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DETERMINATION OF INORGANIC COMPONENTS INCLUDING MINOR AND TRACE ELEMENTS IN SURMA (KOHL) FORMULATIONS

AZHAR M. SYED, M. QADIRUDDIN, K. SHIRIN AND ZAHEER BABAR HASHMI*
PCSIR Laboratories Complex, Off University Road, Karachi-75280, Pakistan

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Quantitative estimations of silicon dioxide, phosphate, chloride and nitrates alongwith minor and trace elements in various Surma (Kohl) formulations have been carried out using chemical and AAS methods. Out of ten different preparations, eight were found to contain lead as major constituent (72 - 82%). The remaining two were zinc based having 53 and 63% of zinc, respectively.

Key words: Estimations, Inorganic components, Surma (Kohl).

Introduction

In Ayurvedic and Unani medicine invariably crude or natural forms of drugs are used, these are simple or Mufradath. Also, there are medicaments which are neither refined chemicals nor concentrates of simple drugs; they represent preparations made after elaborate process of manufacture and according to doctorines appealing strongly to specialized reasoning. Surma (Kohl) is one of these class of medicaments used for treatment and preventation of eye diseases, and also for keeping eyes normal and healthy [1].

The use of Surma has been reported in the ancient civilization. There has been controversy whether it was galena or antimony based. It was due to confusions of vernacular names of lead and antimony. In Egypt galena was known as Mestem or Stim while this word was identical to Greek word Stimmi or Stibi and the Latin word Stibium, meaning antimony. Fischer [2] and Lucas [3] made a detailed study by analysing the original samples and proved that in Egyptian preparation of Surma, major constituent was galena.

Although, the method of formulation of the samples studied in the present work has not been reported by the manufacturer, indications have been given that herbs, gem-stones, minerals and marine coelenterates are used in these preparations.

Nadkarni [4] has mentioned that roots of *Captia teeta* made into a paste with Rasavanti is used as collyrium or eye salve. Also *Piper nigrum* Linn. as white pepper paste is used for the treatment of eyes.

Hakim Syed Safiuddin Ali [5] has reported some plants used for eye diseases and its preventions; i.e. Chaksu (*Cassia absus* Linn.), Saferon (*Crocus sativus* Linn.), Mamiram - golden thread root (*Cosptis teets* Linn.), Neem - Margosa (*Melia azadirachta* Linn.) and long pepper (*Piper longum* Linn.).

* Mohammad Hashim Tajir Surma, Karachi.

Hakim Ali [5] has also reported the use of gem-stones such as emerald and lapis luzuli for curing a number of eye diseases. He has also mentioned the use of marine coelenterates such as cuttle fish bone for the treatment of cataract in eye.

Hakim Awan [6] has described the use of fennel fruit (*Foeniculum vulgare* Linn.) and Ext. Berberis (*Berberis aristate* Linn.) for keeping the eyes healthy and protected against diseases.

In Tibbi Pharmacopia [7], the use of copper, gold and zinc as elements and cornelion and pearls as gem-stones has been reported for protection and cure of eye diseases.

This study has been carried out on ten different preparations procured from M/s. Mohammad Hashim Surma Tajir, a well reputed manufacturer and medical expert of Surma (Kohl).

Experimental

All chemicals used were analytical reagent grade. Distilled water from all pyrex glass water still was used. All glassware used was thoroughly washed with dil.HNO_3 and distilled water before use. Nickel crucible used was made of 99.9% pure nickel.

Instruments. (a) Hitachi Z-8000 atomic absorption spectrophotometer equipped with Zeeman background corrector and a data processor was used. For the estimation of sodium and potassium, (b) Corning Model 410 flame photometer was used. All the parameters were set according to the instrument manufacturer's instructions.

Preparation of solution for atomic absorptions pectroscopy. 0.05 – 10g of each sample was fused with sodium peroxide (Na_2O_2) in the nickel crucible and leached with water. It was boiled for few minutes to destroy excess peroxide. The solution was filtered and filtrate made upto 500 ml (Solution A). The residue was dissolved in dil. nitric acid (HNO_3 1:1) and made upto 250 ml (Solution B).

Solution A (10 ml)was acidified with HCl and made upto 100 ml; 10 ml of B was also diluted to 100 ml. Further dilutions of both the solutions were prepared for the estimation of the elements present in major quantity to keep their concentrations within linear range of absorbance. Estimations were made in both the solutions and the result reported was sum of the two [8].

Estimation of sodium and potassium. 1.0 g of Surma sample was boiled with 25 ml of NHO_3 (1:1) and filtered. The filtrate was made upto 100 ml and sodium and potassium were estimated by flame photometers [9].

Estimation of chloride and phosphate. 50 ml of Solution A was acidified with NHO_3, a known volume of standard silver nitrate ($AgNO_3$) was added and excess $AgNO_3$ was back titrated with standard NH_4 SCN solution and chloride content was calculated. Phosphate was estimated in Solution A by molybdenum blue using colourimetric method.

Estimation of silicon dioxide. 1.0 g of sample was roasted to remove organic matter, volatile material and sulphur. The ash was dissolved in aqua regia and then fumed with perchloric acid. The dehydrated silica was filtered and ignited in platinum crucible and weighed. A few drops of conc. H_2SO_4, followed by 5 ml of HF, were added. The acid was slowly evaporated and the crucible was reweighed after ignition and cooling. The difference of two weights gave the amount of SiO_2 [10].

TABLE 1. ESTIMATION OF SILICON DIOXIDE, PHOSPHATE, CHLORIDE, AMMONIA AND NITRATE NITROGEN IN SURMA PREPARATIONS.

Product No.	SiO_2 (%)	Cl^{-1} (ppm)	NH_4^+ (ppm)	NO_3^{-1} (ppm/traces)	PO_4^{-3}
1.	1.71	93	6	Nil	Traces
2.	2.16	577	8	Traces	"
3.	2.35	262	8	Traces	"
4.	0.70	421	10	Traces	"
5.	0.15	169	6	Nil	"
6.	0.22	169	6	Nil	"
7.	0.58	285	6	18	"
8.	3.70	203	6	Traces	"
9.	0.14	562	6	Traces	"
10.	0.70	421	10	Traces	"

Results and Discussion

According to the classification of elements with reference to human body weight, there are six major, six minor [11] and twenty four trace elements [12,13]. In Surma preparations, four major elements in the form of oxides, phosphates, nitrate and calcium have been determined. Six minor elements estimated in these preparations are sulphur, potassium, sodium, and chlorine in the form of chloride and magnesium and silicon in the form of silicon dioxide. Trace elements detected are lead, zinc, aluminium, iron, copper, manganese, cobalt and chromium.

Table 1 gives the estimation of silicon dioxide, phosphate, chloride, ammonia and nitrate nitrogen in ten products of Surma preparations.

Table 2 and 3 show the elements present in lead based and zinc based Surma preparations respectively. These products were reported for use of different eye treatments [14].

The presence of important elements in Surma may arise due to the reported constituents, i.e. herbs, gem-stones, minerals and marine coelenterates alongwith galena or zinc oxide.

TABLE 2. ELEMENTS PRESENT IN LEAD BASED SURMA PREPARATIONS.

Elements present	Product No. 1	Product No. 3	Product No. 4	Product No. 5	Product No. 6	Product No. 7	Product No. 8	Product No. 10
Pb %	80.97	77.53	72.02	76.67	81.49	78.63	78.59	72.02
S %	13.12	11.96	11.13	13.14	12.70	12.64	11.26	11.13
Zn %	1.12	0.65	0.58	0.96	0.82	0.71	0.64	0.58
Ca %	0.40	0.51	0.64	0.51	0.59	0.78	0.79	0.64
Ag %	0.30	0.03	0.03	0.53	0.11	0.06	0.05	0.03
Al %	0.24	0.14	0.59	0.28	0.21	0.15	–	0.59
Fe %	0.10	0.14	0.20	0.19	0.18	0.06	0.06	0.20
Mg %	0.06	0.04	0.08	0.05	0.06	0.04	0.04	0.08
Cu %	0.03	0.06	0.02	0.05	0.02	0.03	–	0.59
Mn %	0.03	0.08	0.41	0.07	0.06	0.01	0.02	0.41
Co %	0.01	0.02	0.07	0.01	0.02	0.07	0.11	0.07
Na (µg/g)	181.0	195.0	172.0	138.0	143.0	156.0	194.0	172.0
K (µg/g)	91.8	45.3	58.2	40.4	42.1	8.9	113.7	58.2
Cr (µg/g)	28.9	30.3	127.8	177.1	33.0	29.0	33.8	127.8

TABLE 3. ELEMENTS PRESENT IN ZINC BASED SURMA PREPARATIONS.

Elements present	Product No.2	Product No.9
Zn %	53.75	63.35
Ag %	0.93	0.05
S %	0.75	0.19
Al %	0.67	–
Fe %	0.58	0.12
Mg %	0.23	0.12
Ca %	0.21	1.09
Cu %	0.19	0.06
Mn %	0.13	0.02
Pb %	0.12	0.09
Co %	0.04	0.01
Na (μg/g)	749.0	482.0
K (μg/g)	1719.1	1915.2
Cr (μg/g)	183.2	44.6

The aim of present study was to carry out a scientific investigation and to find out the actual composition of these preparations in order to make a complete evaluation, covering the inorganic portion. This may be useful for medicinal purposes taking into consideration the presence of important major, minor and trace elements. Although the pharmacology of Surma with regard to eye has not yet been studied, some work has been carried out with respect to lead and its absorption in the eye [15]. It may be useful if such studies may now be carried out for other elements detected in these preparations. For example, lead in the form of galena has astringent action and it may cause precipitation of proteins at the site of application [15]. Also, it has strong absorptive property keeping the eyes protected from dust and other foreign matter [15]. The action of other elements present in Surma may also have useful effects in the eye, specially, the trace elements may accelerate the bio-active components, serving as mixed catalysts or as substitute of multienzymes.

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