ABSTRACT

*Sulphur*, commonly referred as Gandhagam in Siddha literature, has a wide range of therapeutic efficacy. It is used in the preparations like Rasayanan, Pills, Mezhugu and Bhasmas and Chenduram as a major / one of the ingredients in Siddha therapeutics. The name kandagam refers “odor” in Tamil literature. It possess bitter and Astringent tastes. Traditionally *Sulphur* is known with other names like Gandagam, Kaarizhai Natham, Parai natham, Parai Veenyam, Atheetha prakasam, Beejam, Selvi vindhu, Sakthi, Sakthi peesam, Chenduram thrathri, Thevuram, Natham, Nammal, Parai natham, Ponwarai, Rasa srothinam.

In Siddha system sixty four types of poisons are mentioned for therapeutic purpose. Pirappu kandagam, Vaiпу kandagam, Kozi thalai kandagam, VanaKondhi vaipu, are some of the varieties. Pirappu kandagam, is the naturally occuring *sulphur from* which remaining were prepared by subjecting it to purification. Kozi thalai kandagam, name itself suggest that it resembles red color of the crown of Cock. Based on the color *Sulphur* is four types

1. White sulphur is used to cure all diseases.
2. Parrot nose red colour Kandham is used for calcinations of nine metals.
3. Golden color Kandagam resembles the colour of Gooseberry, easily reacts with Mercury to form Rajali, is used in therapeutics.
4. Black Kandagam similar with the Crow black colour is a rare variety used as a rejuvenator.

In nature, both plant and animal origin substances contain Sulphur in a permissible quantity such as leafy vegetables, egg, meat, garlic etc.

Reactivity

An easy bond making with the metallic ions i.e the reactivity of sulphur, makes it unique to act as a precursor in the preparation of chenduram.

Mode of action

Sulphur is a laxative, it enhances bile juice secretion, alterative, antiseptic and diaphoretic. It is excreted through duct glands like sweat, urine, mammary glands. It enhances secretions of skin, bronchioles and rectum.

Therapeutic uses

Sulphur is mainly used therapeutically in Eighteen types of Leucoderma, Flatulence, Hepatomegaly, Ascites, Gastric ulcer, Eye diseases, Poisonous bites, chronic venereal diseases, Rheumatic fever, Diarrehea and respiratory symptoms.

Dose:

650 mg- 1.9 g medicine;

For Laxative purpose- 4.2 g - 12.6 g

MATERIALS AND METHODS

Common herbal decoctions used for the purification of the Sulphur as per Siddha literature are aqueous extract of *Tamarindus indica*, Sour rice water, Sour butter milk, Mushroom juice, cow’s milk and stem juice of *Musa paradisica*. The paste of *Lawsonia innermis* mixed with curd is also used for purification of *sulphur*. Purification with the cow’s milk is taken for the present study.

Method

Stage wise purification method with the photographs was mentioned below:

Quantity sufficient of butter was taken melted. Then 250 g of sulphur was taken and melted at a temperature of 60-70°C. The above melted sulphur is poured into a earthen container containing cow’s milk. The Sulphur pored into the milk is allowed it to cool on its own. The above process is repeated for thirty times by taking the fresh milk each time.

The purified Sulphur after cooling is filtered and washed with the normal water.

An amount of 12 gms of Sulphur before, middle and after the purification process were collected for the chemical analysis. (i.e I stage before purification (raw material), 15th stage i.e during the process and 30th stage i.e after purification)

The collected samples were subjected to the following investigations like

- Estimation of Sulphur
- Estimation of Calcium

Results

Physico-chemical analysis

Results are given in Table 1
Physical changes observed during purification process

The colour of the sulphur before purification was bright yellow and shiny in nature. During the process it loses its luster, softness and become easily fragile. Finally, pale yellow coloured substance with brittle nature was observed at the end of the process.

The criteria by which the sulphur is purified is decided by the disappearance of its smell during the process of purification. The raw sulphur will have a foul smell which will be lost during the processing with butter and milk, is an important parameter followed by the traditional siddha practitioners.

It had an irritable taste during the I stage of process where as the final processed sulphur was tasteless. Obtaining a tastelessness substance finally after the purification is also an important marker considered by traditional Siddha practitioners during the purification of sulphur. With the advanced technologies the sulphur was further investigated to check the validation of sulphur’s purity.

Chemical investigations

Quantification of Sulphur

The above results denote the purity of sulphur at every stage as well as a steady increase of purification in the amount of sulphur.

<table>
<thead>
<tr>
<th>Percentage of Elements</th>
<th>I Sulphur (before purification)</th>
<th>II Sulphur (during the process)</th>
<th>III Sulphur (after purification)</th>
<th>I Milk</th>
<th>II Milk</th>
<th>III Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur %</td>
<td>39.132</td>
<td>46.0201</td>
<td>86.5871</td>
<td>1.8600</td>
<td>3.8937</td>
<td>4.2136</td>
</tr>
<tr>
<td>Calcium</td>
<td>140</td>
<td>140</td>
<td>120</td>
<td>160</td>
<td>140</td>
<td>100</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>0.1453</td>
<td>0.1828</td>
<td>0.2260</td>
<td>0.1445</td>
<td>0.1943</td>
<td>0.2383</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.082</td>
<td>0.0086</td>
<td>0.0094</td>
<td>0.0084</td>
<td>0.0066</td>
<td>0.0058</td>
</tr>
<tr>
<td>Lead</td>
<td>0.1157</td>
<td>0.3912</td>
<td>0.4235</td>
<td>0.4209</td>
<td>0.5741</td>
<td>0.3378</td>
</tr>
</tbody>
</table>

Table 1: Physico-chemical analysis
Estimation of heavy metals

Mostly, heavy metals are considered to be the impurities of drug which may inhibit the efficiency of the drug. Safety of the drug can be validated by estimating the heavy metals like mercury and lead. The heavy metals present in sulphur were estimated with the help of Atomic Absorption Spectroscopy.

Estimation of calcium

As milk is taken as a purifying agent and is rich in calcium the estimation of Calcium was undertaken. Generally, calcium is a reducing agent, used for reducing metals. In this study calcium plays a significant role as a reducing agent.
A loss in quantity of calcium was observed (by flame photometry) at the final stage of purification. It decreased from 160 ppm to 100 ppm in milk used for detoxification process. It may be attributed to the chelating activity of calcium during the purification process. The levels of calcium in purified sulphur were also less as compared to that of the initial sulphur which shows the purity of sulphur.

**Estimation of Phosphorous**

Phosphorous is another active ingredient of milk. Levels of phosphorous were studied using titrametric analysis. It was found that phosphorous level has steadily increased from 0.145% - 0.226% in sulphur. During purification process, phosphorous levels increased both in milk and sulphur. Even though, it doesn’t have detoxifying property as such that of calcium it helps as an additive nutrient for the processed sulphur.

Thus, phosphorous provides to be a supplement during the purification of sulphur.

**CONCLUSION**

In the present study the detoxification of sulphur with the milk was done to remove the toxic substances and also enable it to use safely in therapeutics. During the purification process the purity percentage of sulphur was found increased. The milk as a detoxifying agent was successful in removing toxic agents from the processed drug thus enhancing the potency of the drug.

As milk is taken for the study which is rich in calcium and phosphorus the impact of milk constituents on sulphur during the process was studied and they also observed in permissible amounts after the purification. Disappearance of Foul smell of Sulphur which was observed initially and increased tendency of its fragile nature were also an important parameters to confirm that Gandhaka was purified as per Siddha literature.

The chemical analysis of the stage wise samples of Sulphur as well as milk showed an increasing percentage of sulphur, decreasing percentage of Mercury and Lead finally, with in permissible quantity after the purification. The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methyl mercury in a million parts (1 ppm). The mercury content during the initial stage of purification was 0.082 ppm which was significantly reduced to 0.00942 ppm during the final purification.

During purification of sulphur levels of lead steadily increased from 0.1157 ppm to 0.4225 ppm. Yet the values were well within the safety limits as prescribed by FDA (10 ppm). From the above we can conclude that milk which is used as detoxifying agent as per Siddha literature was able to get rid of the impurities if remains also are with in the permissible quantity.

As sulphur occurs in the natural form combined with the other metals it is subjected to purification to get rid of the impurities. In the present study purification was undertaken with the milk as a detoxifying agent one can conclude with the above that milk which is used as a detoxifying agent is suitable for the purification of Gandhakam to get rid of the impurities.

**REFERENCES**