



## PHYSICO CHEMICAL STANDARDIZATION OF DIFFERENT SAMPLES OF SUVARNAMAKSHIK (CHALCOPYRITE)

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### ABSTRACT

Rasashastra is branch of Ayurveda dealing with mainly metallic and herbomineral preparations. These formulations are unique due to its innate qualities like quick action, low dose, tastelessness, prolonged shelf life and better palatability. But due to ever increasing demand of these drugs and depletion of natural resources, they are replaced with substandard and adulterated samples these days. Suvarnamakshik (Chalcopryrite) is the drug mentioned under the category of Maharasavarga (group of minerals) in ancient texts. But, on pilot survey of this particular drug it was found that the samples of Suvarnamakshik available in market were not genuine. Hence, this study was undertaken to ensure the procurement of potent Suvarnamakshik samples with application of appropriate tests along with Inductively Coupled Plasma Atomic Emission Spectrophotometry for elemental assay. Three samples were included in study, sample collected from Khetri copper mines, Rajasthan (SMKh) was found authentic which had presence of 20.72% of copper as compared to other two market samples (SMAl and SMKo) which showed 0.84% and 0.95% copper respectively. Copper being the key element in Suvarnamakshik authentic sample will definitely prove beneficial in therapeutics.

**Key words:** Suvarnamakshik, Adulteration, Inductively Coupled Plasma Spectrophotometry, Copper.

### INTRODUCTION

Rasashastra is an ancient alchemical science which deals not only with pharmaceutical study of drugs but also with their proper utilization in therapeutics. To achieve this aim and for any research work to be successful authentic or genuine raw drug should be used. Thus, standardization of raw drug is the first step before commencing for any research work. It is noteworthy that Grahyagrahyatva (acceptable variety) criterion for raw drugs mentioned in ancient Ayurvedic texts prove helpful even today for selection of genuine raw drugs<sup>1</sup>. Ancient tests combined with modern parameters work as a ladder to reach towards authentic samples.

Suvarnamakshik is the drug mentioned under the category of Maharasavarga<sup>2</sup> in ancient texts. It is the most extensively used drug as individual formulation in form of Bhasma and also as a component drug in many other formulations. It has got varied use in many diseases. But on thorough survey of this particular drug it was found that the samples of Suvarnamakshik available in market were not genuine. Hence, this study was undertaken to ensure the procurement of potent Suvarnamakshik samples. Suvarnamakshik can be compared with Chalcopryrite according to modern view and is also mentioned in Ayurvedic Pharmacopoeia of India. Chalcopryrite is one of the minerals referred to as 'Fools gold', because of its bright golden color. In Greek 'Chalkos' means copper and 'Pyrites' means strike fire.

**Composition**<sup>3</sup>—CuFeS<sub>2</sub>

Copper- 34.5%, Iron – 30.5%, Sulphur – 35%

### MATERIALS AND METHODS

Thorough survey was conducted to collect samples from different sources:

- 1) Market – Samples were collected from different shops in local market
- 2) Private dealer – Sample of around 420 gm. was collected from a private dealer from Kolkata
- 3) Copper mines – Sample of around 3.2kg was collected by actually visiting the copper mines at Khetri, Rajasthan.

All the above collected samples were decoded as follows:

- a) SM Kh – Khetri copper mines, Rajasthan (Fig.1)
- b) SM Ko – Dealer, Kolkata (Fig.2)
- c) SM Al – Local market, Mumbai (Fig.3)

Following tests were applied to all 3 samples

**Ancient:** Grahyagrahyatva<sup>4</sup> (acceptable variety) criterion for Suvarnamakshik is mentioned in ancient texts (Table 1)

**Modern tests:**

**Chemical tests:** Following confirmatory tests were carried out. (Table 2)

**Charcoal test**<sup>5</sup>

In these tests small amount of powdered mineral is roasted in a small depression in the charcoal block. Some minerals will produce sublimes on the block, specific odors, characteristic oxides, or metal residues. In Chalcopryrite coarse powder fuses to magnetic black globule.

Hydrochloric acid (Flame test)<sup>6</sup>: Touched with Hydrochloric acid tints flame with blue flash.

Nitric acid<sup>7</sup>: Solution with Conc. nitric acid is green

**Inductively coupled plasma spectrophotometry with AES (Table3)**

Inductively coupled plasma atomic emission spectroscopy is a common instrumental method for qualitative and quantitative analysis of most metallic elements. Compositions at the part per million level are routinely determined and lower levels can be measured on samples. This test was carried out at IIT, Powai to determine amount of Copper, Iron and Sulphur from the samples.

**RESULTS AND OBSERVATIONS**

**Ancient test:** SMK<sub>h</sub> passed all the grahyagrahyatva criteria. SMAI Market sample passed the minimum tests.

**Modern tests**

**ICP-AES**

Maximum amount of copper (20.72%) was found in sample collected from copper mines. Very less or negligible amount of copper was detected from other two samples. As Copper is the key element in this mineral it should be present in sufficient amount.

**Chemical tests**

Confirmatory test to confirm the presence of copper and iron was passed by SMK<sub>h</sub> sample.

**Table 1**

Sr.no.	Sample	SMAI	SMK <sub>o</sub>	SMK <sub>h</sub>
	Criteria			
1.	Swarnabh(Golden tinge)	Absent	Present	Present
2.	Nishkona ( No angles)	Absent	Present	Present
3.	Guru (Heavy)	Present	Present	Present
4.	Krishnatamvikirett... (leaves black impression when rubbed on palm)	Absent	Absent	Present
5.	Neelachhavi (bluish tinge)	Absent	Absent	Present

**Table 2**

Sample	Charcoal test	HCl(flame) Test	HNO <sub>3</sub>
SM AI	+		
SMK <sub>o</sub>	+	+	+
SMK <sub>h</sub>	+	+	+

**Table 3**

Samples	SMAI	SMK <sub>o</sub>	SMK <sub>h</sub>
Composition in %			
Copper	0.84	0.95	20.72
Iron	39.53	15.36	45.93
Sulphur	37.73	1.33	31.30



**Fig. 1 SMK<sub>h</sub>**



**Fig.2 SMK<sub>o</sub>**



**Fig.3 SMAI**

**DISCUSSION**

Even though Ayurveda is known to humans since time immemorial it is no more an ancient science now. But advances in recent technology and its application in field of Ayurveda has brought about a complete novel look to this traditional branch of medicine.

Rasashastra is branch of Ayurveda in which integrated application of modern and ancient parameters will work wonders and help in future research in this field and its globalization. In field of Rasashastra there are many drugs which are known to humans. But in due course of time due to extinction of mineral ore and their unavailability genuine drugs

are replaced by substandard drugs. Hence, it is very essential to take a firm step towards standardization of these drugs. *Suvarnamakshik* is one such drug. Hence, a study was conducted on procurement and authentication of this particular drug. Thorough market survey was done and three samples from different sources were collected and subjected to analytical tests. Both ancient as well as modern parameters were applied. Grahyagrahyatva criteria is exclusively mentioned in Rasashastra and is helpful even today, so initially while choosing the samples this test was applied and then subjected to further tests. All the properties of *Grahya Suvarnamakshik* (accepted variety) was present in SMK<sub>h</sub>. Also simple chemical tests for qualitative analysis was carried out. Flame test was

done to confirm the presence of copper in the samples. SMK<sub>h</sub> and SMK<sub>o</sub> showed blue flame suggestive of presence of copper. Quantitative analysis was done by Inductively coupled plasma spectrophotometry with AES. Even though many references state that amount of copper should be 34 -35% in Chalcopyrite, analyses often show variation from this, often due to mechanical admixture of pyrite<sup>8</sup>. Also it is mentioned in API<sup>9</sup> that Suvarnamakshik in ore form should contain not less than 5% Copper, not less than 20% Iron and not less than 12% sulphur. SMK<sub>h</sub> had 20.72% copper, 45.93% iron and 30.30% sulphur, whereas SMK<sub>o</sub> showed 0.95%, 15.36% and 1.33% copper, iron and sulphur respectively and SMAI showed 0.84%, 39.53%, and 37.73% copper, iron and sulphur respectively.

## CONCLUSION

All the tests applied to the samples revealed that SMK<sub>h</sub> passed maximum tests. Also, ICP- AES revealed that elemental assay of sample collected from Khetri copper mines (SMK<sub>h</sub>) is in compliance with the standards mentioned in API so it can be concluded that SMK<sub>h</sub> is genuine Suvarnamakshik.

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