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REVIEW OF ANALYTICAL STUDY OF GODANTI BHASMA

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ABSTRACT

Godanti Bhasma is a very versatile *Ayurvedic* preparation, which became very popular due to its easy availability, cheaper cost of preparation and multiple indications. It is indicated in diseases like pain, fever, gastritis, calcium deficiency, burning sensation, cough, etc. It is globally popular as Gypsum (calcium sulfate dihydrate), which is soft, white and crystalline mineral, having colour variation due to the presence of the other elements. Few texts like *Rasa Tarangini, Rasamritum, Siddha Bhasajya Sangraha* and Rasadarpan listed it as *Rasa Dravya*. During its *Bhasma* preparation about .th of the initial material is lost. The recent experimental finding suggests it as a very promising formulation for Peptic Ulcer Disease, Pyrexia of unknown origin and also very safe in a dose dependent manner. *Godanti Bhasma* also used as a Carrier for many drugs.

KEYWORDS: *Godanti Bhasma, Rasashastra, Bhasma*, appearance, properties.

INTRODUCTION

Rasashastra is a pharmaceutical subsidiary of *Ayurveda* which mainly deals with the various aspects of metals, animal origin products, gems, minerals and toxic herbs such as their characteristics, medicinal uses and also their conversion into unique formulations, which helps in contending acute conditions or serious diseases. In *Rasa Shastra* Calcium containing compounds are included in *SudhaVarga*, which includes both *Khanijadravyas* (mineral drugs) like Godanti, *Khatika*, etc. and *Pranija Dravyas* (products obtained from the animals) like *Kukkutandatwak, Sankha, shukti, Pravala, Kaparda*, etc. In *Samhita* period *Acharya Charaka* and *Sushruta* (oldest classical texts of Ayurveda) include all metals and minerals in

Parthiva Dravya (Obtains from earth crust).*Rasamritam* has included these drugs under "*Sudha Viganeeyum*" based on its chemical composition.[1] Among all these Sudha Varg *Dravyas Godanti* is a quite known remedial *Rasadravya* and it is used in the form of Bhasma (incinerated formulation). It is a very soft sulfate mineral with the chemical formula CaSO4.2H2O. First time *Acharya Sada Nand Sharma* illuminated its medicinal importance. According to *Ayurveda, Godanti Bhasma* is propitious for *PittajJwar* (High-grade Fever), *Sirahshool* (Headache), *JirnaJwar* (Chronic Fever), *Pradar* (Leucorrhea), *Kaas* (Non-productive Cough) and *Rakta-pitta* (Bleeding disorders). Physicians also practice it for high blood pressure, headache due to hypertension, insomnia, restless leg syndrome, indigestion,

MATERIAL AND METHODS

The whole study is based on the *Rasashastra,* thesis related to topic, API textbook of Medicine and information from contemporary modern texts, available resources from the internet.

OBSERVATIONS

Physical Properties of *Godanti*[2]

Nature of *Godanti* is Crystalline showing elongated tabular crystals. Colour of *Godanti* is Greyish white. Streak of *Godanti* is White. Cleavage of *Godanti* is Perfect.

Fracture of *Godanti* Even. Luster of Godanti is Silky. Tenacity of *Godanti* is Sectile.

Transparency of *Godanti* is Translucent. Hardness of *Godanti* is 2. Specific Gravity of *Godanti* is 2 to 2.5.

Table No. 1: Physical Properties of *Godanti.*

Varga	***Shudha Varga*[4]**
Synonyms	*Godantika, Godant, Godanta, Shweta*[3] *Sanskrita :Godanta, English – Selenite, Gypsum, Gujarati – Godanti, Ghapa, Chirodi, Hindi – Godanti, Marathi – Godanti, Siragola, Tamil – Karpura Chilajattu (S.F.I.), Telugu – Hara sothamu, Urdu – Godanti (*N.F.U.M.)
Varna[4]	*Shweta*
Grahya Swaroop[4]	*Patraachitam* (present in the scaly or layered pattern) *Sumrisann* (smooth on touch) *Sharadindusunirmalam* (It should

	have the pure and shining representation just like a moon of *Sharad Ritu*) *Deeptaprabham* (lustrous)
Varities[5]	1. *Kanarupa Godanta*, *2. Talakrit Godanta*, *3. PindkritGodanta.* *4. KousheyKritGodanta*.
Guna[7]	*Lavan Rasa*(salty in taste), *Madhur Vipaki*, *Sheet veerya* (Cold in Potency)
Vyadhi Prabhav	*Pitta Jwar Nashak* (High grade fever), *Jeerna Jwarhar* (Relapsing fever), *Balya* (Tonic), *Deepana* (Appetizer), *Swas Kaas Nashak* (Reliving dyspnea & Cough), *Shirshool* (Headache), *Kshaya* (Antiobesity), *Paandu* (Anemia), *Urahkshat* (Consumption), *Baal Shosh* (infatile Cachexia), and *Shwet Pradar* (leucorrhoea).
Dose	*Rasa Taringini*, it is within 1 to 3 *Ratti* (125 mg-375 mg).[3] *Rasa Tantrasara*, it is within 2 to 8 *Ratti* (250 mg-1 gm).[8] *Rasa Darpana*, it is within. to 1 *Masha* (375 mg-750 mg).[5]
Anupan	*Madhu*, *Goghrita*, *Godugdha*, *Mishri* or as per the requirement of disease10 or with *Sudarshanachurna Kwatha*.[8]

Analytical studies

Organolepic Evaluation of *Godanti Bhasma* after *Marana* converted into creamish-white, smooth tasteless powder without odor complies the Bhasma Pariksha (*Ayurvedic* evaluation method of *Bhasma*) like Varna, Rekhapurnata and slakshnatvum etc.

Table 2: Characteristics of *Godanti Bhasma* by *Ayurvedic* Parameters.

Sr.No.	Parameter	*Godanti Bhasma*
1.	Colour	Creamish White
2.	Odour	Odourless
3.	Touch	Smooth
4.	Taste	Tasteless
5.	Apperance	Lusterless White Powder

Physico-Chemical Parameters of *Godanti Bhasma*

Table 3: Various physico-chemical Analysis of *Godati Bhasma.*

Sr.No.	Tests	Values[9]	Values[10]
1	pH Value	9.90	9
2	Loss ondrying	0.07%	0.14%
3	Total Ash	99.8%	99.87%
4	Acid insoluble ash	0.90%	0.42%
5	Water soluble exytractive (%W/W)	14.40%	31.082%
6	Alcohol soluble extractive (%W/W)	5.90%	----------

Quantitative detection of *Bhasma* contains 28.69 % (w/w) Calcium. *Bhasma* Contain Ca++, SO4 -- & Cl- ionis present. CO3 - ion is absent.

pH Value

The alkaline pH of the formulation favors dissolution under gastric conditions.

Loss on drying

The value show that in spite of formulation is mineral compound in nature it is hygroscopic. So value may vary upon the condition of storage condition.

Total Ash

It determines the quantity of non-volatile inorganic material present in the drug.

Acid insoluble ash

Acid insoluble ash is designed to measure the amount of ash insoluble in diluted hydrochloric acid.

Water soluble extractive (%w/w)

The determination of extractable matter refers to the amount of constituents in a given amount of medicinal plants material extracted with solvents.

Evalution of Flow Ability of Bhasma

A group of analytical methods are required for characterization of powder rheometer. Limits of these Powder flow measurement are shown in table No 4.

Table 4: Measurements attributes of Powder rheometer[9]

Sr.No.	Analytical Method	Measurement Limit
1.	Bulk Density	0.5-0.6
2.	Tapped Density	9-1.25
3.	Comressibility Index	0.4-0.6
4.	Hausner Ratio	1.16-1.17
5.	Angle of Response	31.4-32

Elemental determinations by EDAX analysis[11]

Elemental analysis shows qualitative & quantitative percentage of several other elements Raw *Godanti* powder (Initial substance) & *Godanti Bhasma* (Final formulation) in trace amount. These elements are as Mg, Si, and Sb. But, Ca and S are found in majority. Elemental analysis of *Godanti Bhasma* showed the increase level of Calcium and Sulphur as compared to Raw *Godanti*. This is not in actually the increase of Ca. While, this was consequence of *Shodhan* and *Marana* Process, which removed the water in the form of Hydrate and other elements in the form of oxide.[12]

Table No.5: Weight Percentage Raw *Godanti* and *Godanti Bhasma* by EDAX analysis.

Sr.No.	Elements	Raw Godanti	Godanti Bhasma
1.	Ca	23.31%	11.95%
2.	S	18.50%	11.86%
3.	O	3.0%	70.41%
4.	C	3.38%	5.78%

Phase identification by X-Ray Diffraction[13]

Value in XRD Analysis implies to the presence of Calcium in two stationary phases like, CaSO4 and CaS. This value is in range between 3.4973 for Calcium Sulphate and 2.32861211 for Calcium sulphide. X.R.D analysis of *Godanti Bhasma* shows, anhydrite CaSO4 (Orthorhombic) as major phase and CaS (Cubic) as minor phase.[14]

Table No.6: Crystal parameter of *Godanti Bhasma.*

Samples	D spacing Values	Lattice Parameter	Calcium sulphate	Calsium sulphate
Raw Godanti	7.60, 4.28, 3.79, 2.68	Monoclinic and prismatic	Rhombohrdral	----------
Godanti Bhasma	3.49, 2.85, 2.32, 2.20	Orthorombic	Orthrhombic	Cubic

Surface morphology by SEM and TEM[15]

Scanning electron microscope is a very useful tool for studying morphology of Nano-particles, calsium sulphate and calcium sulphide possess different crystal growth patterns and structure.[14]

Table N0.7: Morphological Analysis of *Godanti* and its Bhasma by SEM.

Samples	Particle size	Calcium sulphate	Calsium sulphide
Raw *Godanti*	2-6 Micrometer	Mixed Shapes of rod and rhombohederal with irregular geometry	----------
Godanti Bhasma	14-33 nanometers	Mixed Shapes of rod and rhombohrderal	Cubical

Results of SEM study showed that particle(s) size in raw *Godanti* was 2-6 micrometers and *Godanti Bhasma* particles were found in the range of 14-33 nanometers respectively. So, we can say that there was great reduction in the size of particles after 3 successive *Gajaputa*. Morphologically, particles were in cubical and orthorhombic in shape. Further, the TEM results confirmed the morphology and formation of Nano-sized particles in the Godanti Bhasma.Very minute difference seen in the particle size in these two study which is due to TEM has a higher resolution than SEM by a factor of 10 or more.

Table No.8: Morphological Analysis of *Godanti* and its *Bhasma* by TEM.

Samples	Particle Size	Calcium sulphate	Calsium sulphide
Raw Godanti	1.5-2.5 micrometer	Mixed, rod and rhombohederal with irregular geometry	----------
Godanti Bhasma	9.31nm	Mixed, rod and rhombohederal	Cubical

FTIR

Major peaks were found at 111.8, 1122.8 & 1116.1 which are in same range that confirm the presence of calcium sulphatebut the liquid mediums used were not differentiated by the infra-red spectroscopy.[16]

Nambure Phased Spot Test (N.P.S.T.)[17]

It is simple test, which helps to distinguish different calcium containing *Bhasmas* without use of any sophisticated technological equipment. In this test 50% alcoholic solution of *Haridra* (Turmeric), was absorbed on with supernatant fluid of different *Bhasmas*, develop different colored spots and the spot also differ in their fading time. It may be explained on the basis of chemical constituent presents in Haridra itself and affinity of these constituents towards the

supernatant fluid of calcium compound (s). Haridra solution contains some Phenolic constituents and several Sesquiterpenes with Enone and Dienone. Such compounds undergo variable changes in their color when fluid of different pH is applied to them. When the supernatant fluids of different calcium *Bhasmas* were applied on the Haridra test pape of color of Haridra test paper in respect to pH of the Bhasmasolution.[10]

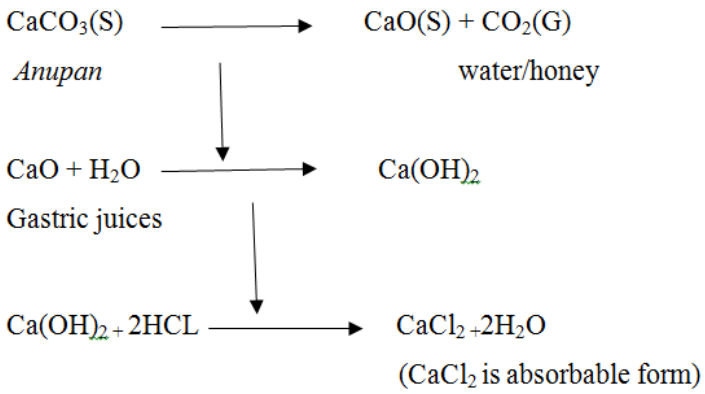
Observation of NSPT is presented in table no.9.

Table No.9: Observation of all 3 phases of *Bhasma.*

Phase 1	Phase 2	Phase 3
A think pink circle formed on a wide wet spot	Starts fading ways rapidly	The entire circle faded away within 24 hours

Metabolism and absorption of Calcium containing *Bhasmas*[18]

The calcium in cereals and green leafy vegetables are less utilized due to the presence of oxalates and phytates present in them respectively. Calcium compounds are alkaline in nature. The natural calcium preparations like *Bhasmas* are more effective than synthetic calcium due to the reason that, they contain easily absorbable and assimilable form of oxide an they also contain other trace elements such as magnesium, copper, zinc etc. Irrespective of the gastrointestinal condition they do exhibit their efficacy unlike synthetic molecules which cannot be absorbed in unhealthy gut conditions such as indigestion, chronic gut motility disorders and hormonal imbalances. The additional advantage of *Bhasmas* of *sudhavarga Dravyas* is that they exhibit other therapeutic actions such as correcting indigestion and properties like antacid, ulcer healing and antispasmodic properties which cannot be expected with synthetic molecules. The absorbability of calcium compound *Bhasmas* which are in oxide form may be explained as below.



Exceeding the recommended daily calcium intake for an extended period of time can result in hypercalcemia and calcium metabolism disorder. *Godanti Bhasma* was evaluated for its toxicity, antiulcer and antipyretic activity in experimental animals.

Acute toxicity studies[19]

The LD50 of *Bhasma* as per OECD guideline falls under class IV does no signs of acute toxicity up to a maximum dose of 2000 µg/kg. There were no changes observed in normal behavioral pattern and no signs and symptoms of toxicity and mortality were detected. Acute oral administration of *Godanti Bhasma* showed no mortality in mice in the period of 14 days.

Antiulcer studies[19]

The experimental paradigms used for antiulcer activity were cold restraint stress induces ulcer model[20] and diclofenac induced ulcer model[21] in rat. *Godanti Bhasma* at the doses of 250 and 500 µg/kg produced significant ($p < 0.001$) reduction in ulcer index as compared to control. It is interesting to note that *Godanti Bhasma* at 500 µg/kg dose shows comparable activity to 250 µg/kg dose as difference was not significant at $p > 0.05$. The activity was less than that of ranitidine. The biochemical estimation showed reduction in thiobarbituric acid reactive substances (TBARS).[22,23] content of stomach tissue in *Godanti Bhasma* treated group: No significant difference was noted in serum calcium activity between the groups.

Antipyretic studies[24]

Yeast induced pyrexia model in rat [25]was used for antipyretic activity. The subcutaneous injection of yeast suspension markedly elevated the rectal temperature. Treatment with *Bhasma* at the dose of 250 and 500 µg/kg body weightdecreased the rectal temperature of the rats but not in a dose dependent manner. The antipyretic effect started from first hour was maintained for 4 hrs after administration of the Bhasma.

The result obtained from both the standard and Bhasma treated rats were compared with the control group and a significant reduction ($p > 0.001$) in the yeast induced hyper pyrexia was observed. It is interesting to note that *Godanti Bhasma* at 500 µg/kg dose shows comparable activity to 250 µg/kg dose as difference was not significant at $p > 0.05$.

Godanti Mishran also work as antipyretic medicine at dose of 90 mg/kg in rat. But result is relative slightly lower than the standard drug (Paracetamol, 50 mg/Kg) for experiment.

Antimicrobial study[24]

Gondanti Bhasma itself has hardly shows antimicrobial activity against any potential pathogenic bacteria. But if is use with some other *Rasa Dravya* like Hartal (As3O2) it show. In vitro antimicrobial study of Hartal-Godanti Bhasma reveals in concentration of 250 mg/ ml is effectively works against gram positive bacteria.

Summarized study is shown in table 10.

Table No.10: Antimicrobial study of *Hartal-Godanti.*

Sr.No.	Bacterium Strain	250 mg/ml	150mg/ml	100mg/ml
1.	*Streptococcus pneumoniae*	100%	0%	0%
2.	*Staphylococcus aureus*	50%	0%	0%
3.	*Klebsiella pneumoniae*	50%	0%	0%
4.	*Pseudomonas aeruginosa*	25%	0%	0%

Similarly, *Godanti Mishran* showed significant potent antimicrobial effect against Styphylococcus aureus in different concentration, 1000 µg/ml, 500 µg/ml, 250 µg/ml and 125 µg/ml. In case of *E.* Colihigh concentration is required i.e, 1000 µg/ml & 500 µg/ml.

CONCLUSION

Godanti is included in the *Rasa Shastra* in modern era. Therefore, it is only use for *Dehavada* not for *Dhattuvada*. *Nimbu* and *Dronpushi* (*Leucas cephalotes*) *Swarasa* (Juice) is used as media for *Shodhana* of *Godanti*. Either Neem *swarasa* or *Grahitakumari Swaras* is used as treatment media for *Marana*. Whole processing gets only 25 % loss in actual initial weight. It can be easily made by traditional puta method or by contemporary method by electric furnace. Mild alkaline nature *Bhasma* is good for faster absorption in mammalian body. It has no antibiotic like action but prove role in ulcer healing and antipyretic agents.

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