



## Gandhaka Taila, Its Analytical Evaluation

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### Abstract:

Gandhaka Taila is a herbo-mineral preparation explained in various classical texts, mainly indicated in kushta. When the texts of Rasa Shastra were scrutinised, the nomenclature, Gandhaka taila is seen to be given for various preparations. The method of preparation is similar to that of Gandhaka Druti. Interestingly Rasendra Chintamani and Rasatarangini have explained a unique preparation of Gandhaka Taila. 3 batches of Gandhaka Taila were prepared to develop SOP (standard Operative Procedure) and samples were analysed with suitable analytical parameters. The 3 samples of Gandhaka Taila prepared showed almost similar results in all the analysis carried out.

**Key words:** *gandhaka, gandhaka taila, analysis*

### Introduction:

Rasa Shastra is an integral part of Ayurveda, considering Lord Shiva as the creator of this Shastra. According to the classical texts of Rasashastra, aushadhi (medicines) are classified into Rasoushadhi (herbo-mineral/herbo-metallic preparations) and kashtoushadhi (herbal formulations). Rasoushadhi gained much importance due to its properties like, small dosage, palatability, quick action, and their lesser duration of administration.

Gandhaka (Sulphur), the most abundantly used drug among uparasa (a group of drugs in rasashastra) is well known for its efficacy in curing various diseases<sup>1</sup>. Gandhaka is been given prime importance along with parada, as it forms a base for various rasoushadhi. Shuddha Gandhaka (purified sulphur) has various qualities like rasayana, deepana, pachana and it is indicated in kushta, kandu, visarpa, dadru, krimi, visha etc. Shuddha Gandhaka is indicated both internally as well as externally.

Gandhaka Taila is a herbo-mineral preparation explained in various classical texts, mainly indicated in kushta, kshaya, pandu, swasa, kasa, shula, grahani<sup>2</sup>. Various references are available for the preparation of Gandhaka Taila. Some of the procedures for Gandhaka Taila are similar to the preparation of Gandhaka Druti. In Rasendra Chintamani, a preparation of Gandhaka Taila is explained where the process it undergoes is similar to that of preparation of a ghrita, under the context of Gandhaka Taila<sup>3</sup>.

Gandhaka after shodhana karma, in fine powder, is added into boiling milk, mixed well and kept for self-cooling. After cooling, little quantity of curd is added into the milk to prepare the curd. By churning curd the butter obtained is melted to get Gandhaka Ghrita. The obtained ghrita (ghee) is named as Gandhaka Taila. This formulation is indicated in kushta for both internal and external administration.

### Materials and Methods:

All the required ingredients of Gandhaka Taila were procured, identified and authenticated to be of good quality, with the help of classical and modern physico-chemical parameters, prior to their use.

Pharmaceutical study

Table no: 1 showing list of ingredients

Name Of The Drug	Description	Purpose
Ashudhdha Gandhaka	Sulphur (S)	Shodhana of Gandhaka
Go Ghrita	Cow Ghee	
Go ksheera	Cow milk	
Shudhdha Gandhaka	Sulphur	Preparation of Gandhaka Taila
Go ksheera	Milk	
Dadhi	Curd	
Jala	Water	

Gandhaka taila was prepared in 3 batches following same procedure under similar conditions in order to develop SOP and to fix analytical standards.

20 litres of milk was taken in a mud pot and kept for boiling in mild fire. When foam started to appear at 100<sup>0</sup>C, finely powdered Shuddha Gandhaka of 500 gm was added and stirred well. After swanga sheetha (self-cooling), 1 litre of curd was added and the mixture was kept for fermentation. After complete curdling of milk, obtained curd was shifted to another vessel that was yellowish white in colour. In the bottom of pot, some sulphur was found that was precipitated.

The obtained curd was subjected to process of manthana (churning) by using wood churner. Gradually butter started to appear. After complete formation of butter, it was collected and weighed. After churning, the butter obtained was semisolid with the characteristic odour of sulphur with slight increase in pH of 5.6. All the features remain same after cleaning butter except pH which was 6.2. This obtained butter was subjected to mild heat and liquefied. It was later filtered using Cora cloth to obtain a condensed liquid form like Ghrita known as Gandhaka Taila.

All the samples took approximately 5 hours to boil the milk, 5 hours for swanga sheetha, 72 hours for fermentation and 5 hours taken for manthana process. 20-30 minutes for melting of butter.

Analytical study

All the 3 samples were analysed as it was essential to assure the quality of final product. We have followed organoleptic characters, physicochemical characters and advanced instrumental techniques of analysis such as FT IR<sup>4</sup>, GC MS<sup>5</sup>, ICP OES<sup>6</sup>, particle size analysis. Particle size analysis was done by laser diffraction method<sup>7</sup>.

### **Result:**

**Table no: 2 showing results of Gandhaka taila preparation**

Sample	Quantity of Gandhaka	Quantity of milk	Quantity of curd obtained	Quantity of water added	Quantity of Navaneetha obtained	Final outcome
Sample 1	500 gm	20 litres	20.900 litre	5 litre	550 gm	299 gm
Sample 2	500 gm	20 litres	20.950 litre	5 litre	660 gm	335 gm
Sample 3	500 gm	20 litres	20.900 litre	5 litre	720 gm	360 gm

Organoleptic characters

**Table No: 3 showing organoleptic characters of gandhaka taila.**

Parameters	Sample 1	Sample 2	Sample 3
Colour	yellow	yellow	yellow
Odour	Of gandhaka	Of gandhaka	Of gandhaka
Taste	Madhura+	Madhura+	Madhura+
Consistency	Semisolid, oily	Semisolid, oily	semisolid, oily

Physico chemical parameters

**Table no: 4 showing the analytical study result of Gandhaka taila sample 1**

Parameters	Initial	3 months	6 months
Specific gravity	0.940	0.942	0.942
Viscosity	55.28	56.85	58.19
Refractive index	1.486	1.486	1.486
Acid value	1.671	1.720	2.222
Iodine value	6.67	38.16	74.31
Saponification value	70.032	131.21	222.26
Peroxide value	0.797	-	1.193
Rancidity test	Negative	Negative	Slightly oxidized

**Table no: 5 showing the analytical study result of Gandhaka taila sample 2**

Parameters	Initial	3 months	6 months
Specific gravity	0.916	0.916	0.918
Viscosity	52.70	52.82	53.25
Refractive index	1.485	1.485	1.485
Acid value	1.667	1.725	2.859
Iodine value	10.12	23.56	53.87
Saponification value	86.580	115.613	201.984
Peroxide value	0.780	-	0.991
Rancidity test	Negative	Negative	Oxidized

**Table no: 6 showing the analytical study result of Gandhaka taila sample 3**

Parameters	Initial	3 months	6 months
Specific gravity	0.933	0.938	0.939
Viscosity	59.64	60.02	62.13
Refractive index	1.486	1.485	1.485
Acid value	1.659	1.662	2.574
Iodine value	10.87	28.32	56.65
Saponification value	89.831	121.136	218.423
Peroxide value	0.797	-	0.997
Rancidity test	Negative	Slightly oxidized	Completely oxidized

**Instrumental parameters**

**Table no: 7 showing results of GC MS profile of gandhaka taila**

Parameters	Sample 1	Sample 2	Sample 3
Caproic acid	0.74%	0.77%	0.87%
Caprylic acid	0.65%	0.88%	0.71%
Capric acid	1.75%	2.71%	1.78%
4-Decenoic acid	0.19%	0.21%	0.19%
Lauric acid	2.53%	4.81%	2.65%

Tridecanoic acid	0.06%	0.26%	0.05%
Myristic acid	10.03%	10.97%	10.70%
Myristoleic acid	0.90%	0.80%	0.88%
Pentadecanoic acid	1.27%	1.98%	1.37%
12-methyl tetradecanoic acid	0.46%	0.32%	0.51%
Palmitic acid	35.96%	32.90%	37.05%
Palmitoleic acid	1.56%	1.23%	1.44%
14-methyl hexadecanoic acid	0.76%	0.74%	0.81%
Margaric acid	0.60%	0.70%	0.63%
Stearic acid	14.55%	12.95%	15.99%
Oleic acid	21.98%	23.05%	19.58%
Vaccenic acid	3.57%	1.43%	3.20%
Methyl-11,14-octadecadienoic acid	1.36%	2.75%	1.26%
Linolenic acid	0.25%	0.19%	0.34%
9,12 octadecadienoic acid	0.20%	0.16%	0.23%
Archidic acid	0.29%	0.20%	0.28%
Lignoceric acid	0.12%		0.11%
Behenic acid	0.21%		0.19%

**Table no: 8 showing particle size analysis value of Gandhaka Taila Sample 1**

Peaks	Diameter	% Volume	Width (nm)
Peak 1	6.67	100	16.79
Peak 2	0.000	0.0	0.000
Peak 3	0.000	0.0	0.000

**Table no: 9 showing particle size analysis value of Gandhaka Taila Sample 2**

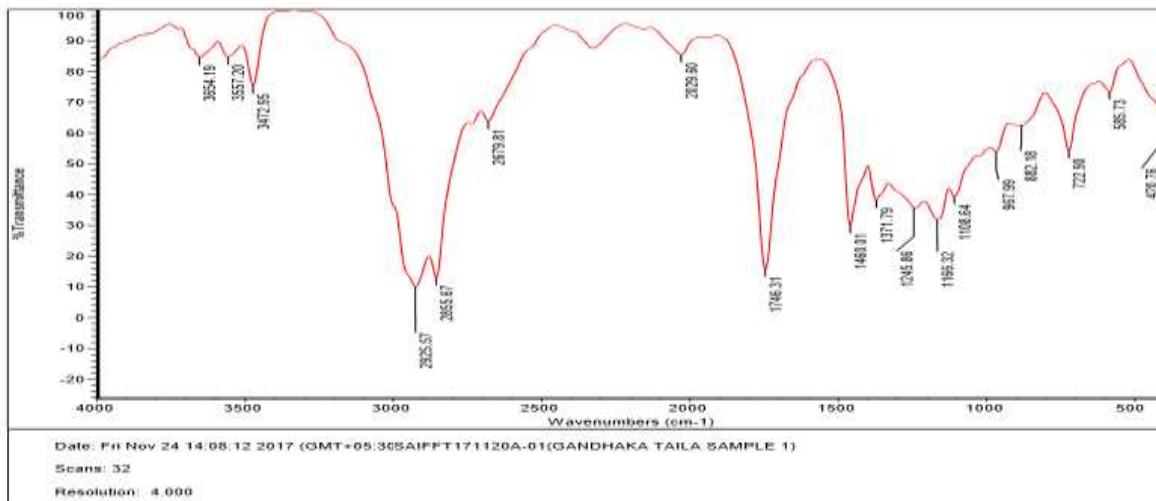
Peaks	Diameter	% Volume	Width (nm)
Peak 1	30.77	44.6	36.94
Peak 2	5.16	55.4	8.94
Peak 3	0.000	0.0	0.000

**Table no: 10 showing particle size analysis value of Gandhaka Taila Sample 3**

Peaks	Diameter	% Volume	Width (nm)
Peak 1	6.18	100	17.10
Peak 2	0.000	0.0	0.000
Peak 3	0.000	0.0	0.000

**Table no: 11 showing result of ICP AES**

Gandhaka taila	Percentage of Sulphur
Sample 1	3.21%
Sample 2	1.63%
Sample 3	4.99%



Fig

ure no: 1 showing FT IR result of Gandhaka Taila sample 1

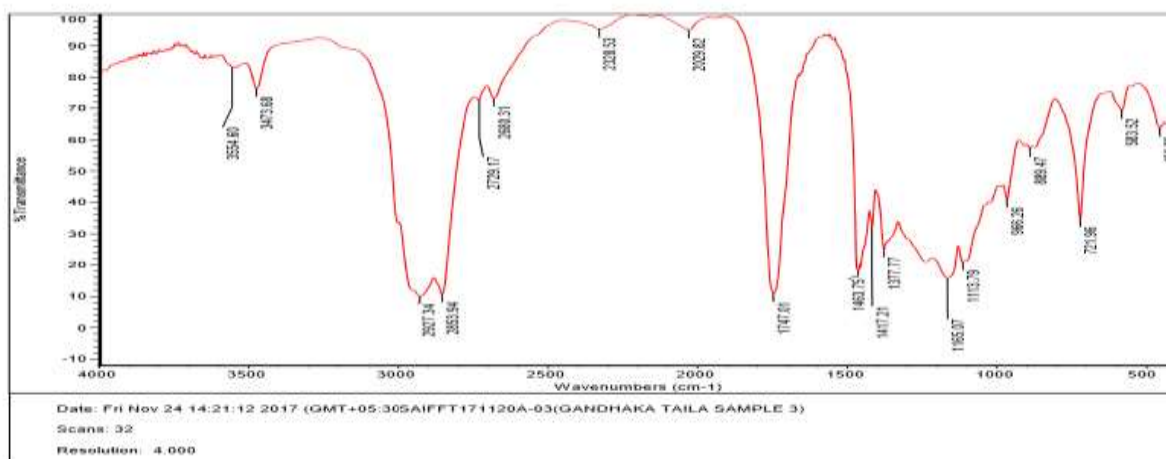


Figure no: 2 showing FT IR result of Gandhaka Taila sample 2

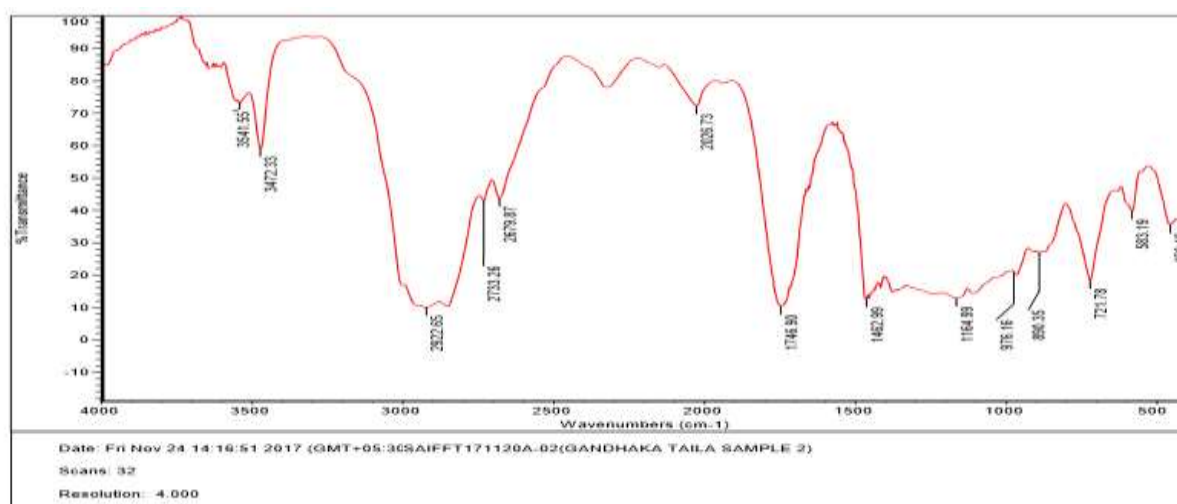


Figure no: 3 showing FT IR result of Gandhaka Taila sample 3

### **Discussion:**

All samples were yellow in colour with characteristic sulphur over it. On tasting, Madhura Rasa was perceived primarily. Consistency was unctuous semisolid.(Table 3)

Specific gravity of samples varies between 0.916-0.940 to an average of 0.9296. This result clearly indicates that specific gravity of all the samples were close to that of cow's ghee (0.93-0.94).

Viscosity of the samples was ranged between 52.70 to 59.64, with an average of 55.87. Sample 2 had

### **Comparatively Lower Viscosity And Lower Specific Gravity.**

Refractive index of all the samples were almost similar i.e. 1.485-1.486. This is slightly higher than that of pure ghee (1.4545). Presence of dissolved sulphur might have increased the refractive index of the sample.

In this study, the acid values of sample were similar with an average of 1.666. It is possible that triglycerides had undergone slightly more hydrolysis due to more contact of heat.

Iodine values of the samples were 9.22 which is quiet less than that of pure ghee (26-28).

There was no major variation in saponification value among the samples (average 82.15). However slight lower value (70.32) was observed in sample.

Peroxide value of sample was on average of 0.791. Rancidity test was negative for all samples.(Table 4,5,6)

FT-IR spectra of sample 1 showed 18 peaks and sample 2 showed only 14 peaks. Maximum 19 peaks were observed in sample 3. Most of the peak values are similar among samples, indicating FT-IR is a useful technique for standardisation of Gandhaka Taila. Most of these peaks are characteristics of cow's ghee<sup>8</sup>. Peak between 2900-3000 per cm is mostly due to C-H stretch. The FT-IR spectra showed a distinct absorption between 966-968 per cm. It is the characteristics of trans- compounds (Figure 1,2,3). This indicates the presence of TFA in samples<sup>9</sup>.

In GC MS study, Gandhaka Taila samples has almost shown 23 peaks indicating the presence of 23 different fatty acids. Largest peak with an average of 35.50% of total area was corresponding to Palmitic acid. This is followed by Oleic acid, Stearic acid and Myristic acid respectively.(Table 7)

Particle size analysis was done following laser diffraction method. All samples had 100% Nano particles with diameter ranging from 17.1-36.94 nm.(Table 8,9,10)

Concentration of sulphur varied in samples between 1.63% (sample 1) to 4.99% (sample 2) making an average of 2.28% (Table 11). This confirms the presence of sulphur in final product.

Shelf life study was carried out in 3<sup>rd</sup> month and 6<sup>th</sup> month. It was observed that specific gravity, refractive index and viscosity remained stable throughout the study. Acid value showed slight but progress increase (initially 1.671, after 3 months 1.720 and after 6 months 2.222 in sample 1, 1.667, 1.725 and 2.859 in sample 2, 1.659, 1.662 and 2.574 in sample 3). This nearly indicates that the amount of free fatty acids is progressively increasing along with time. Striking and progressive increase in iodine value was observed in all samples. This shows the increased degree of unsaturation and more tendency towards rancidity (table 4, 5, 6).

Saponification value also shows a rapid tendency of progressive increase in all the samples, indicating the tendency towards more and more hydrolysis. Peroxide value also shows increase in all the samples at 6<sup>th</sup> month even though the increase is marginal. This again shows the tendency towards rancidity (table 4, 5, 6).

Test for rancidity was negative initially, slight oxidation was observed at the end of 3<sup>rd</sup> month, but complete oxidation was observed at the end of 6<sup>th</sup> month indicating the samples are rancid. Comparatively sample 1 was more stable, as it doesn't show any oxidation in 3<sup>rd</sup> month and slight oxidation at 6<sup>th</sup> month. However, a controlled real time stability test with more frequent analysis is required to confirm the shelf life of Gandhaka Taila (table 4, 5, 6).

### **Conclusion:**

By evaluating the prepared samples using various analytical parameters, gandhaka taila samples are standardised.

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