PHARMACEUTICO ANALYTICAL STUDY OF SHANKHA AVARTAN (SPIRALED OUT EXTENSIONS OF CONCH) BHASMA (CALX) & SHANKHA NABHI BHASMA (MIDDLE CORE OF CONCH)

Amol Ashokrao Yadav*1, Rupali Motikar2

ABSTRACT
The texts described many formulations containing Shankha Bh\amas. In the text Yogratnakar mentioned a typical Shankha Nabhi Bhasma to prepare the formulations in Netrarogchikitsa. So there is need to find out root cause of use of typical Shankha Nabhi (Inner core of conch) bhasma by comparing with its Avartana (spiralled out extension of the inner core of conch) Bhasma & effect of shodhan by modern analysis techniques.Analysis of Ashuddha Shankha Avartana Churna showed presence of Iron, Copper, Zinc along with Calcium-the major content of Calcium content in Ashuddha Shankha Avartana Churna, Ashuddha Shankha Nabhi Churna, Ashuddha Shankha Avartana Bhasma,Ashuddha Shankha Nabhi Bhasma, Shuddha Shankha Avartana Bhasma,Shuddha Shankha Nabhi Bhasma, are compared it is found highest in Shuddha Shankha Nabhi Bhasma.This also shows that shodhan procedure has some effect on elements other than calcium.

KEYWORDS: Calcium, XRF, Bhasma(Calx), Analysis.

INTRODUCTION
Calcium Compounds are categorized under the name Sudha Varga. The word Sudha has several meanings e.g. Nectar, good liquid, good drink, honey etc. However few others of 18th century have used this word to indicate a specific class of the medicinal substances, which are basically calcium compounds. Thus the Sudha Varga in context of Rasashastra means a group of medicinal substances which are basically calcium compounds. It is to be kept in minds this classification of medicinal substances is totally based on knowledge of chemistry and Rasashastra. The substances included in this class were used in ancient times e.g. conches, oyster shells, pearls, pearls, corals, cowries, etc. There were constant addition to this class e.g. egg shells, back of tortoise, sepia, etc. Quite recently some minerals, which are not calcium compounds, but have similar properties are also included in this class e.g. Dugdhapashan, Kousheyashma etc.
Calcium is a soft, silvery-white metallic element found most widely in such rocks as chalk, limestone and marble. It is one of the most abundant metals and makes up about 3.5% of the earth’s crust. It reacts readily with both oxygen and water. In nature, it occurs only in compounds—chiefly as calcium carbonate, calcium fluoride, and calcium sulphate. Sir Humphry Davy, an English chemist, first isolated calcium as a pure metal in 1808. However, the ancient Egyptians, Greeks, Romans, and Indians knew about calcium compounds and used them to make mortar.

**Formation of Organic calcium compounds:**
Limestone is a type of rock made up mostly of calcite, a mineral form of calcium carbonate. Most fresh water and sea water contain calcium carbonate. All limestone is formed when the calcium carbonate gets deposited. There are two ways by which limestone is formed.

1) **Those formed completely without aid of living organisms.**
Natural chalk is a soft, fine-grained white limestone. It was formed as a mud on the bottom of an ancient sea. It consists largely of tiny shells and crystals of calcite, both made up of the compound calcium carbonate.

2) **Those are formed by living organisms.**
Many aquatic organisms, in this kind, prepare organic calcium carbonate out of their bodies and use to make their shells and bones. The oysters, clams, corals, snails, and sea urchins do this. When the animals die, the shells and bones are broken up by waves into shells, sand, coral sand, and mud. Most of the limestone layers in all parts of the earth were once shell or coral sand and mud.

**Natural sources of calcium:**

1) **Mineral sources:**
- Quick Lime (churnaka)
- Chalk (khatika)
- Talc (Dugdhapashana)
- Selenite (Godanti)
- Magnesium Silicate (kousheyashma)
- Fossile Norinite (Badarashma)

2) **Animal source and Marine Originates:**
- Cuttle Fish (Samudrafen)
- Oyster Shell (Shukti)
- Concha (Shankha)
- Cowrie (Kapardika)
- Antlers (Mrigashringa)
- Egg-Shell (Kukkutandatwak)
- Goat’s Bone (Ajasthi)
- Coral (Pravala)
- Pearl (Mouktika)

3) **Plant Sources:**
- Arjuna (Terminalia arjuna)
- Karanja (Pongamia glabra)
- Arka (Calotropia procera)
- Kutaja (Holarrhena antidysenterica)
- Kumari (Aloe vera)
Calcium is essential to all living things, especially human beings and other animals. It is vital from the growth and maintenance of the bones and teeth, and it helps the blood to clot and the muscles to contract. The metabolism of calcium and its exchange takes place between gut, plasma, bone and kidney. The regulation of plasma calcium is under influence of parathyroids, calcitonin and T₃-T₄ hormones of thyroid, glucocorticoids and sex hormones viz. androgens and oestrogens.

Calcium Compounds are categorized under the name Sudha varga. Thus the Sudha varga in context of Rasashastra means a group of medicinal substances which are basically calcium compounds. In texts of Rasashastra Bhasmas of Shankha has been described as a great source of Calcium. The texts described many formulations containing Shankha Bhasmas. In the text Yogratnakar mentioned a typical Shankha Nabhi Bhasma to prepare the formulations in Netrarogchikitsa e.g. Chandrodhayavarti, Shashikalavarti, Nayanashan anjan. So there is need to find out root cause of use of typical Shankha Nabhi (Inner core of conch) bhasma by comparing with its Avartana (spiralled out extension of the inner core of conch) Bhasma by modern analysis techniques.

OBJECTIVES:

The process involves few steps – the end product of every step will be tested by Ayurvedic parameters and modern pharmaceutical tests as follows

1) To purify Shankha Avartana and Shankha Nabhi by Shodhan technique.
2) To Analise the impure & pure samples of Shankha Avartana and Shankha Nabhi by modern Analysis techniques i.e. XRF.

Objectives:

1) To find out impurities in Shankha Avartana and Shankha Nabhi & effect of Shodhan procedure on the impurities.
2) To prepare Shankha Avartana Bhasma and Shankha Nabhi Bhasma to compare percentage of calcium and detection of other elements in both Bhasmas.

REVIEW OF LITERATURE:

Shankha -

Synonyms:

Shankha i.e. Conch has numerous synonyms in Sanskrit like: Samudraja, Kambu, Kshudra, Sunanda, Shankhanaka, Trirekha, Dirghanada, Kamboja.

English:

Conch.
Scientific Name:
Strombus gigas – Queen Conch. (Phylum – Mollusca)

Occurrence:
Conches live on the floor of tropical seas. There are many kinds of conches. But in North America, the word conch most commonly means the queen conch, also called the pink conch. The conch ranges from Bermuda, the Bahamas, and the Florida Keys of the West Indies. It grows to a length of about 1 foot.

Characteristics:
Conch is a large sea snail with a heavy, spiral shell. The shell varies widely in color from white to pink, yellow and orange and hornlike knobs. The flesh of the queen conch is valued as food and as fish bait. For thousands of years, people have used conch shell as trumpets.

In India, in ancient times, the blowing of conch shell was practiced during wars, to frighten the enemy. In Hindu prayers conch shell is a symbol of Akash (space, one of the Panchamahabhutas). It is believed that blowing of conch shell averts the evil powers. The external shell is formed as a spiralled out extension of the inner core.

Properties of calcium:
- Atomic No. : 20
- Atomic Wt. : 40.08
- Chemical Symbol : ‘Ca’
- Group of Elements : “Alkaline earth metals”
- Melting Point : 839°C
- Boiling Point : 1484°C

Chemical composition:
Calcium carbonate – CaCO₃ along with organic elements.

Varieties:
Two varieties viz. Levorotatory i.e. Vamavarta and Dextrorotatory i.e. Dakshinavarta are mentioned, of which the latter one is supposed to be auspicious. If the pointed mouth-like portion is held in front the tall like portion backwards and the opening slit upward, then these varieties can be recognized easily. The levorotatory variety is most common while Dextrorotatory is rare.

Properties and Usage:
Shankha Bhasma i.e. incinerated conch shell, is hot in potency, Astringent in property and is the drug of choice for hyperacidity (amalapitta) peptic ulcer (parinama hula). It stimulates the appetite, improves digestion, eliminates flatulence and averts vomiting. It is a potent Astringent,
hence beneficial in diarrhea, dysentery and chronic colitis. It ameliorates acne, improves complexion and also augments the strength. The dextrorotatory variety, which is rare, is supposed to have divine powers, which are described in the texts.

**Dosages:**

240 – 280 mg, with proper vehicle

**Formulations:**

Agnikumar, Kamdudha, Pravalpanchamrit, Shankhavati, Shankhdara, Loknathras, Prataplangeshwar, Vantihridras, Mahashankhavati, Chandrodaya Varti, Nayanashan anjan, Shashikalavarti, Shankhadiavati, Kataphaladi anjan, Muktadi mahaanjan.

**Dolayantra:**

An earthen vessel is taken and two holes are made on both side of the neck of vessel in which a rod is put. The vessel is filled half with the required liquid. The substance (to be processed) kept in cloth pouch is bound with strings to the rod so that the pouch may stay swinging in the liquid. Then the vessel is subjected for slow heating. This apparatus is known as Dola Yantra i.e. swing apparatus.

An earthen vessel wel roasted in fire, should be selected. The holes on the both sides of its neck should be done delicately, so that it will not crack the vessel. The wooden rod is used, should be sturdy. The pouch used should be either cotton or silk, but not of synthetic material which may get melt with the heat. The pouch should be tied fit and should have four layers of cloth. The thread used to suspend the pouch, should be made up of silk. The pouch should be suspended in such a way, that it will not touch the bottom, but should be completely immersed in the liquid.

The procedure of heating should be slow. When the liquid in an earthen vessel starts boiling, the heat should be still curtailed if required. The liquid is to supposed to be boiling steadily. The liquid in the apparatus is replenished as and when necessary. The boiling liquid in the vessel comes in the contact with the drug material in the pouch during this Sweden procedure. (3)

**Gajaputa:**

The structure of gajaputa is similler to that of Mahaputa. The only difference is in its dimensions and number of cow – dung cakes used. Gajaputa is an underground cavity measuring 2’x2’x2’ in length, breadth and depth. About 250 cow – dung cakes are placed at the base on which the crucible is kept for heating. Moreover, 125 cow-dung cakes are placed on the upper surface of the crucible, covering it on all sides. The cow-dung cakes are ignited and crucible receives heat from all sides. On cooling on its own (Swanga shita), the crucible is taken out and the drug
The substance gets ready in a form of optimum paka. The temperature in Gajaputa ranges between 800°C to 1000°C.

**Usage**

Gajaputa is used to prepare bhasma like Vajra Bhasma (incineration of Diamond), Abhraka bhasma (incineration of mica) and Shankha bhasma (incineration of conch) etc.

**Marana**

This word is derived from the original Sanskrit root ‘Mri’ which means to die. The casual form of this root becomes Marayati which means to kill. The casual noun becomes Marana which means killing. The basic concept behind these is very simple. The metals and minerals are subjected to various experiments so as to convert them into such a form so that it will not be converted back to the original form and which will be easily absorbed and assimilated in the body. As the original form of metals and minerals is irreversible changed, the word Marana, process of ‘killing’, is used. Another word viz. Bhasma is often used to indicate the final product after the process of Marana. The meaning of word Bhasma is Ash. Plant material, when it is subjected to heat is converted into ash. From which original substance cannot be regained. In the similar way most of the ‘Marana’ processes consist of applying intense heat to minerals and they are converted into irreversible form and therefore termed as ‘Bhasma.’

Marana or Bhasmikaran (process of preparing Bhasma) usually consist of three different steps. These are:

1) Pulverization
2) Mixing of liquid substances
3) Controlled heating

1) Pulverization:

The ‘Purified’ substances is first converted into fine powder. Depending upon the quantity, many instruments can be used ranging from simple mortar and pestle to mechanized electrical pulverizers. Aim of this process is to reduce particle size. Reduction in the particle size creates more available surface for conversion process. It also enhances absorption from the G.I. tract. As this process is carried out on ‘purified’ substances, most of them are already in brittle form. In fact to make substances brittle is one of the objectives of ‘purification’ processes. This process is carried out till one gets fine and uniform powder.

2) Mixing of liquid substances so as to assimilate them in the powdered substances:

This process is very important one. Terminologically this is called AS ‘Bhavana’. The powdered substance taken in a stone mortar is completely covered with the liquid substance and the

---

Amol et al. / Pharma Science Monitor 8(3), Jul-Sep 2017, 44-54
mixture is gradually and slowly triturated using adequate force. This is continued till all the liquid substance is dried up or absorbed into the original substance. This process is useful in two ways. It is a firm belief of Ayurveda that properties of liquids used for this purpose are incorporated in the final product.

3) Controlled heating:
This is the most important part of Marana. After the previous procedure, the semisolid substance is ready for heating. It is first converted in to round slices of suitable size and dried. These slices are called as ‘chakrika’. Usually they are kept in the closed vessel and heated for a definite number of times. In few cases the finally powdered mixture after the bhavana process is subjected to heat in open air. Chemically the conversion occurring in the substance is in the form of oxides as there is abundant supply of air. The mode of heat and amount of heat had been decided by the ancient research workers. For controlling the temperature and time for which heat is given, the ancient workers had used type of fuel and quantity of fuel to be used as measures. Because of heat given in particular way, the original metallic and mineral substance is converted into such a form so that when used internally it gets absorbed from the G.I. tract very easily and is effective in small dosage.

MATERIAL AND METHODS

Year of experimentation: 2017

A. Raw Material Procurement

500 gm of Conch shell was procured from Bhaishajyam Ayurveda Aushadhalaya, kharghar Navi Mumbai.

B. Raw material Testing/ Analysis

1) By Ayurvedic Parameters.

2) By Modern parameter.

1) By Ayurvedic Parameters.

1) Rekhapurnatva:

Rekha means line pattern of ridges on tips of fingers. Purnatva means filling. When the Bhasma is handled in between the tips of fingers, the pattern of ridges on the finger tips can be clearly seen. This indicates that the Bhasma prepared in fine enough for ingestion.

2) Varitaratva:

Vari means water. Taratva means ability to float. When the Bhasma is slowly sprinkled over steady surface of water, it floats over it. It is obvious that for this test to be positive the Bhasma must be so fine that after it is sprinkled on water, the combined force created due to its weight.
and gravitation is less than the surface tension of water. This test cannot be applied to such Bhasma which are completely or partially soluble in water. For obvious reason.

3) Unam or uttam test:

The word Unam is probably derived from the original word Unnam as a colloquial spoken form which means to hangover or appear. The word Uttam means the best. The test itself demands that if the Bhasma to be tested is sprinkled over water it should float over the surface and if a good grain is kept over the spread Bhasma it also should float as swan floats over surface water.

4) Nirdhumatva:

It means smokelessness. If a small quantity of prepared Bhasma is put over fire, it should not produce any smoke. The implied meaning of this test is, it should not contain any organic matter in free state indicating sufficient amount of heat had been applied during preparation of the Bhasma.

2) By Modern parameters.

1. XRF

1. XRF = X-ray Fluorescence:

- The x-ray Fluorescence spectroscopy is first discovered in 1895 by the German Physicist Wilhelm Conrad Roentgen
- X-ray Fluorescence is the emission of characteristic “secondary” or fluorescent X-Rays from a material that has been excited by bombarding with high energy X-Rays or Gamma rays.
- The phenomenon is widely used for elemental analysis and chemical analysis.
- It is used for Macro analysis for any element from atomic No.11 to 92 (Sodium to Uranium) and up to hundred PPM (lowest range) 100% analysis can be done.(4)

C. Purification of raw material

1) Purification of Shankha Nabhi.

2) Purification of Shankha Avartana.

1) Shankha Avartana i.e. spirelled out extensions of all shankha were removed from its nabhi i.e. inner core

2) Pieces of Shankha Avartana and Shankha Nabhi’s were put seperately in different cloth Pouch.

3) Two Dola yantra were prepared.
4) These two cloth pouch each containing Pieces of Shankha Avartana and Shankha Nabhi’s streamed with lemon juice in different dola yantra for 12 hours.
5) After 12 hours both cloth pouch taken out of dolayantra and contents were removed from pouch and washed with hot water. (5)

D. Preparation of:

1) Pure Shankha Nabhi Bhasma and Shankha Avartana
   Bhasma
2) Impure Shankha Nabhi Bhasma and Shankha Avartana
   Bhasma.

   a) Purified pieces of Shankha Avartana and Shankha Nabhi were properly sealed in two different saucers.
   b) Similarly, Impure pieces of Shankha Avartana and Shankha Nabhi were properly sealed in two different saucers.
   c) All these saucers dried in the sunlight and subjected to heating for giving one gajaputa.
   d) After cooling of Gajaputa, all saucers were taken out carefully and Corrosponding Bhasma from all four saucers were collected in four different containers.(6&7)

OBSERVATIONS AND RESULTS

OBSERVATIONS:

1) Wt. of Pure Shankha Avartana: 130gms
   Wt. of Pure Shankha Avartana Bhasma: 83.12gms
   Total Wt. loss during procedure: 46.88gms
2) Wt. of Pure Shankha Nabhi: 130gms
   Wt. of Pure Shankha Nabhi Bhasma: 83.87gms
   Total Wt. loss during procedure: 46.13gms
3) Wt. of Impure Shankha Avartana: 170gms
   Wt. of Impure Shankha Avartana Bhasma: 126.19gms
   Total Wt. loss during procedure: 46.13gms
4) Wt. of Impure Shankha Nabhi: 170gms
   Wt. of Impure Shankha Nabhi Bhasma: 150.25gms
   Total Wt. loss during procedure: 19.75gms.
## RESULTS

### Table No. 1

**Analysis of Ashuddha Shankha Avartana Churna:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass %</th>
<th>2 sigma</th>
<th>Intensity [cps/uA]</th>
<th>Formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>K</td>
<td>70.216</td>
<td>0.104</td>
<td>21.5999</td>
<td>CaO</td>
<td>98.246</td>
</tr>
<tr>
<td>Iron</td>
<td>K</td>
<td>0.254</td>
<td>0.045</td>
<td>0.591</td>
<td>Fe2O₃</td>
<td>0.362</td>
</tr>
<tr>
<td>Copper</td>
<td>K</td>
<td>0.465</td>
<td>0.040</td>
<td>2.168</td>
<td>CuO</td>
<td>0.583</td>
</tr>
<tr>
<td>Zinc</td>
<td>K</td>
<td>0.280</td>
<td>0.087</td>
<td>1.566</td>
<td>ZnO</td>
<td>0.349</td>
</tr>
</tbody>
</table>

### Table No. 2

**Analysis of Ashuddha Shankha Nabhi Churna:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass %</th>
<th>2 sigma</th>
<th>Intensity [cps/uA]</th>
<th>formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>K</td>
<td>70.038</td>
<td>0.243</td>
<td>23.680</td>
<td>CaO</td>
<td>97.197</td>
</tr>
<tr>
<td>Iron</td>
<td>K</td>
<td>0.251</td>
<td>0.046</td>
<td>0.645</td>
<td>Fe2O₃</td>
<td>0.359</td>
</tr>
<tr>
<td>Copper</td>
<td>K</td>
<td>0.586</td>
<td>0.048</td>
<td>2.999</td>
<td>CuO</td>
<td>0.733</td>
</tr>
<tr>
<td>Zinc</td>
<td>K</td>
<td>0.371</td>
<td>0.259</td>
<td>2.277</td>
<td>ZnO</td>
<td>0.462</td>
</tr>
</tbody>
</table>

### Table No. 3

**Analysis of Ashuddha Shankha Avartana Bhasma:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass %</th>
<th>2 sigma</th>
<th>Intensity [cps/uA]</th>
<th>formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>K</td>
<td>71.468</td>
<td>0.037</td>
<td>25.451</td>
<td>CaO</td>
<td>99.584</td>
</tr>
<tr>
<td>Iron</td>
<td>K</td>
<td>0.011</td>
<td>0.023</td>
<td>0.030</td>
<td>Fe2O₃</td>
<td>0.016</td>
</tr>
</tbody>
</table>

### Table No. 4

**Analysis of Ashuddha Shankha Nabhi Bhasma:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass %</th>
<th>2 sigma</th>
<th>Intensity [cps/uA]</th>
<th>formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>K</td>
<td>70.496</td>
<td>0.080</td>
<td>26.492</td>
<td>CaO</td>
<td>98.639</td>
</tr>
<tr>
<td>Iron</td>
<td>K</td>
<td>0.525</td>
<td>0.049</td>
<td>1.490</td>
<td>Fe2O₃</td>
<td>0.751</td>
</tr>
</tbody>
</table>
Table No. 5
Analysis of Shuddha Shankha Avartana Bhasma:

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass%</th>
<th>2 sigma%</th>
<th>Intensity [cps/uA]</th>
<th>formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>K</td>
<td>0.185</td>
<td>0.044</td>
<td>0.136</td>
<td>SO₃</td>
<td>0.395</td>
</tr>
<tr>
<td>Calcium</td>
<td>K</td>
<td>70.811</td>
<td>0.084</td>
<td>30.625</td>
<td>CaO</td>
<td>99.078</td>
</tr>
<tr>
<td>Zinc</td>
<td>K</td>
<td>0.125</td>
<td>0.028</td>
<td>0.991</td>
<td>ZnO</td>
<td>0.156</td>
</tr>
</tbody>
</table>

Table No.6
Analysis of Shuddha Shankha Nabhi Bhasma:

<table>
<thead>
<tr>
<th>Element</th>
<th>Line</th>
<th>Mass%</th>
<th>2 sigma%</th>
<th>Intensity [cps/uA]</th>
<th>formula</th>
<th>Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>K</td>
<td>71.245</td>
<td>0.013</td>
<td>30.743</td>
<td>CaO</td>
<td>99.686</td>
</tr>
</tbody>
</table>

DISCUSSION & CONCLUSION
Analysis of Ashuddha Shankha Avartana Churna showed presence of Iron, Copper, Zinc along with Calcium-the major content. If Calcium content in Ashuddha Shankha Avartana Churna, Ashuddha Shankha Nabhi Churna, Ashuddha Shankha Avartana Bhasma, Ashuddha Shankha Nabhi Bhasma, Shuddha Shankha Avartana Bhasma, Shuddha Shankha Nabhi Bhasma, are compared it is found highest in Shuddha Shankha Nabhi Bhasma. This also shows that shodhan procedure has some effect on elements other than calcium. In Yogaratnakar, in some of formulations shankha churna is said to be taken & in some a special mention of Shankha nabhi must be taken. This indicates that ancient acharyas might be knowing the particular action of these two, hence the difference in indications. Whether action of only calcium has been expected in these formulations containing shakha nabhi, needs further research. The above analysis shows the composition of each bhasma and might be considered for future reference in other batches.

REFERENCES