Research Article

CHEMICAL STANDARDIZATION OF MEGA SANJEEVI MAATHIRAI, A HERBOMETALLIC SIDDHA DRUG

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ABSTRACT

Siddha system of medicine believes herbometallic formulation to be potent than herbal formulation alone. So far, fewer studies have been conducted on standardization of such preparations. Mega sanjeevi mathirai (MSM), a traditional Siddha herbometallic drug was prepared as per the procedures mentioned in a siddha literature. The chemical finger print was taken by using modern analytical techniques like Inductive coupled plasma optical emission spectroscopy (ICP-OES) and Fourier transform infra-red spectroscopy (FTIR). In addition, the particle size of mega sanjeevi mathirai was also assessed by High Resolution Scanning Electron Microscope (HR SEM). The results confirmed the absence of lead, arsenic and cadmium. Reports showed the presence of inorganic elements such as mercury (2.96ppm), sodium (6.26ppm), potassium (4.22ppm), calcium (15.10ppm), phosphorous (3.63ppm) and sulphur (6.25ppm). FTIR confirmed the presence of organic moieties as follows; IR (KBr, cm^{-1}), 3399 (-OH structure of –COOH group), 1716 (C=O structure of carboxylic acid), 1618 (C=N structure), 1214 (Asymmetric C-O-C structure), 1047 (Symmetric C-O-C structure). The range of particle size varies between 3 -10 µ. These findings could be used as a chemical fingerprint for future reference of Mega sanjeevi mathirai in chemical standardization.

Keywords: Metallic Drug, Ayurveda, Basma, Traditional Medicine, Drug Standardization, Mercury.

INTRODUCTION

Indian systems of medicines have been widely used for thousands of years in India. Siddha system is the ancient and unique among the Indian system of medicines. Standardization of traditional drug is a burning topic in today's drug research industry. Standardization in herbal formulation is difficult, because they are usually mixtures of many constituents and the active principle in most cases is unknown[1]. In Siddha system of medicine, the drug sources are obtained from plants, inorganic ores and animals. Gradual unavailability of herbals makes attention towards utilization of metal based drugs and animal based drugs for therapeutic purpose. Now days, acceptance of traditional system of medicine in developed countries is sharply increasing[2]. Proper standardization of drug preparation methods as well as chemical analysis of traditional formulation is mandatory to gain support for its use worldwide. Very few studies have been done on the chemical standardization, efficacy and safety aspects of herbo-metallic traditional drugs.

Mega sanjeevi mathirai (MSM), a herbo metallic Siddha drug is mainly used to treat infectious genital diseases, sexually transmitted diseases, chronic urinary tract infection and cystitis especially in chronic diabetes mellitus patient[3]. Since this drug was not chemically standardized, the aim of our present study was to standardize the chemical composition of the mega sanjeevi mathirai by modern analytical techniques.

MATERIALS AND METHODS

Preparation of mega sanjeevi mathirai

The drug was prepared as per the standard procedures mentioned in Siddha formulary literature Anupoga vaithiya navaneetham. All the ingredients were bought from authorized Siddha raw material shop in Chennai, India. Lingam (cinnabar – red sulphide of mercury), Rasa chenduram (mercury sulphide), Veeram (mercury perchloride) and Pooram (mercury subchloride) were taken in the quantity of 8.75g each. All the four inorganic raw materials were further processed individually with selective liquids for purification process (Suddhi muraigal). The above four raw inorganic materials were either dipped in the liquids or boiled with the liquids according to the procedure. The liquids added for the purification process include honey, cow milk, lemon fruit juice, *Acalypha indica* leaf juice, *Mukiya maderaspatna* leaf juice and *Piper nigram* seed decoction. After the purification process, above said four inorganic materials were mixed with 35g pericarp powder of *Terminalia chebula* dry fruit and grinded continuously for 15hr by adding 300ml of lime juice. Then, grinded outcome was made as pills of 65mg, which was dried in room temperature[3] (Figure 1).

Estimation of inorganic elements and Infrared spectra in raw materials

Inorganic elements of all four raw materials were quantified by Inductive coupled plasma optical emission spectroscopy (Optima 5300 DV ICP-OES) equipped with a Sea Spray concentric nebulizer (Glass Expansion,

Pocasset, MA) and cyclonic spray chamber. Following procedures were followed: nebulizer flow, 0.8/min^{-1}; radiofrequency power, 1450 W; sample introduction, 1.5 ml min^{-1}; flush time, 20 s; delay time, 10 s; read time, 10 s; wash time, 30 s; and replicates, three. Standards were prepared by dilution of 1000 mg l^{-1} stock solutions and the calibration curve was obtained using five to ten points including the blank.

Raw materials were powdered and the infrared spectral characterization was obtained by using Perkin-Elmer FTIR Spectrophotometer in the region (4000-450 cm-1) by KBr pellet method[1].

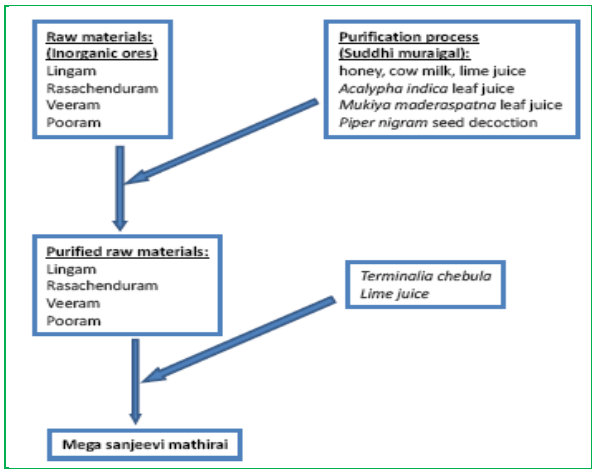

Figure 1: Flow chart of drug preparation procedure of Mega sanjeevi mathirai

Estimation of inorganic elements and Infrared spectra in purified raw materials

ICP-OES and FTIR were repeated after the purification processes in the purified raw materials was done in order to assess the chemical modulations because of purification processes.

Estimation of inorganic elements, Infrared spectra and drug particle size in MSM

After the mega sanjeevi mathirai was prepared, ICP-OES and FTIR were repeated to assess the final chemical composition in the product.

Fine powder of MSM was analyzed for particle morphology by High Resolution Scanning Electron Microscope (JEOL ASM 3500 HR-SEM). A representative portion of each sample was sprinkled onto a double side carbon tape and mounted on aluminum stubs in order to get a higher quality secondary electron image for SEM examination[1].

RESULTS AND DISCUSSION

Changes of inorganic element composition in purification process in raw materials

Toxic metals like arsenic, cadmium and lead were absent in all the raw materials. Mercury level has been drastically reduced in the purified raw materials. Thus, the intention of purification process of metallic raw materials by using herbal juices could to reduce the toxic metal quantity in the herbo-metallic formulations. All other elements have been considerably reduced after purification process except sulphur in lingam. (Table 1).

Changes of Infra-red spectra after purification process in raw materials

No major changes were observed in spectra of lingam and rasachenduram, which showed almost similar spectra before and after purification process (Figure 2, 3, 4 & 5).

In purified veeram, acidic (OH) (3361) moiety and CO moiety of carboxylic acid (1715) were introduced. Addition of these functional groups might be the purpose for the purification process in veeram (Figure 6 & 7). Purification procedure of pooram leads to the insertion of numerous moieties. Ester group (1733) has been converted in to acidic (1716) moiety. Hydroxyl (OH) group (3503) has been converted into carboxylic (COOH) moiety (3349). Other notable insertion after purification of pooram include aromatic, CH2, CH3 and ether (-COC) link (1064) (Figure 8 & 9). These findings have given the clue that "Suddhi muraigal" in the traditional drug preparation has some significance in chemical structural modulation.

Table 1: Analysis of inorganic elements by ICP-OES in raw materials before & after purification process and in final product mega sanjeevi mathirai

Raw material name	Inorganic elements in parts per million (ppm)								
	Lead	Cadmium	Arsenic	Mercury	Sulphur	Na^+	K^+	Ca^{2+}	Phosphorus
lingam (raw)	BDL	BDL	BDL	113.39	114.2	1.33	207.33	25.72	14.23
Lingam (after purification)	BDL	BDL	BDL	70.83	217.3	1.22	17.13	2.28	1.1
Rasacehnduram (raw)	BDL	BDL	BDL	201.4	258.9	9.51	22.15	28.61	9.51
Rasachenduram (after purification)	BDL	BDL	BDL	123.3	207.9	5.20	19.14	18.30	5.1
Veeram (Raw)	BDL	BDL	BDL	117.7	7.23	8.83	27.05	12.08	6.1
Veeram (after purification)	BDL	BDL	BDL	80.59	2.29	6.73	17.68	2.88	4.12
Pooram (raw)	BDL	BDL	BDL	241.5	14.21	3.29	17.13	23.70	8.12
Pooram (after purification)	BDL	BDL	BDL	100.23	10.51	1.24	12.16	20.26	7.16
MSM	BDL	BDL	BDL	2.96	6.25	6.26	4.22	15.10	3.63

BDL - below detectable level; MSM – Mega sanjeevi mathrai

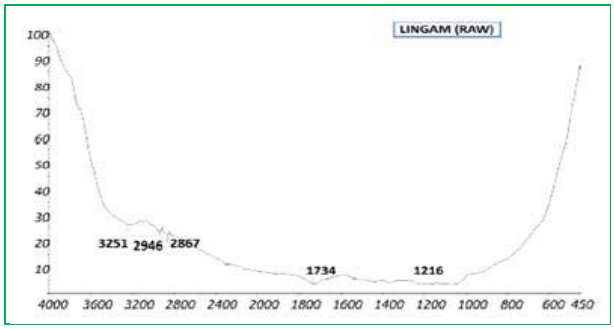

Figure 2: Infra-red spectra of lingam before purification process

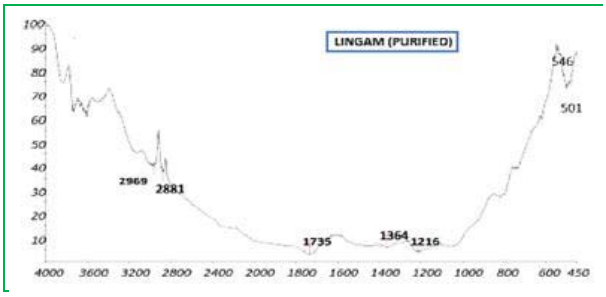

Figure 3: Infra-red spectra of lingam after purification process

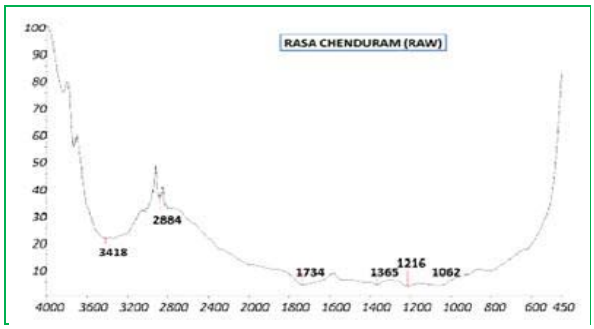

Figure 4: Infra-red spectra of rasachenduram before purification process

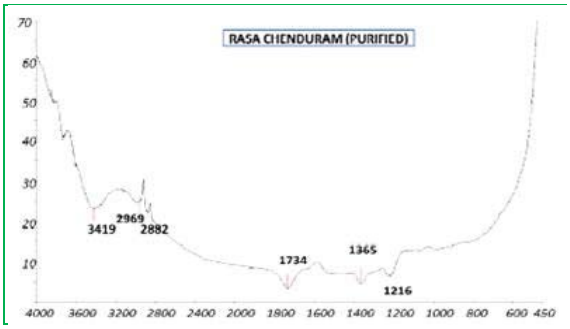

Figure 5: Infra-red spectra of rasachenduram after purification process

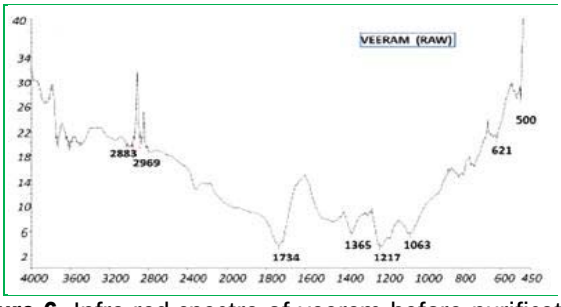

Figure 6: Infra-red spectra of veeram before purification process

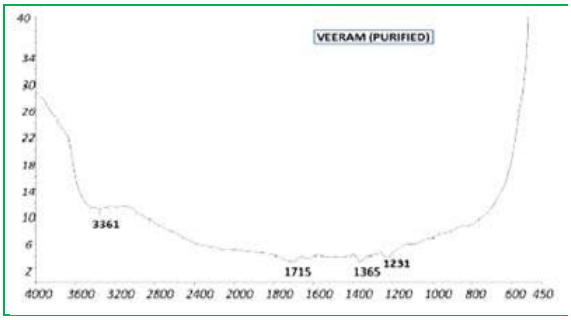

Figure7: Infra-red spectra of veeram after purification process

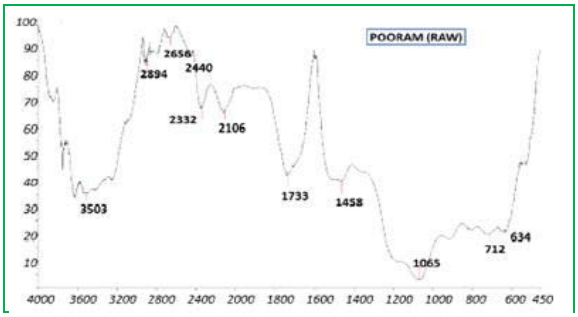

Figure 8: Infra-red spectra of pooram before purification process

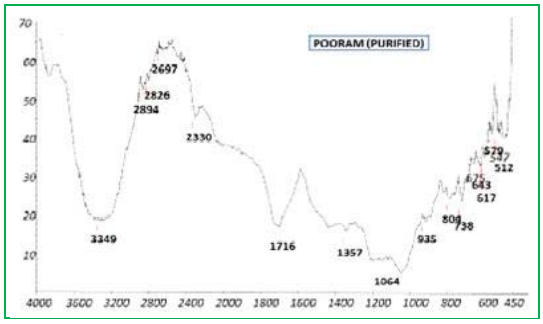

Figure 9: Infra-red spectra of pooram after purification process

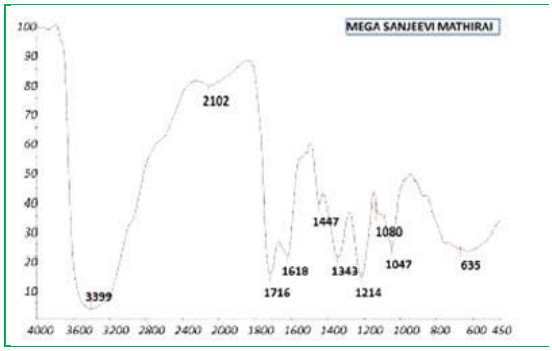

Figure 10: Infra-red spectra of mega sanjeevi mathirai

Chemical composition of Mega sanjeevi mathirai

ICP-OES revealed the absence of toxic metals like lead, cadmium and arsenic. But amount of mercury presented in this drug was 2.96ppm, which is above the permitted limit (1 ppm)[4]. High mercurial amount in this drug alarms for further study on toxicity profile. Detailed study is necessary to evaluate whether the herbal components have any protective role or chelation role in mercury toxicity. Other inorganic elements like sodium, potassium,

calcium, phosphorous and sulphur were also present in minimal quantity (Table 1).

Infra-red spectra of mega sanjeevi mathirai have shown few peaks as follows;

3399 (-OH structure of –COOH group), 1716 (C=O structure of carboxylic acid), 1618 (C=N structure), 1214 (Asymmetric C-O-C structure) and 1047 (Symmetric C-O-C structure). These organic moieties might be responsible for the therapeutic values (Figure 10).

HR SEM analysis revealed that the particle size of MSM is in the range of 3 to 10µ. Shape of the particles was cubical and the surface was smooth (Figure 11).

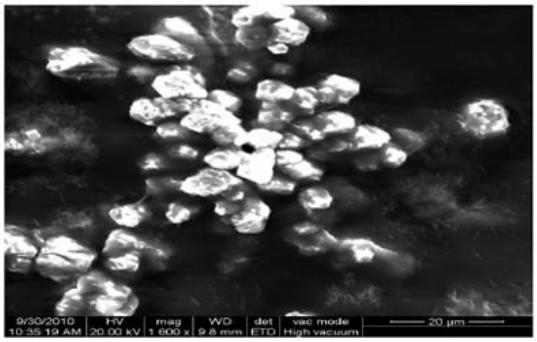

Figure 11: HR SEM photo of Mega sanjeevi mathirai

CONCLUSION

In this study, Mega sanjeevi mathirai was prepared and analyzed according to the standard procedures. There were notable changes in spectra after the suddhai muraigal (purification process). The findings in Mega sanjeevi mathirai revealed the absence of heavy metals like lead, arsenic and cadmium. But mercury was present above the permitted level. Organic moieties like OH structure of –COOH group, C=O structure of carboxylic acid, C=N structure, asymmetric C-O-C structure and Symmetric C-O-C structure were also present in mega sanjeevi mathirai. This report could be used as chemical finger print for future references in chemical standardization of Mega sanjeevi mathirai.

Further detailed studies are required to evaluate the importance of "Suddhi muraigal" in Siddha drug preparation technique, which may reveal the scope for chemical modulation by traditional methods in pharmaceutical industry. Since the chemical composition is mainly depend on the herbals, which might contain varied amount of phytochemicals in response to different climate or different geological location, similar studies have to be repeated by using herbals collected from different locations and the variations in chemical composition have to be further documented.

REFERENCES

1. Sudha A, Murthy VS, Chandra TS. Standardization of Metal-Based Herbal Medicines. Am J Infec Dis, 5:2009; 193-9.
2. Hwang YO, Park SG, Park GY, Choi SM, Kim MY. Total arsenic, mercury, lead and cadmium contents in edible seaweed in Korea. Food additives and Contaminants:Part B:Surveillance, 3:2010; 7-13.
3. Sayabu HA. Anupoga Vaithiya Navaneetham Vol.VII (Tamil). India:Thamatai publication; 2002. P.74-5.
4. Lohar DR. Protocol For Testing Ayurvedic, Siddha & Unani Medicines. Government of India, Department of AYUSH, Ministry of Health & Family Welfare, Pharmacopoeial Laboratory for Indian Medicines, Ghaziabad; P.36.

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