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PHARMACEUTICAL CHARACTERIZATION & PHARMACOLOGICAL CONSIDERATION OF SHANKHA BHASMA: AN AYURVEDIC FORMULATION

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ABSTRACT

Ayurveda is Indian system of traditional medicine which has its roots to natural principles viz. *panchatatva*, *tridosha* etc. The medicines used in this system also belongs to the natural sources viz. herbal, mineral, metals and animal origin. *Shankhabhasma* is one of the important formulations prepared from *Shankha* (Conch shell-a calcium containing compound from aquatic origin) used frequently and safely in treating various ailments by Ayurvedic physicians. Though the tedious process of preparation of *Shankhabhasma* is explained in texts, for scientific understanding of the pharmaceutical processing and pharmacological action of *Shankha bhasma*, a critical review of the *Shankha* and *Shankhabhasma* has been done from the *Ayurvedic* texts and various published articles regarding its classification (*vargikarana*), types, acceptable variety (*grahyalakshana*), detoxification (*shodhana*), incineration (*marana*), therapeutic values and evidence based scientific rationality behind its processing and pharmacology has been done.

Keywords:*Ayurveda*, Traditional medicine, *Shankabhasma*, *Rasashastra*, *Marana*

INTRODUCTION

Rasashastra is the science of Ayurvedic Pharmaceutics which deals with alchemy and the preparation of medicines from drugs of herbal, mineral, metals and animal origin. The drugs are classified based on usage in alchemy. *Shankha* (Conch Shell) is one such drug mentioned in *Rasashastra* under *SudhaVarga*. The word "*Shankha*" literally means "the substance which pacifies evil or calamity".[1]*Shankha* is a conical or oblong shell of a marine animal. It is available from most of the water sources. Its medicinal usage is known since Vedic era and was used to treat various ailments effectively. It has been used vividly in various formulations in *brihattrayee* and *laghutrayee*. In order to understand the pharmaceutical processing and pharmacological action of *Shankhabhasma*, a critical review of the *Shankha* and *ShankhaBhasma* has been done from the *Ayurvedic* texts and various published articles regarding its classification (*vargikarana*), types, acceptable variety (*grahyalakshana*), detoxification (*shodhana*), incineration (*marana*), therapeutic values and evidence based scientific rationality behind its processing and pharmacology has been done.

Shankha containing formulations described in *Ayurvedic* texts, used for various therapeutic purpose enlisted in Table No. 1

Table 1: Pharmacological action of *Shankha* containing compounds in *Ayurvedic* texts.

Ayurvedic Texts	Therapeutic indication of *Shankha* containing compounds
Charaka Samhita[2]	*Raktapitta, Nasagata Raktapitta, hikka, Shwasa, Kasa, Raktatisar, Visarpa, Netragata raktapitta, Rasayana,*
Sushruta Samhita[3]	*Rakta Stambhak, Lomashatan, Pittaja abhishyanda, Shuktika, Arma , Pidika, Siraj, Timir, Lekhana*
Ashtanga Hridaya[4]	*Raktatisar, Shwitra, kshatshukra, timir, drishtiprada, Nirmala drishti*
Sharangdhara Samhita[5]	*Kshaya, Kasa, Gulma, Netraroga, Shukra Roga, Romashatan Arma vartma, Drishtiprada, Arma*
RasaRatna Sammucchaya[6]	*Kshara bandha,*[21] *Kasa, Rajayakshama, Arsha, Grahani, Shoola, Gulma, Romashatan*
Rasa Tarangini[7]	*Timir, Arjun, Netra Shukra, Agnimandya, Visuchika, Sangrahani, Taridoshaja Shoola, Jeerna jwara, Yakshma, pratishyaya, Kasa, Arma, Grahani*

Vernacular names:

Sanskrit : Shankha
Hindi : Shankha
English : Conch Shell
Scientific name : *Turbinella pyrum*
Phylum : Mollusca
Higher classification : Turbinella
Rank : Species
Family : Turbinellidae
Kingdom : Animalia

Synonym: *Shankhak, Samudraja, Arnavabhava, Kambu, Kamboja, Kutijantah, Jalaja, Trirekha, Dirghanada, Pavanadhvani, Bahunada, Mahanada, Shankha, Sunaada, Sukhana, Haripriya Jalachar, Dirghagosha, Varija, Shodasavarta, Pitta*

Classification (*Vargikaran*): On the basis of its properties and usage *Shankha* has been classified in different *vargas* in different classics on the basis of its properties and use in alchemy.

Table 2: Classification of *Shankha* according to different *Ayurvedic* Texts

Reference	*Varga*
Ayurveda Prakash[8]	*Uprasa Varga, Upratna Varga*
Rasamrita[9]	*Sudha varga*
Rasarnava[10]	*Shukla Varga*
Rasendra Chintamani[11]	*Uprasa Varga*
Rasa Ratnakara[12]	*Uprasa Varga, Shukla Varga*
Rasendra Sara, Sangraha[13]	*Uprasa Varga*
Dhanvantari nighantu [14]	*Uprasa Varga, Upratna Varga, Shukla Varga, Chandanadi Varga*
Raj Nighantu[15]	*Shukla Varga, Suvarnadi varga*
Kaideva Nighantu [16]	*Dhatu Varga, Mansa Varga*
Bhavprakash Nighantu [17]	*Uprasa Varga , Upratna Varga, Dhatu Varga, Mansa Varga*
Madanpal Nighantu [18]	*Suvarnadi varga*

Table 3: Types of *Shankha* according to different *Ayurvedic* Texts

Types of *Shankha*	
On the basis of Morphology	*(1) Dakshinavarta, (2) Vamavarta*
On the basis of Action (prabhav)	*(1) Divya Shankha (2)Sadharana Shankha*
On the basis of Size [19]	*(1) Shankha (2) Kshudra Shankha*

Dakshinavarta Shankha is seldom seen and considered for the worship while *Vamavarta Shankha* is abundantly present and considered for the preparation of *bhasma*.

Acceptable Variety *(Grahya lakshana)*: *Shankha* which is round, smooth having a small mouth, white colour like moon, heavy is considered as best.

Detoxification (*Shodhana*): In order to remove impurities, toxins and unwanted property present in the drugs and to make them therapeutically suitable for internal administration, it is subjected to process of detoxification (*shodhana*). *Shankha* is broken into small pieces and made a poultice which is subjected to different media and boiled for given time.

Table 4: Showing various methods of Detoxification (*Shodhana*) of *Shankha*[20, 21, 22]

References	Materials	Method	Time Period
Ayurveda Prakasha	*Amla rasa, Kanji*	*Swedana* in *Dolayantra*	1 Yama
Rasa Tarangini	*Kanji*	*Swedana* in *Dolayantra*	1 Yama
Rasa Tarangini	*Jayanti swarasa*	*Swedana* in *Dolayantra*	1 Yama
Rasa Tarangini	*Jambira vari*	*Swedana* in *Dolayantra*	4 Yama
Rasa Tarangini	*Nimbukamla*	*Swedana* in *Dolayantra*	½ Yama
Rasa Tarangini	*Tanduliya jala*	*Swedana* in *Dolayantra*	1 Yama
Rasayana Sara	*Gomutra, Lavana* and *Nimbu*	*Swedana* in *Dolayantra*	1 Yama

Incineration (*Marana*): The *ShodhitaShankha* pieces are cleaned with hot water and dried. Then the pieces are directly placed into *SharavaSamputa* and given *Puta.* The obtained material is impregnated with liquids indicated, made into pellets, dried, packed in *SharavaSamputa* and subjected to *Puta*.

Table 5: Various methods of Incineration (*Marana*) of *Shankha*

References	Materials	Method
Rasa Tarangini	*Shudha shankha*	*3 Gaja puta*
Rasendra Sara Sangraha[23]	*1 Pala shudha shankha with ½ masha tankana*	*Andhamusha*
Ayurveda Prakasha	*Bhavana* with *nimbu swarasa*	*Laghu puta*
Rasayana Sara	*Shudha shankha*	*1 Gajaputa*
Rasamitra	*Puta* with *bhavana of kumari swarasa*	*3 Gaja puta*

Table 6: Pharmacological properties of *ShankhaBhasma*:

Rasa	*Madhur, Kashaya, madhur, Katu, Kshara*
Guna	*Laghu, Lekhana, Khara, Kshara, Hima*
Virya	*Sheeta, Anushna, Ushna*
Vipaka	*Madhura, Katu*
Effecton*Dosha*	*Tridoshgna, Pitta kapha nashak, Kapha pitta Nashak, Dushta Rakta nashak*

Therapeutic Indication: *Grahani doshahara, Parinama Shoolahara, Raktapittahar, Atisara, Ajirnahara Shoolahara, Swasanashana, Tarunyapitakanuth, Amlapittahara, Vishahara, Gulmahara, Udaramayam, Akshipushpahara, Mehahara, Varnya, Grahi, Balya, varnya, Tridoshhar*

Dose[24] : For internal use 2-4ratti

Anupana[25] : *Jala* or *Nimbuswarasa*.

Kalpa: *Praval panchamrita, Grahani kapata Rasa, Maha Shankha Vati, Shankha Dravak Rasa, Kaphaketu rasa, Chandrodaya Varti, Shankha Vati, Sutashekhar Rasa.*

Organoleptic Characters of *ShankhaBhasma*:[26]

Colour : Dull white/ greyish
Odour : Odorless
Taste : Astringent
Texture : Fine and smooth

It should have properties like should not produce sound while chewing *(dantagre kachkachabhav)*, should not produce nausea (*avami)*, should be fine in touch *(shlakshna),* lusture less *(nischandrika),* fine to be filled in crevices of finger *(rekha purita),* should float on water (*varitaratwa, unnam)* and should not unite and revert to its original stage when mixed with *panchamrita* drugs (*apunarbhava*, *nirutha*).

Table 7: Physicochemical testing of *Shankhabhasma*

Parameter	Value	
	Classical Puta Method	Muffle Furnace Method
Loss on drying (by oven)	0.176% w/w	0.843% w/w
Alcohol soluble extractive	1.0% w/w	0.77% w/w
Total ash	95.56% w/w	93.20% w/w
Acid insoluble ash	0.73% w/w	0.85% w/w
pH value	10.25	12.93
Ca content	46.24% w/w	44.83% w/w

X-ray Diffraction (XRD) analysis: XRD analysis revealed Calcium carbonate (Calcite) as major composition of the *Shankhabhasma*.

SEM (Scanning Electron Microscopy): The raw drug showed rod like structures while the *Shankha bhasma* showed polygonal structures. The particles of *Shankhabhasma* showed mean diameter from 320-440 nm.

ICPAES (Inductively coupled plasma atomic Emission Spectrometry): The wavelength showing highest values of intensities were selected for calculations of Ca, Mg, Hg, As, Cd and Pb.

Table 8: Elemental assay of Raw Conch Shell and Classical *Shankhabhasma*[27]

Elements	**Raw Chonch Shell**	***Shankha Bhasma***
Ca	49.24%	46.24%
Mg	0.04%	0.05%
Pb	1.87 ppm	0.78 ppm
Cd	ND	ND
Hg	ND	ND
As	ND	ND

DISCUSSION

Shankhabhasma (Conch shell) is a good calcium supplement. *Shankha's* outer epithelium contains aragonite which forms chambers. These chambers hold and bound to the crystals of aragonite, giving the *Shankha's* shell its stiffness. Its chemical constituents are carbonates of calcium, iron, magnesium sulphate, phosphate and chloride.[28] To make it free from impurities and make it suitable for the transformation to medicine *Shankha bhasma* is subjected to procedure of detoxification (*shodhana*). Different medias are used for this process like *kumari Swarasa*, *nimbuswarasa* etc. The corrosive nature of the *shodhana* medias and pressure applied during trituration might help in loosening the molecular cohesiveness and helps drugs to break into fine particles. Ayurvedic scholars have described various methods for the preparation of *sankha bhasma*. *Gajaputa* is the most used method for the preparation of *sankhabhasma*. The ideal temperature for the process of making *bhasma* (*marana*) of

sankhabhasma is around 800 °C which can be achieved easily through *Gajaputa*.[29] The *Bhasma* should not produce irritation in the mouth of user but, if irritation is produced *bhasma* should be triturated with said liquid and subjected to *Laghuputa* (500° C).[30]

The raw conch is aragonite in nature, while after incineration this aragonite structure get transformed to calcite which is better absorbed. Temperature more than 1000° C may convert calcium carbonate to calcium oxide. There is a noticeable reduction in the size of the particle after every *puta*. The physicochemical analysis indicates decrease in Acid insoluble ash gradually and increase in Acid soluble ash with number of *Puta* indicating its conversion to more assimilatory form and improves the bioavailability of drugs. *Bhasmas* have very small particle size which increases the bioavailability of the drug. Hess's law of thermodynamics and Fourier's law can be applied to the concept of *Puta* to understand the energy transfer and heat conduction. Hess's law of thermodynamics can be used to explain the exchange of heat from the *puta* to the pellets inside the *saravasamputa* and according to the Fourier's law "the time rate of heat transfer through a material is proportional to the negative gradient in the temperature and to the area." Heat flows from a hot surface to a cold surface due to temperature gradient. This explains the conduction of heat through the pellet. So, the shape of pellets is very much important. It should be flat in shape with standard thickness and not round. *Bhasmas* which are considered to have nanoparticle size are more bioavailable than their original form. Particle size analysis shows that as the number of *puta* increases, particle size decreases, making it finer.[31] Various parameters are given for the recognition of quality *bhasmas*. But *Shankhabhasma* does not comply the parameters like *varitaratva* i.e. floating on surface of water. Since the *bhasma* is hygroscopic it sinks to the bottom.

Corroborated clinical use:

Hyperacidity/ GERD: *Shankhabhasma* purified by *nimbu swarasa* was found more effective compared to *Shankhabhasma* purified by sour gruel. Hence *Shankhabhasma* prepared by the use of lemon juice is recommended as therapy for GERD.[32] Purified *Shankhabhasma* has promising cytoprotective and anti-secretary action and that may be due to its oxidative stress negating action in gastric tissue.[33] The antiulcer effect produced can be attributed the synergistic effect of calcium and other adjuvants. Pharmacological studies are done for standardization of ulcer effect and it was found have good anti-ulcer effect in aspirin induced study.[34] In one of the study *Shankhabhasma* showed dose dependent reduction of ulcer index in indomethacin treated rats as well as in rats subjected to cold restraint stress, when compared to control.[35] Formulation of *Shankhabhasma* e.g. *SutshekharRasa* is relatively more effective than *Shankhabhasma* in *Amlapitta*,[36]

Depilation activity: *Shankha Bhasma* containing *Lomashatan Kalpa* is used to remove unwanted hair from the body. A pilot study was conducted on 10 patients. Number of hairs, hair length and thickness were reduced significantly. No adverse effect was noticed on the skin.[37]

Ulcerative colitis: In one of the studies *Shankhabhasma* is also significantly effective in management of *Pravahika* (ulcerative colitis)[38]

Contraindication of *Shankhabhasma*: *Shankhabhasma* may contraindicated in patient suffering from calculus(stone) because since it is a calcium rich formulation. It may cause further complications in patient suffering from calculus.

CONCLUSION

Processed *Shankha* (Conch Shell) is used frequently in the form of *Shankhabhasma* in Ayurvedic medicine, which is very effective in ailments like hyperacidity, GERD, ulcerative colitis, depilation etc. Proper preparation of the *bhasma* (in terms of media, temperature, time and no. of repetition of procedure) is mandatory for the desired pharmacological action as there is evidence that deviation from the standard pharmaceutical procedure results in production of less potent medicines and expected clinical result is not achieved.

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