzed. The particle size and chemical elements of both quantitative and qualitative analysis of kusta kaja kesari were assessed by Scanning Electron Microscope with Energy Dispersive X-Ray Analysis (SEM & EDAX). The SEM image of kusta kaja kesari has nano particles denoting a better bio-availability. This is a base line study and it will be a reference data. Further studies need to be carried out to ascertain its pharmacological aspect of the medicine.

**Keywords:** Siddha drug, kusta kaja kesari, SEM, EDAX.

**Introduction**

In Siddha the diseases of mankind are classified into 4448 types on the basis of Mukkutram. According to Siddha system of medicine health is defined as the state of physical, psychological, social and spiritual component of a human being<sup>(1)</sup>. Metallo herbal drugs have been used in the treatment of various infectious diseases by the Indian System of Medicine as minerals and metals play a vital role in the human metabolism. The process of preparation of the medicinal formulations generally involves, plants and

minerals and several alchemical operations like calcinations, sublimation, distillation, fusion, fermentation, etc, in an eco-friendly environment. Such medicines which contain metals like mercury, silver, arsenic, tin, lead, sulphur, gold can treat effectively all types of infectious diseases and chronic ailments in small dosages without side effects. Most of the medicines are prepared by the trituration of the metals with herbal juices to bring down the metal toxicity and particle size in such a way that there is a balance of micro and nano size so as to increase the bioavailability to the human system<sup>(2)</sup>.

Many herbal and metallic formulations were mentioned in siddha literatures. Standardization of metallic formulation is essential to assess the safety and purity of the drug. The scientific study on Siddha medicines to validate these properties seems to be very minimal. WHO and AYUSH have suggested certain guidelines to be followed during the standardisation procedures. Kusta kaja kesari, Siddha formulation, is widely used for the treatment of megam and skin diseases. In this study an attempt was made to furnish physico-chemical analysis and instrumental analysis with a notion of standardizing the drug kusta kaja kesari in such a way this would be a further reference for any analytical studies.

## Materials and Methods

### Preparation of kusta kaja kesari:

The Siddha classical medicine kusta kaja kesari was procured from IMCOPS (The Indian Medical Practitioner's Co-operative Pharmacy & Stores Ltd.). The drug was prepared by the method mentioned in the text Siddha Vaidhya Thirattu. The ingredients of kusta kaja kesari are Abraga parpam, Kaantha chenduram, Aya chenduram, Rasa parpam, Savuri pazha juice. The above drugs are ground with savuri pazha juice to a rolling consistency. After grinding to a soft consistency of soft pill, it was rolled as pills of 45 mg (payaralavu) and allowed to dry.

### Physicochemical Evaluation:

The drug kusta kaja kesari was subjected for the physicochemical parameters such as loss on drying, total ash, acid insoluble ash, water soluble ash, alcohol and water soluble extractives were evaluated as per the guidelines.

#### 1. Loss on Drying:

An accurately weighed 2g of *kusta kaja kesari* formulation was taken in a tarred glass bottle. The crude drug was heated at 105<sup>0</sup>C for 6 hours in an oven till a constant weight. Percentage moisture content of the sample was calculated with reference to the shade dried material.

#### 2. Determination of total ash:

Weighed accurately 2g of *kusta kaja kesari* formulation was added in crucible at a temperature 600<sup>0</sup>C in a muffle furnace till carbon free ash was obtained. It was calculated with reference to the air dried drug.

#### 3. Determination of acid insoluble ash:

Ash above obtained, was boiled for 5min with 25ml of 1M Hydrochloric acid and filtered using an ash less filter paper. Insoluble matter retained on filter paper was washed with hot water and filter paper was burnt to a constant weight in a muffle furnace. The percentage of acid insoluble as was calculated with reference to the air dried drug.

#### 4. Determination of water soluble ash:

Total ash 1g was boiled for 5min with 25ml water and insoluble matter collected on an ash less filter paper was washed with hot water and ignited for 15min at a temperature not exceeding 450<sup>0</sup>C in a muffle furnace. The amount of soluble ash is determined by drying the filtrate.

#### 5. Determination of water soluble Extractive:

5gm of air dried drug, coarsely powered *kustakaja kesari* was macerated with 100ml of distilled water in a closed flask for twenty-four hours shaking frequently. Solution was filtered and 25 ml of filtrated was evaporated in a tarred flat bottom shallow dish, further dried at 100<sup>0</sup> C and weighted. The percentage of water soluble extractive was calculated with reference to the air dried drugs.

#### 6. Determination of alcohol soluble extractive:

2.5gm. of air dried drugs; coarsely powdered *kusta kaja kesari* was macerated with 50 ml. alcohol in closed flask for 24 hrs. With frequent shaking it was filtered rapidly taking precaution against loss of alcohol. 10ml of filtrate was then evaporated in a tarred flat bottom shallow dish, dried at 100<sup>0</sup>C and weighted. The percentage of alcohol soluble extractive was calculated with reference to air dried drug.

### Characterization study:

#### Scanning Electron Microscope Analysis (SEM):

SEM analysis was done mainly to study the morphology of the grains and the crystalline structure and arrangement of the particles. It was carried out at a magnification range of 12 X to 1,00,000X using S-3400n SEM-Hitachi at CECRI, Karaikudi. A focused beam of high energy electrons is allowed to pass to generate signals at the surface of the sample drug. The signals derived from the interactions between the sample and electrons produce an image on the screen showing the details including external morphology (texture), chemical composition, and crystalline structure and orientation of materials making up the sample.

The micrographs obtained from this analysis gave enough data about the topography of the sample<sup>(3)</sup>. The KKK sample was subjected to SEM analysis and the angle was measured from this angle, the size of the particles was calculated (Figure 1,2,3,4).

### Energy Dispersive X-ray Analysis (EDAX):

The SEM instrument equipped with EDAX enabled the instrument to perform compositional analysis of the sample kusta kaja kesari. Energy-dispersive X-Ray spectroscopy (EDAX) is an analytical technique used for the elemental analysis of a sample. It relies on an

interaction of source of X ray excitation and a sample. Its characterization capabilities are that each element has a unique atomic structure allowing unique set of peaks on its X-ray emission spectrum. To stimulate the emission of characteristic X-rays from a specimen, a high-energy beam of charged particles such as beam of X-rays, is focused into the sample being studied. The number and energy of the X-rays emitted from a specimen can be measured by an energy-dispersive spectrometer. Elemental composition of the kusta kaja kesari can be found out (Table 1).

## Results and Discussion

### Physico chemical analysis:

s.no	Parameters	Percentage
1	Loss on drying	1.92%
2	Total ash value	66.15%
3	Acid insoluble ash	51.01%
4	Water soluble ash	1.19%
5	Water soluble extraction	9.7%
6	Alcohol soluble extraction	8.1%

The above stated physiochemical properties for the given sample certified to be present.

### Characterization study:

#### Scanning electron microscope (SEM):

Particle size of KKK was carried out in Scanning Electron Microscope (SEM). SEM analysis of the drug kusta kaja kesari revealed the presence of nano and near nano particles of size 127 µm, 42.4 µm, 25.4 µm

and 254 µm. The results obtained from the SEM analysis shows that most of the particles present in kustakaja kesari are in nano and micro sized particles. The extremely small size of nano particles allow them to penetrate the cells and interact with cellular molecules. As the particle is in nano size, a low dose of the drug is more enough to treat diseases. Hence the kustakaja kesari, which is prepared biologically, contains nano particles enhancing fast pharmacological action at target sites<sup>(6)</sup>.

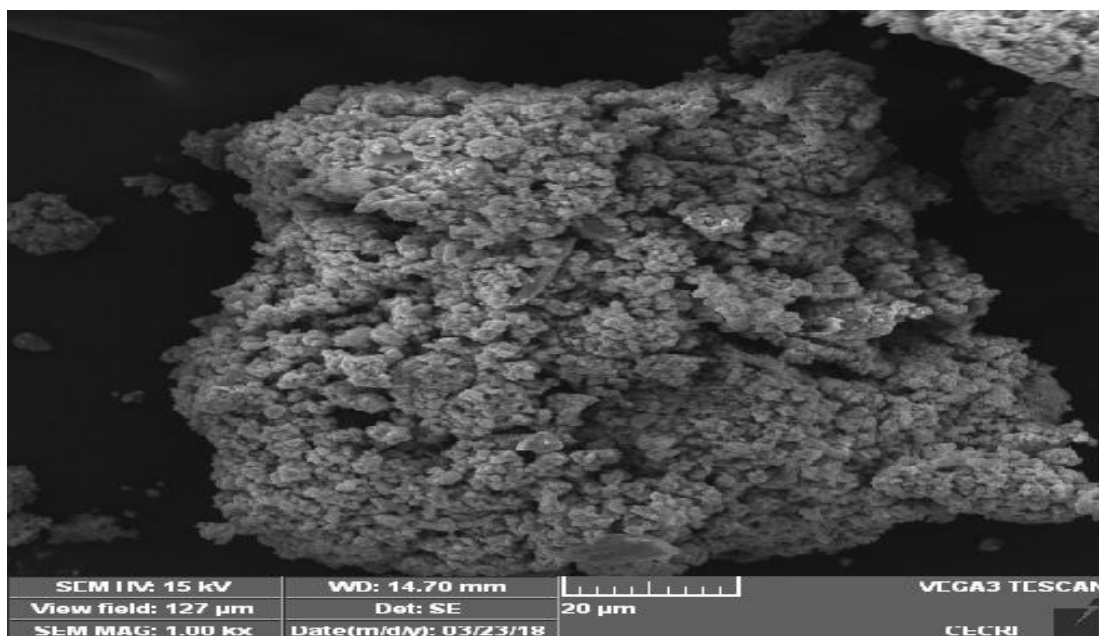


Fig 1: Showing SEM report of KKK(1KX magnification)

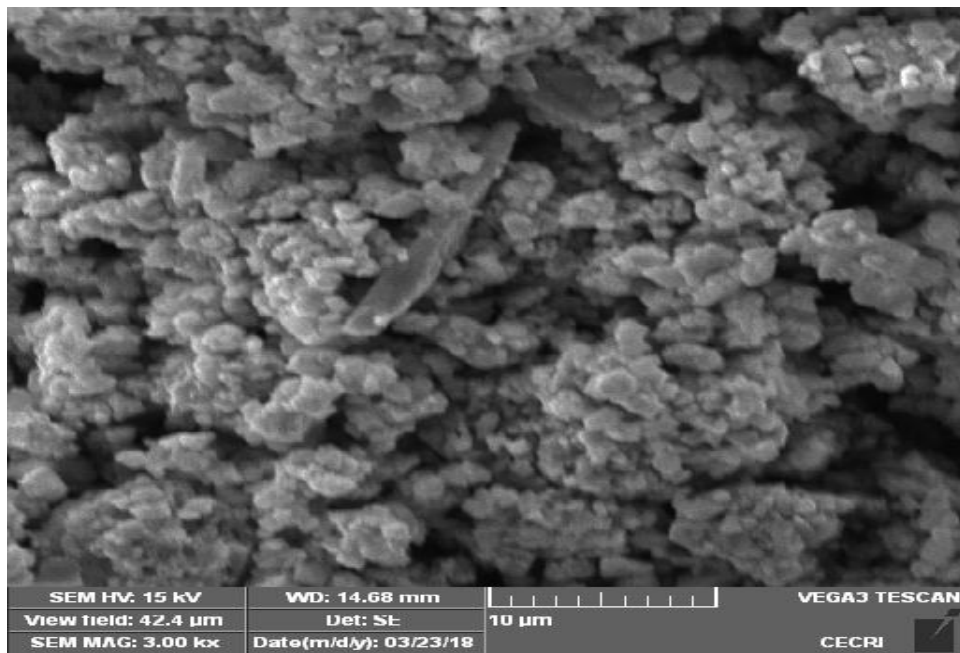


Fig 2: Showing SEM report of KKK(3KX magnification)

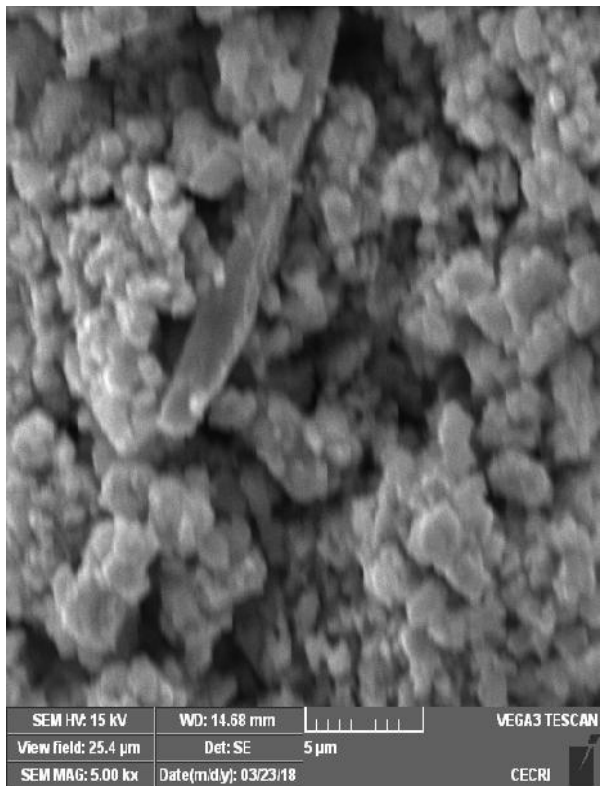


Fig 3: showing SEM report of KKK(5KX magnification)

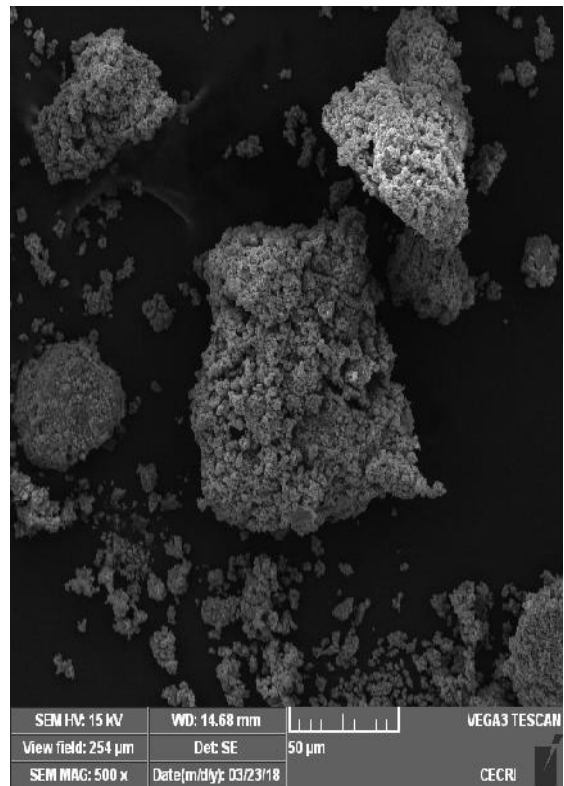
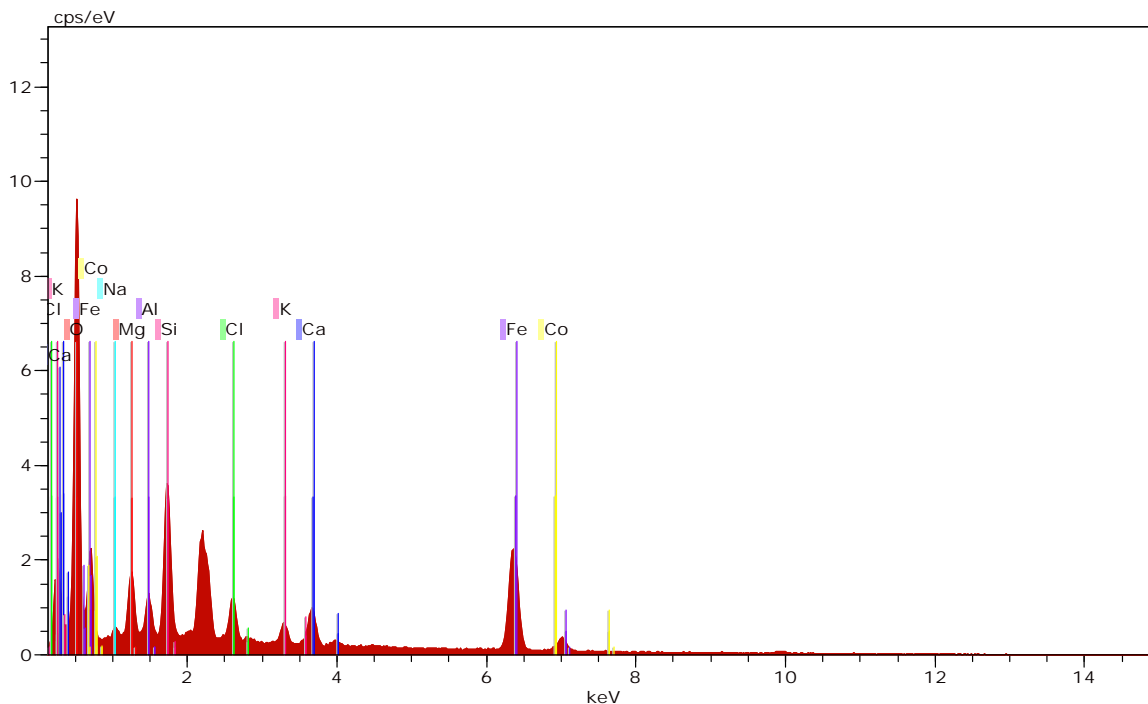


Fig 4: showing SEM report of KKK(500KX magnification)

**EDAX :**

**Elemental analysis of kusta kaja kesari**



**Table 1:**

Spectrum: Acquisition 7578

	El	AN	Series	unn.	C norm.	C Atom.	C Error (1 Sigma)	K fact.	Z corr.	A corr.	F corr.
					[wt.%]	[wt.%]	[at.%]	[wt.%]			
O	8	K-series	26.62	43.39	67.07	3.20	0.504	0.861	1.000	1.000	
Fe	26	K-series	20.87	34.03	15.07	0.66	0.153	2.148	1.000	1.035	
Si	14	K-series	4.25	6.93	6.10	0.21	0.031	2.200	1.000	1.005	
Mg	12	K-series	2.26	3.68	3.75	0.15	0.020	1.820	1.000	1.004	
Ca	20	K-series	1.84	3.00	1.85	0.09	0.011	2.589	1.000	1.040	
Co	27	K-series	1.71	2.79	1.17	0.10	0.014	1.912	1.000	1.041	
Cl	17	K-series	1.31	2.14	1.49	0.07	0.008	2.578	1.000	1.016	
Al	13	K-series	1.11	1.81	1.66	0.08	0.009	1.965	1.000	1.005	
K	19	K-series	0.76	1.24	0.79	0.05	0.004	2.775	1.000		

Energy dispersive x-ray analysis (EDAX) of KKK was carried out and the elements present like, Carbon, Oxygen, iron, Magnesium, chloride, Aluminium, potassium, silica, Sulphur and Calcium were estimated. From the spectra atom percentage of the elements are found to be as follows. Oxygen=43.39%, iron=34.03%, silica=6.93%, Magnesium =3.68%, calcium=3.00%, copper=2.79%, chloride=2.14%, Aluminium=1.81%, potassium=1.24%. SEM and EDAX provide good estimate of the concentration of main elements in the drug. Furthermore, it provides useful information in the

distribution of the elements forming the drug and their sample chemical form.

**Conclusion**

The present study evaluated the Physico chemical properties of Siddha formulation Kusta kaja kesari. SEM analysis reveals the morphology and partial size of the drug which is essential for its bio-availability. The EDAX result explores the active elements present in the drug like Carbon, Oxygen, Zinc, Magnesium, Calcium, Potassium, Iron which is necessary for its therapeutic effect against the diseases.

The standardization and elemental analysis of the Kusta kaja kesari were studied. It will be an initiative step in the field of standardization of siddha drugs for global acceptance.

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