

Pharmaceutico-Analytical Study of Soota Taila- An Inimitable Formulation

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ABSTRACT

Ayurveda is one of the oldest systems of medicines, is momentous in audience of worldwide on virtue of its holistic approach of life.

Rasashastra and *Bhaishajya Kalpana* is specialized branch in the field of *Ayurveda* which deals with pharmaceutical and therapeutic scopes, the nature possesses an immense valuable and powerful medicine in form of metals, minerals and plants.

Soota taila is unique preparation mentioned in *Rasa Ratna Sammucchaya*. This formulation is prepared like that of *dhruti* preparation, having ingredients like *Shuddha Parada*, *Shuddha Gandhaka*, *Shuddha Manashila*, *Shuddha Haratala*, *Tila taila* and *Kanjika* aid in managing conditions like *Kampavata* (Parkinson's disease), *Bahukampa*, *Shirakampa* [head tremor], *Janghakampa*, *Ekangavata* (hemiplegia) and all the various types of *vata vyadhi*'s. Physical test shows Loss on Drying at 105°C is 0.01%, Saponification value is 187.95%, Iodine value is 111.67%, Acid value is 2.02%, Peroxide value is 5.15%, Ester value is 185.93, Refractive index at 30°C is 1.451, Specific gravity is 0.9435, Weight (gm) per ml is 0.9373 gm/ml, Viscosity at 30°C is 94.6031 cP, Rancidity test (Kreis test) is Negative, Total aerobic counts is Nil, Total fungal count is Nil. FTIR analysis states: *soota taila* contains δ -lactone, Conjugated anhydride, Tertiary alcohol, Sulfone, Fluoro compound, Sulfonamide, Sulfonic acid anhydrous hydride, Ester, Sulfate, Sulfonyl chloride, Fluoro compound, Phenol, 1, 4-disubstituted or 1,2,3,4-tetrasubstituted and 1, 3- disubstituted, Halo compound. This shows the presence of organic compounds in the drugs. HPTLC Shows presence of various functional groups such as HPTLC technique major phytochemical present in the drug or formulation can be estimated. Considering all analytical parameters through the study conducted, one can conclude that *Soota Taila* may benefit in managing conditions like *Kampavata* (Parkinson's disease), *Bahukampa*, *Shirakampa* [head tremor], *Janghakampa*, *Ekangavata* (hemiplegia) and all the various types of *vata vyadhi*'s as mentioned in the classics.

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KEYWORDS: *Soota taila*, *dhruti kalpana*, *vatavyadhi*, *parkinsons disease*, *hemiplegia*

INTRODUCTION

Health and disease are coeval with life. All societies invariably looked upon to the natural resources for maintenance of health and for attaining freedom from illness.

Ayurveda is not merely a science of diseases and drugs, where it has every aspect of life in its sphere.

The main aim of this system is maintenance of good health as well as enhancing the healthy life span.

Rasashastra and *Bhaishajya kalpana* known as the art of *Vedic* alchemy is a fusion between mineral and organic compounds. It is specialized branch in the

field of Ayurveda which deals with pharmaceutical and therapeutic scopes.

Soota Taila is inimitable, distinctive formulation mentioned in *Rasa Ratna Sammucchaya* 21st chapter which is named as taila but preparation method is similar to that of *Dhruti Kalpana*.

Dhruti Kalpana (liquification) is one such important formulation which gives effective results with minimal dosage, easy to consume, quick absorption both internally and externally.

*Soota Taila*¹ having ingredients like *Shuddha Parada*, *Shuddha Gandhaka*, *Shuddha Manashila*, *Shuddha Haratala*, *Tila taila* and *Kanjika*. **Parada** acts as *Yogavahi*, *Rasayana*, *Balya*, *Vrisya*. *Prabhava* as *Kushtahara*, *Amruta*, *Sarvarogahara*. **Gandhaka** has potent rasayana activity; it is *garahara*, *vishahara*, *kushtahara* and *kapha vatahara*. **Manashila** as *Kashaya* and *Madhura rasa* mitigates *Vata* and *Kapha dosha* and also possesses *Lekhana* property which is beneficial in *srotho vivarana*, *Prabhava* as *visha nashaka*. and **Haratala** in use of *nadi dourbalya*, *pachana*, *lekhana*, *sothahara rakta shodhaka twachya jwaraghna*, *swasa* and *Krimighna*. **Kanjika** is strong and acidic acts as digestive stimulant, reduces *vata kapahaja* diseases, improves intellect. **Tila taila**, internally is great for improving iron levels, controlling cholesterol, managing heart diseases and improving strength, on skin is beneficial because it acts as antioxidant, contains vitamin E, oil is rich in minerals [copper, calcium, zinc, iron]. All these will aid in managing conditions like *Kampavata* (*Parkinson's disease*), *Bahukampa*, *Shirakampa* [*head tremor*], *Janghakampa*, *Ekgangavata* (*hemiplegia*) and all the various types of *vata vyadhi's*. *Soota taila* can be used both internally and externally. When *Soota Taila* gets processed judiciously, can be beneficial in curing various *vata roga* and can be beneficial to society.

AIMS AND OBJECTIVES

AIM:

“PHARMACEUTICO-ANALYTICAL STUDY OF SOOTA TAILA”

RESULTS

Pharmaceutical Results:

Table no.99: Showing results of Hingulottha Parada

Batch	Wt of Hingula taken for urdhwapatana	Wt of Parada obtained	Yield%	Total Yield %
Batch I	285gm	172gm	70.49%	73.6%
Batch II	285gm	190gm	77.86%	

Table no.100: Showing results of Hingulottha Parada Shodhana

Wt of ashoditha Parada taken	Wt of shoditha Parada	Yield %
362g	360g	99.44%

OBJECTIVES:

- Up to date review of *Soota taila*, *Parada*, *Gandhaka*, *Manashila*, *Haratala* and other associated drugs.
- Preparation of *soota taila* according to classical method mentioned in *Rasaratna sammucchaya* with due importance to SOP
- To carryout physico-chemical analysis of *Kajjali*, *homogeneous mixture of soota taila and Soota taila*.

METHODOLOGY

- Raw materials were collected after authoritative identification through *grahya agrahya lakshanas*.
- Extraction of *Parada* from *Hingula* by subjecting it to *Urdhvapatana* method.²
- *Gandhaka shodhana* was carried out in *Godugdha* by subjecting it to *Kurma Puta* by *Bhoodhara Yantra* method³
- *Samaguna Kajjali*⁴ was prepared by *mardana* method for 210 hours.
- *Manashila shodhana* will be carried out by *bhavana* with *ardraka swarasa* for 7 times⁵.
- *Haratala shodhana* will be carried out by *bhavana* with *churnodaka* for 7 times.⁶
- Preparation of *Kanjika*⁷ using *shali* and *masha* with 14 parts of water, until it gets half cooked and filtering product and was kept undisturbed for 21 days after all positive lakshana the *kanji* was collected.
- Preparation of *tila taila* was carried out.
- Homogeneous mixture of *Kajjali*, *Manashila*, *Haratala* along with *Kanjika* was carried out upto *lepa* consistency
- Application of *lepa* over *kora* cloth and formation of *varti*
- Ignition of *varti* like *Dhriti* and collection of *taila* which is named as *soota taila*.
- *Soota taila* was sent for analytical tests.

Table no.101: Showing results of Gandhaka shodhana

Wt of Gandhaka taken	Wt of Sh. Gandhaka obtained	loss	Yield
500 gms	490 gms	10gms	
490gms	450gms	40gms	84.4%
450gms	422gms	28gms	
Total		78gms	

Table no.102: showing Results of Manashila Shodhana

No of bhavana	Quantity of Manashila taken	Quantity obtained	Gain{+} Loss{-}	Yield
1	478gms	524gms	46gms	
2	524gms	529gms	5gms	
3	529gms	536gms	7gms	
4	536gms	548gms	12gms	111.08%
5	548gms	548gms	0gms	
6	548gms	520gms	-28gms	
7	520gms	531ggms	11gms	
Total			53gms	

Table no.103: showing Results of Haratala Shodhana

No of bhavana	Quantity of Haratala taken	Quantity obtained	Gain{+} Loss{-}	Yield
1	570gms	630gms	60gms	
2	630gms	630gms	00gms	
3	630gms	640gms	10gms	
4	640gms	645gms	05gms	117.5%
5	645gms	655gms	10gms	
6	655gms	675gms	20gms	
7	675gms	670gms	-5gms	
Total			100gms	

Table no.104: Showing results from preparation of Kajjali

Wt of Parada	Wt of Gandhaka	Wt of Kajjali obtained	Yield %
360gm	360gm	692gm	96.11 %

Table no.105: Showing results from preparation of Kanjika

Parameters	Before 21 days	After 21 days
Quantity of Kanjika	3 liters	1 liter
Yield	33.33%	

Table no.106: showing Kanjika with observational parameters

Sl no.	observations	parameters	days			
			00	07	14	21
	Organoleptic	<i>Roopa [colour]</i>	white	Dusky white.	Dusky white	Dusky white
		<i>Rasa[taste]</i>	Tasteless	Slightly bitter	Slightly bitter	Sour
		<i>Gandha [odour]</i>	Pleasant	Unpleasant	Unpleasant	Unpleasant
		<i>Sparsha [consistency]</i>	Thin liquid	Slightly Thick liquid	Slightly Thick liquid	Slightly thick liquid
	Test	Flame test	Absent	Absent	Flame was turned off	Flame continued to burn
		Bubble test	Absent	Small+	Bigger++	No bubbles
		Float/sink test	Floating	Floating	Floating	Sunken
		Fungal growth test	Absent	Absent	Absent	Absent

Table no.107: Showing Results of MTT

Quantity of Tila taila	3000 ml
Observations	All Siddhi lakshanas observed.
Yield	2800ml
Color	Reddish Brown
Yield	93.3%

Table no. 108: showing results of soota taila collected over all

	Number of Varti burnt	Quantity of soota taila collected in ml	Quantity of tila taila used
BATCH- 1	05	70+70+50= 190ml	1.2 liter's
BATCH -2	04	80+70= 150ml	1.2 liter's
Total quantity	09	340 ml	2.4 liter's

Table no.109: showing results of soota taila collected.

Quantity of homogeneous mixture of ST taken	Quantity of ST obtained	Yield
400gms	340ml	85%

ANALYTICAL RESULTS**Table no.110: showing classical approach of organoleptic characters**

TEST	OBSERVATION	
	MTT	ST
Varna	<i>Aruna, Kapisha</i>	Yellowish green/ambered.
Gandha	Characteristic odour	Odourless
Rasa	Tikta	characteristics
Kalka vartivat lakshana	+++	-
Shabdahina when put on agni	+++	-
Phenodgama	+++	-

MODERN PARAMETERS**A. PHYSICAL TESTS****ORGANOLEPTIC CHARACTERS:**

Color, odour, taste of the given sample was tested using sensory organs, and the same were noted.

Table no.111: Showing Organoleptic Characters of MT and ST

Physical test	MTT	ST
Colour	Yellowish brown	Blackish brown
Odour	Characteristic odour	Characteristic odour
Taste	Characteristic taste	Characteristic taste
Appearance	Viscous liquid	Viscous liquid

Table no.112: Organoleptic characters of Kajjali, HMST and ST

Physical test	Kajjali	HMST	ST
Colour	Jet black	Olive green	Yellowish green/amber
Odour	Odourless	Odourless	Characteristic
Taste	Astringent	Astringent	
Touch	Fine	Fine	viscous

PHYSICO-CHEMICAL PARAMETERS**Table no.113: Showing Results of Standardization parameters of SOOTA TAILA[ST]**

Parameter	Results n = 3 %w/w
	ST
Loss on Drying at 105°C	0.01%
Saponification value	187.95%
Acid value	2.02%
Iodine value	111.67%
Peroxide value	5.15%
Ester value	185.93%
Refractive index at 30°C	1.451
Specific gravity	0.9435
Weight (gm) per ml	0.9373 gm/ml
Viscosity at 30°C	94.6031 cP
Rancidity test (Kreis test)	Negative

Table no. 114: Showing all Physico-chemical parameters of Kajjali and HMST

PARAMETERS	KAJJALI	HMST
Loss on Drying at 105°C	0.28%	0.59%
Total ash	0.19%	18.74%
Acid insoluble ash	0.01%	0.76%
Water soluble ash	0.00%	4.15%
Alcohol soluble extractives	0.00%	8.17%
Water soluble extractives	0.10%	26.05%
pH (5% aqueous solution)	5.61+ 0.10	5.88+ 0.10

TOTAL MICROBIAL COUNT:

Table no.117: showing Microbial contamination of Kajjali, HMST and ST

	KAJJALI	HMST	SOOTA TAILA
Total aerobic count	Nil	Nil	Nil
Total fungal count	Nil	Nil	Nil

Table no.118: Showing the percentage of Mercury in Kajjali and HMST

SAMPLE	PERCENTAGE
KAJJALI	61.25%
HMST	9.25%

Table no.119: Showing the Percentage of free mercury in Kajjali and HMST

SAMPLE	Free Mercury
KAJJALI	0.15%
HMST	0.02%

Table no.120: Showing the Percentage of Mercurous Mercury & Mercuric Mercury

SAMPLE	Mercurous Mercury (%)	Mercuric Mercury (%)
KAJJALI	2.15%	58.95%
HMST	0.50%	8.73%

Table no.121: Showing the percentage of Sulfur

SAMPLE	PERCENTAGE
KAJJALI	28.17%
HMST	7.50%

Table no.122: Showing results of Free Sulphur and Sulphide, Sulphite form of Sulphur

SAMPLE	Free sulphur(%)	Sulphide (%)	Sulphite (%)	Sulphate (%)
KAJJALI	0.00%	24.35%	3.82%	0.00%
HMST	0.00%	7.12%	0.38%	0.00%

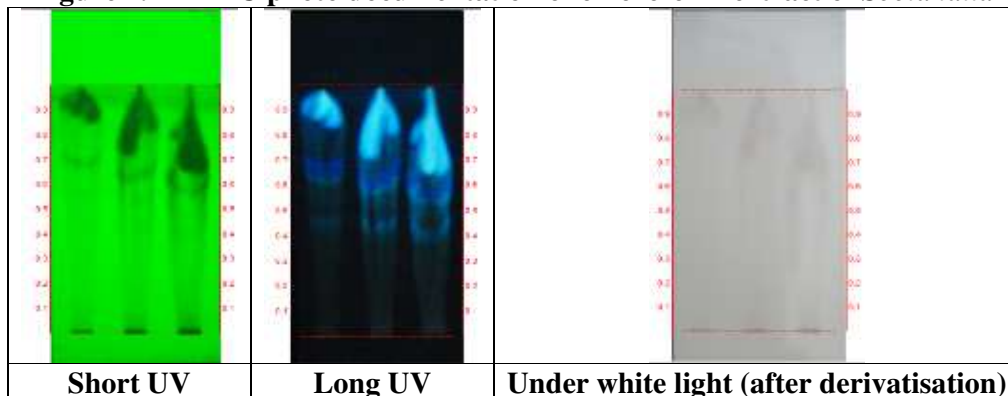
Table no.123: Showing results of Estimation of arsenic

SAMPLE	Arsenic
HMST	1.12%

HIGH PERFORMANCE THIN LAYER CHROMATOGRAPHY:

Table no. 124: Showing results of HPTLC report.

Figure 1. HPTLC photo documentation of chloroform extract of Soota taila



TRACK 1- *Soota taila*– 3µl

TRACK 2- *Soota taila*– 6µl

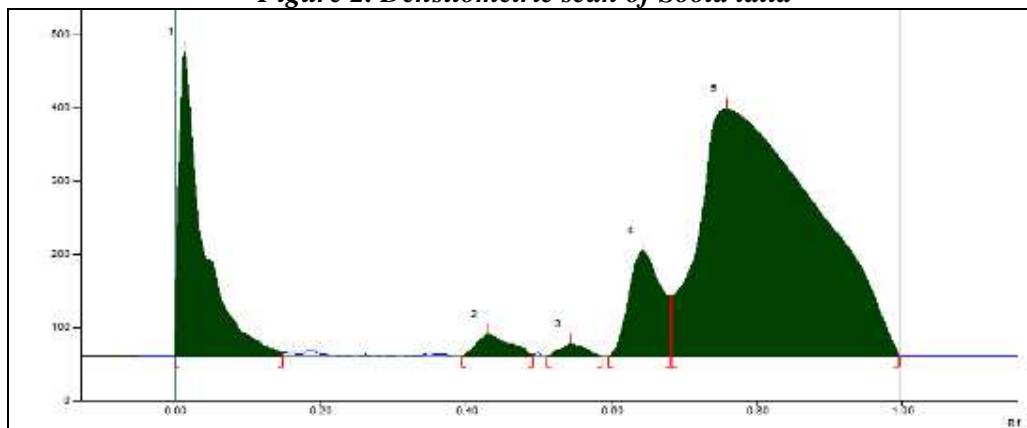
TRACK 3- *Soota taila*– 9µl

Solvent system – Toluene: Ethyl Acetate (9:1)

Table 1: Rf value of Soota taila

Short UV	Long UV	Under white light (after derivatisation)
-	0.45 (F. blue)	-
-	0.62 (F. blue)	-
0.67 (D. green)	0.67 (F. blue)	-

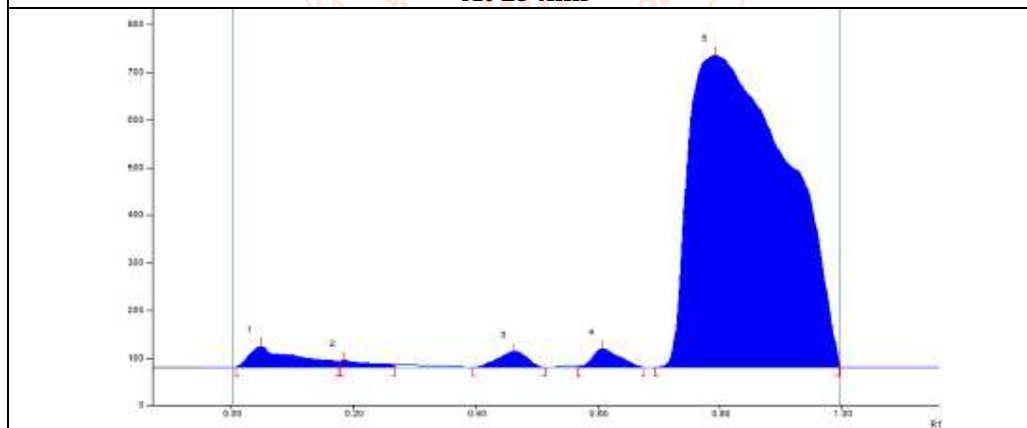
Figure 2. Densitometric scan of Soota taila



Track 3, ID: Soota taila

Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.00 Rf	0.0 AU	0.01 Rf	416.1 AU	43.98 %	0.15 Rf	5.3 AU	9905.3 AU	17.98 %
2	0.40 Rf	0.3 AU	0.43 Rf	30.4 AU	3.22 %	0.49 Rf	2.4 AU	1004.2 AU	1.82 %
3	0.51 Rf	0.4 AU	0.55 Rf	17.3 AU	1.83 %	0.59 Rf	0.2 AU	433.8 AU	0.79 %
4	0.60 Rf	0.2 AU	0.65 Rf	144.5 AU	15.27 %	0.68 Rf	82.7 AU	4590.2 AU	8.33 %
5	0.68 Rf	82.8 AU	0.76 Rf	337.8 AU	35.71 %	1.00 Rf	3.2 AU	39162.1 AU	71.08 %

At 254nm



Track 3, ID: Soota taila

Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	0.2 AU	0.05 Rf	43.8 AU	5.56 %	0.18 Rf	13.2 AU	2412.0 AU	2.96 %
2	0.18 Rf	13.3 AU	0.18 Rf	14.8 AU	1.87 %	0.27 Rf	6.3 AU	534.9 AU	0.66 %
3	0.40 Rf	0.1 AU	0.46 Rf	33.8 AU	4.29 %	0.51 Rf	0.0 AU	1158.6 AU	1.42 %
4	0.57 Rf	2.7 AU	0.61 Rf	39.8 AU	5.05 %	0.68 Rf	0.0 AU	1245.4 AU	1.53 %
5	0.70 Rf	0.0 AU	0.79 Rf	655.5 AU	83.22 %	1.00 Rf	9.9 AU	76065.1 AU	93.43 %

At 366nm

XRD RESULTS**Table no. 125: Showing XRD report of Kajjali compared with standard of HgS**

Identified			Standard	
Peak no	Angle 2 θ	d space	Angle 2 θ	d space
6	26.232	3.3945	26.36	3.37
11	30.444	2.9338	30.53	2.92
21	43.660	2.07	43.74	2.06
25	51.726	1.76583	51.77	1.76
33	86.18	1.1276	86.30	1.12
Name of standard: Metacinnabar			Crystal structure: Cubic	
JCPDS No: 00-075-1538			Mwt: 232.66g/mol.	

Table no.126: Showing XRD report of Kajjali compared with standard of Sulfur

Identified			Standard	
Peak no	Angle 2 θ	d space	Angle 2 θ	d space
3	22.578	3.9349	22.60	3.93
7	27.628	3.2261	27.64	3.22
12	31.185	2.8658	31.27	2.85
26	52.81	1.7321	53.73	1.70
29	63.54	1.4631	64.89	1.43
Name of standard: Sulfur			Crystal structure: Orthorhombic	
JCPDS No: 00-074-1465			Mwt: 256.065g/mol	

Table no.128.: Showing XRD report of HMST compared with standard of HgS

Identified			Standard	
Peak no	Angle 2 θ	d space	Angle 2 θ	d space
46	26.251	3.3922	26.36	3.37
52	30.312	2.9463	30.53	2.92
68	43.675	2.0708	43.74	2.06
71	51.68	1.7674	51.77	1.76
33	86.17	1.1277	86.30	1.12
Name of standard: Metacinnabar			Crystal structure: Cubic	
JCPDS No: 00-075-1538			Mwt: 232.66g/mol.	

Table no.129: Showing XRD report of HMST compared with standard of Sulfur

Identified			Standard	
Peak no	Angle 2 θ	d space	Angle 2 θ	d space
3	22.578	3.9349	22.60	3.93
7	27.628	3.2261	27.64	3.22
12	31.185	2.8658	31.27	2.85
26	52.81	1.7321	53.73	1.70
29	63.54	1.4631	64.89	1.43
Name of standard: Sulfur			Crystal structure: Orthorhombic	
JCPDS No: 00-074-1465			Mwt: 256.065g/mol	

Table no.130: Showing XRD report of HMST compared with standard of Arsenic

Identified			Standard
Peak no	Angle 2 θ	d space	Angle 2 θ
43	23.97	3.709	24.90
48	27.98	3.186	28.03
55	31.99	2.795	32.17
70	51.164	1.7839	51.28
78	67.13	1.393	67.30
Name of standard- arsenic As			crystal structure- rhombohedral
JCPDS No: 00-019-0084			Mwt:74.9216

Table no. 131: Showing XRD report of HMST compared with standard of Cao(lime)

Identified			Standard	
Peak no	Angle 2 θ	d space	Angle 2 θ	D space
55	31.99	2.79	32.20	2.77
63	37.446	2.390	37.35	2.40
73	54.28	1.68	53.86	1.70
77	63.35	1.46	64.15	1.45
78	67.13	1.39	67.37	1.38
Name of standard: Lime CaO			Crystal structure: Cubic	
JCPDS No: 00-037-1497			Mwt: 56.07g/mol	

Table no 132: Showing results of FTIR Peaks of Kajjali

Sample peaks Cm^{-1}	Bond	Functional groups
3436.16	O-H [strong] stretching N-H [Medium] stretching	Alcohol Primary amine
2921.68	O-H [Strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
2851.60	O-H [strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
1631.79	C=C [medium] stretching C=C [medium] stretching N-H [medium] stretching C=C [medium] stretching C=C [strong] stretching S=O [strong] stretching	Alkene vinylidene Conjugated alkene Amine Cyclic alkene Alkene sulfone
1412.03	C-H [medium] stretching O-H [medium] stretching S=O [strong] stretching	Alkane methyl group Alcohol Sulfate
781.00	C-H [strong] stretching C-H [strong] stretching	1,2,3 trisubstituted 1,3 disubstituted

Table no.133: Showing FTIR Peaks of HMST

Sample peaks Cm^{-1}	Bond	Functional groups
3434.50	O-H [Strong] stretching N-H [medium] stretching	Alcohol intermolecular bonded Primary amine
2971.44	O-H [Strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
2923.26	O-H [Strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
1631.99	C=C [medium] stretching N-H [medium] stretching C=C [medium] stretching C=C [medium] stretching	Cyclic alkene Amine Conjugated alkene Alkene disubstituted
1383.92	C-H [medium] stretching C-H [medium] stretching C-H [medium] stretching O-H [medium] stretching S=O [strong] stretching	Alkane methyl group Aldehyde Alkane gem dimthly Alcohol Sulfate

	S=O [strong] stretching C-F [strong] stretching O-H [medium] stretching	Sulfonyl chloride Fluoro compound phenol
952.43	C=C [strong] stretching	Alkene
800.72	C-H [strong] stretching C-H [strong] stretching C-H [strong] stretching C=C [medium] stretching C-Cl [strong] stretching	1, 4- disubstituted or 1,2,3,4-tetrasubstituted. 1, 3- disubstituted 1, 2, 4- trisubstituted alkene Halo compound.

Table no 134: Showing FTIR Peaks of SOOTA TAILA

Sample peaks Cm^{-1}	Bond	Functional groups
2922.72	O-H [Strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
2853.26	O-H [Strong] stretching O-H [weak] stretching N-H [strong] stretching C-H [medium] stretching	Carboxylic acid Alcohol Amine salt. Alkane
1743.39	C=O [strong] stretching C=O [strong] stretching	Conjugated anhydride. δ -lactone
1464.55	C-H [medium] stretching	Alkane methyl group
1377.56	C-H [medium] bending O-H [medium] bending C-F [strong] stretching	Alkane methyl group Alcohol Fluro compound
1160.07	C-N [medium] stretching C-O [strong] stretching S=O[strong] stretching C-F[strong] stretching S=O[strong] stretching S=O[strong] stretching	Amine Tertiary alcohol Sulfone Fluro compound Sulfonamide Sulfonic acid anhydrous hydride
1097.65	C-F[strong] stretching C-N [medium] stretching C-O [strong] stretching C-O [strong] stretching C-O [strong] stretching	Fluro compound Amine Ester Aliphatic ether Secondary alcohol
966.98	C=C [strong] bending	Alkene disubstituted
722.29	C=C [strong] bending C-Cl [strong] stretching C-H[strong] bending C-H[strong] bending C-H[strong] bending	Alkene disubstituted Halo compound Monosubstituted benzene derivative 1, 2, 3- trisubstituted 1,3- disubstituted.

Table no 135: Showing Particle Size of Kajjali, HMST and ST.

Sample	Mean diameter(nm)
Kajjali	822.0nm
HMST	1375.1nm
Soota Taila	1927.4 nm

Table no 136: Showing SEM EDS Result of Kajjali

Sl no	Element	Weight %	Atomic %
1.	C K	18.97	58.54
2.	O K	3.70	8.58
3.	S K	19.13	22.12
4.	Hg M	58.19	10.75

Table no 137: Showing SEM EDS Result of HMST

Sl no	Element	Weight %	Atomic %
1.	C K	15.10	43.91
2.	O K	4.90	10.69
3.	S K	23.86	26.00
4.	As L	27.20	12.68
5.	Rb L	0.44	0.18
6.	Nb L	7.85	2.95
7.	Hg M	20.66	3.60

DISCUSSION

- *Hingula* contains *Parada* which is chemically bonded with *Gandhaka* which is an innate co-drug for *parada bandha*, Citric acid helps for the disintegration of HgS. Organic acid may be responsible to weaken the bond and hence facilitates dissociation of mercury. Reason for applying lepa might be to facilitate uniform heat and reaction by which maximum amount of dissociation of *parada* takes place. *Sandhibandhana* of 7 layers was done with mud smeared cloth to avoid the escaping of *parada* during heating.
- *Shuddha Gandhaka* was brittle and shiny, may be due to the change in crystalline structure while passing through the stage of melting. The impurities like mud or any other material gets separated on the cloth as these impurities do not melt or change at this temperature.
- *Manashila Shodhana* was carried out by lavigation with *Ardraka swarasa*. In this procedure crude *Manashila* was converted into minute particle thus to increase its bioavailability.
- *Churnodaka* is chemically 'calcium hydroxide' when reacts with 'arsenic trisulphide' may form an intermediate product know as arsenate and further it may become calcium arsenate. This compound will be safe and useful form of arsenic. Calcium is natural antagonistic of arsenic
- *Murchana samskara* attributes special properties to *ghrita taila* by removing its *Ama Lakshana* which inhibit lipid peroxidation and incorporated antioxidant property for augmentation of medicinal properties of the medicated sneha. It took 20 hours to get *siddhi lakshana's* of *Tila taila murchana* for 3 liters of *tila taila*.
- *Samaguna Kajjali* was prepared with 210 hours, Maximum duration of *Mardana* may cause more bonding of sulfur and mercury and reduce the free mercury.
- *Samaguna Kajjali* was mixed with *shodhita Manashila* and *shodhita Haratala* to it liquid media was added to form homogeneous mixture
- the further the lepa was applied over kora cloth and varti was formed which was kept aside for one day for drying.
- Dried *varti* was immersed into *murchita tila taila* and kept for one day next day the varti was ignited to collect soota taila. Which was later send for analytical parameters.
- HPTLC is the sophisticated analytical parameter for the evaluation of the herbal drugs. HPTLC can also serve as Fingerprinting technique for identification and quantification of the herbal and Herbo-mineral formulations. It helps to find out the adulteration in the formulation and is used as a standard for the herbal compounds. In present study HPTLC of ST was done. The 5 peaks in densitometric scan of ST at 254nm and 366nm are due to the influence of phytochemical constituents present in the compound.
- Rancidity is negative in ST. The samples have shown no rancidity, which shows the presence of tocopherols as natural antioxidant.
- It is the angle of refraction of light travelled through the media. The values of ST are **1.451** which reveals that some active substances of ingredients used in the process were incorporated into *Sneha kalpana*.
- Viscosity of *sneha dravya* is due to incorporation of bio constituents into sneha from the drugs used for preparation. Viscosity of ST is **94.6031Cp**
- The saponification value of ST is **187.95%**. Long-chain fatty acids found in fat have low saponification value and vice versa. Short chain fatty acids are readily absorbed than long-chain fatty acids. Hence, ST is easily absorbed and digested in the body.
- Iodine value of ST is **111.67%**. This indicates that there is decrease in the degree of unsaturation but within normal limits. an increase in iodine value detects a fair increase in number of unsaturated fatty acid bonds which can be better absorbed when compared to saturated fatty acids.

- The acid value of the ST is **2.02%** Reduced acid value indicates less percentage of free fatty.
- The ester value of ST is **185.93**. As the esters are increased, rancidity chance is decreased. Ester value of ST indicating the fewer chances of rancidity and thus possesses increased shelf life.
- Peroxide value and acid value are most useful primary indicators as to the quality of an oil in terms of refinement and freshness since both will give an early indication of the level of reactive fatty acids and breakdown products. Peroxide values of ST **5.15%**.
- Specific gravity of ST is **0.9435**. Specific gravity indicates addition of some bio constituents from the drugs used during sneha kalpana. It may be due to solid extractives that come from the herbals.
- Weight per ml of ST is **0.9373 gm/ml**. With this result one can presume that better dissolution of bio constituents in the compounds.
- In the present study *Kajjali*, HMST and ST **0.28%**, **0.59%** and **0.01%** respectively loss on drying at 105°C. Hence it can be stated that all have very less amount of moisture content and very rare chance of bacterial and fungal growth.
- The XRD peaks of *Kajjali* and HMST the sample which were compared with standard Angle 2 θ JCPDF values confirmed that the presence of Cinnabar (HgS) in Cubic crystal system, Sulfur in Orthorhombic crystal system. Arsenic in rhombohedral crystal system. Lime in Cubic crystal system
- Elements found through SEM EDX in *Kajjali* are Hg, S, O and C in the percentage of 58.19%, 19.13%, 3.70 % and 18.97% respectively. This shows that mercury is in greater proportion and the elements may be in the form of oxides.
- Elements found through SEM EDX in HMST are C, O, S, As, Rb Nb, Hg in percentage of 32.41%, 7.64%, 17.26%, 23.30%, 0.45%, 6.66% and 12.28% respectively. The additional elements are in trace level i.e., below permissible limits. Hence the drug can be considered as safe.
- The FTIR obtained peaks of the *Kajjali*, HMST and *soota taila* were compared with the standard peaks. It showed the presence of different functional groups like Alcohol, Phenols, Alkanes, Alkenes, Aromatics, Bromide, Iodide, Chloride, Ethers, Carboxylic acids, Esters, Anhydrides, Amines, Phenyl Ring Substitution Overtones, Primary and secondary amines and amides, Sulfonamide, Sulfonic acid anhydrous hydride, Ester, Aliphatic ether, Halo compound. This shows the presence of organic compounds in the drug.
- Particle size (by Zeta Pals method) is crucial parameter it influences surface area and porosity hence as an impact on bioavailability, effectiveness and shelf life of drug. As product is lipid carried, increased particle size for application gives larger surface area with more absorption
- Where as in *Kajjali* and HMST, the particle size has an important influence on dissolution rate. Smaller the drug particle size larger the surface area, leads to faster dissolution. Particle size reduction will result in precise drug delivery and thereby increasing the bioavailability of the drug.
- pH is a negative logarithm of the hydrogen. pH of *Kajjali* and HMST is **5.61 ± 0.10** and **5.88 ± 0.10** respectively. As per readings the products are acidic. According to pH – acidic are absorbed at faster rate from the stomach
- Low value of acid insoluble ash signifies dissolution of drug in acid media the acid insoluble ash of *Kajjali* and HMST are **0.01%** and **0.76%** respectively. Indicating drug is processed well and safety for consumption as maximum solubility.
- It indicates selective media of drug administration. Water soluble ash value of *Kajjali* and HMST are 0.00% and 4.15% respectively. Indicating *kajjali* isn't soluble in water whereas HMST has 4.15% of solubility in water.
- Water soluble and Alcohol Soluble extractives indicate the mode of administration of the drug. Alcohol soluble extractives of *Kajjali* and HMST are 0.00% and 8.17% whereas water soluble extractives are 0.10% and 26.05% respectively.
- *Kajjali*, HMST and ST were tested for Total Bacterial count and Total Fungal count. Total Bacterial count and Total Fungal count is Nil for all 3 samples; Shows no bacterial and fungal growth. This may be due to least moisture content in the sample and proper storage of the drug in an air tight container.
- The percentage of total mercury in *Kajjali* and HMST is 61.25% and 9.25% respectively. Free mercury is 0.15% and 0.02% of *Kajjali* and HMST respectively shows proper formation of *Kajjali* and HMST which was confirmed by *Nishchandravta* and proves safety of the Product respectively.

- Mercurous mercury and mercuric mercury in *Kajjali* are 2.15% and 58.95% respectively.
- The percentage of sulfur in *Kajjali* and HMST are 28.17% and 7.50% respectively. sulphide form in *Kajjali* and HMST are 24.35% and 7.12% respectively. Sulphite form in *Kajjali* and HMST are 3.82% and 0.38% respectively. Sulphate form in *Kajjali* and HMST are 0.00% and 0.00% respectively. Free sulfur in *Kajjali* and HMST are 0.00% and 0.00% respectively. This indicate the drug is more sulphide than sulphite
- Arsenic value in HMST is 1.12%, in less quantity it can be used for treatment of specific cancers.

CONCLUSION

- *Soota Taila* is one such inimitable formulation mentioned in *Rasa Ratna Sammucchaya* 21st chapter, having ingredients like *Shuddha Parada*, *Shuddha Gandhaka*, *Shuddha Manashila*, *Shuddha Haratala*, *Tila taila* and *Kanjika* as ingredients.
- *Soota taila* was Yellowish green/Amber in colour and had characteristic odour. Its physical tests showed Loss on Drying at 105°C is 0.01%, Saponification value is 187.95%, Iodine value is

111.67%, Acid value is 2.02%, Peroxide value is 5.15%, Ester value is 185.93, Refractive index at 30°C is 1.451, Specific gravity is 0.9435, Weight (gm) per ml is 0.9373 gm/ml, Viscosity at 30°C is 94.6031 cP, Rancidity test (Kreis's test) is Negative, Total aerobic counts is Nil, Total fungal count is Nil.

- **FTIR analysis of ST** shows that it contains organic functional group like Carboxylic acid, Alcohol, Amine salt, Alkane, Conjugated anhydride, δ -lactone, Tertiary alcohol, Sulfone, Fluoro compound, Sulfonamide, Sulfonic acid anhydrous hydride, Amine, Ester, Aliphatic ether, Halo compound, Monosubstituted benzene derivative, 1, 2, 3- trisubstituted and 1,3-disubstituted.
- **Zeta pals suggest ST:** mean diameter- 1927.4nm, mean zeta potential of soota taila is -11.35mV
- *Soota Taila* is administered both internally and externally as per classics
- Further detailed study is required to bring out many more characteristics of this unique formulation.

FIGURES:





Pouring of adhraka swarasa

shoununu



Subhavita lakshana of Manashila



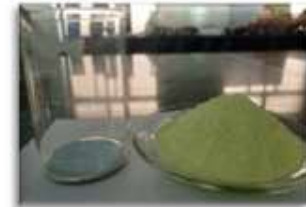
Shodhita Manashila.



Bhavana of Haratala



Shodhita Haratala.



Parada and gandhaka



Shodhita parada+shodhita gandhaka



Varitara test



Unnama test



Rekhapurnatva test



Shali+masha



Candle test on kanjika



Tila Taila Murchana Dravyas



Kalka Dravyas



Murchita Tila Taila



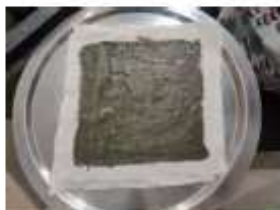
Mixing of Kajjali and Manashila



Mixture of Kajjali + Manashila and Haratala



Kanjika mix with homogeneous mixture of soota taila



Lepa on kora cloth



Varti



Soaked varti



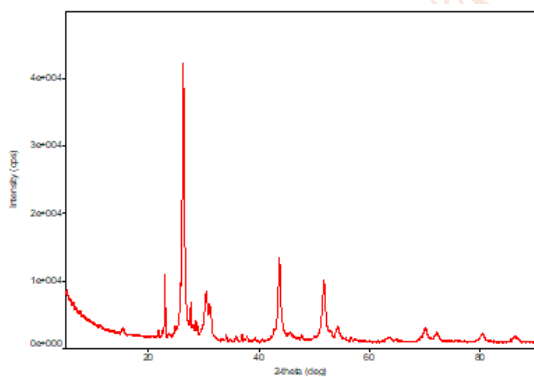
Ignition of varti.



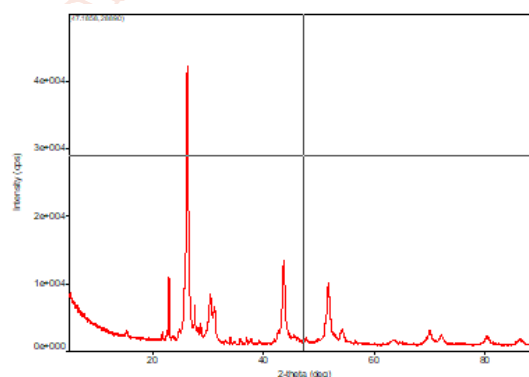
Oil extracted.



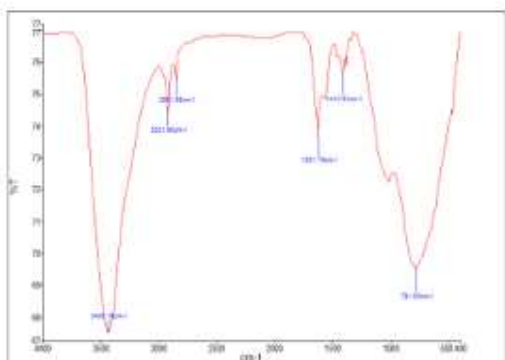
SOOTA TAILA



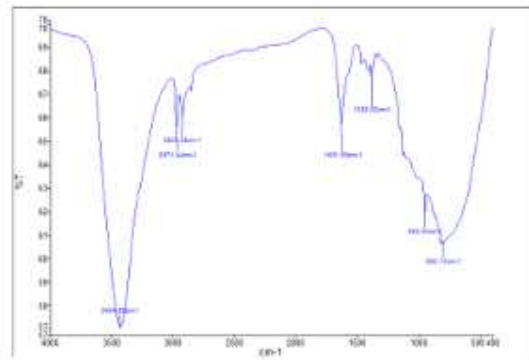
XRD reports of Kajjali



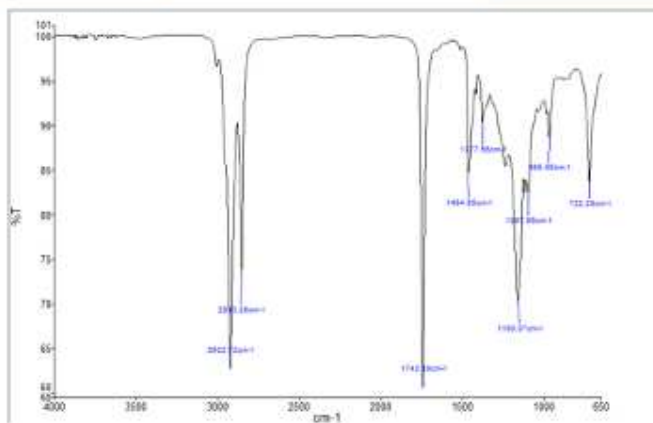
XRD reports of HMST.



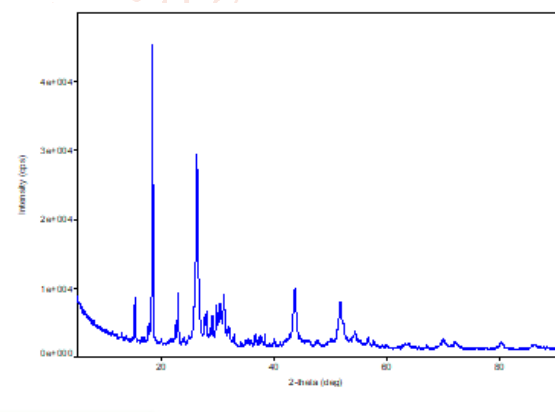
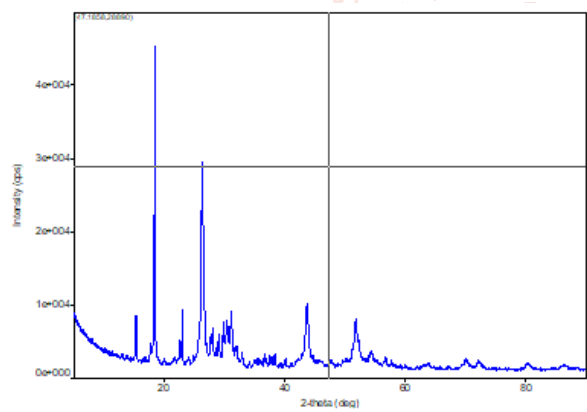
FTIR Reports of Kajjali



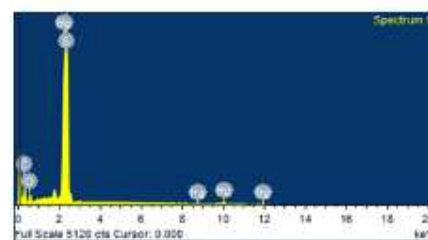
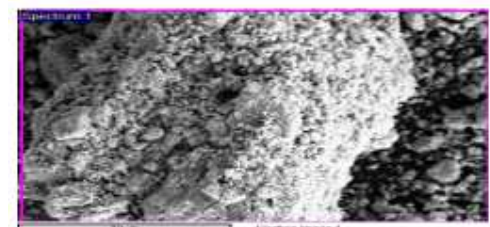
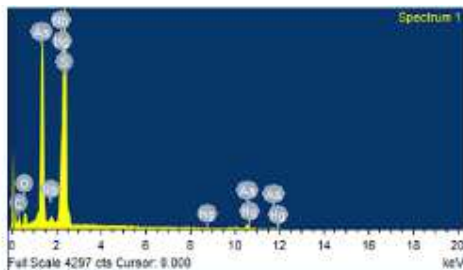
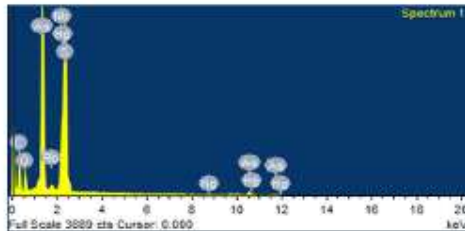
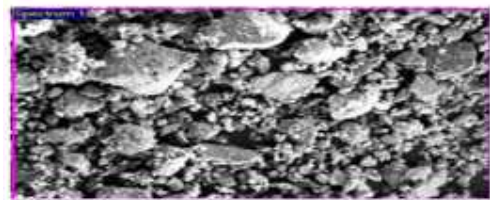
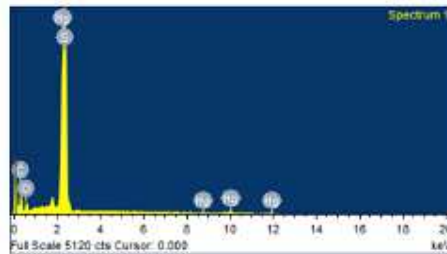
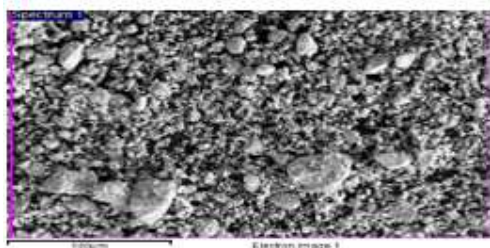
FTIR Reports of HMST



FTIR reports of SOOTA TAILA.



HPTLC REPORT



SEM-EDS reports of HMST

SEM-EDS reports of KAJJALI

Measurement Parameters:		Temperature	= 25.0 deg. C	Runs Completed	= 5
Liquid	= Water	Run Duration	= 00:00:30	Total Elapsed Time	= 00:02:30
Viscosity	= 0.890 cP	Average Count Rate	= 187.4 kcps	Ref. Index Real	= 1.533
Ref. Index Fluid	= 1.330	Ref. Index Imag	= 0.000	Dust Filter	= Off
Angle	= 50.00				
Wavelength	= 658.0 nm				
Baseline	= Auto (Slope Analysis)				

Measurement Parameters:		Mean Zeta Potential	= -17.38 mV	Liquid	= Ethanol
Zeta Potential Model	= Hückel	Temperature	= 25.0 °C	Viscosity	= 1.084 cP
Mean Mobility	= -0.23 (µs) / (V/cm)	pH	= 7.50	Refractive Index	= 1.357
Conductance	= 2 µS	Concentration	= 0.01 mg/mL	Dielectric Constant	= 24.30
Particle Size	= 375.0 nm				

Sample 1_Kajjali (Combined)

Effective Diameter: 822.0 nm

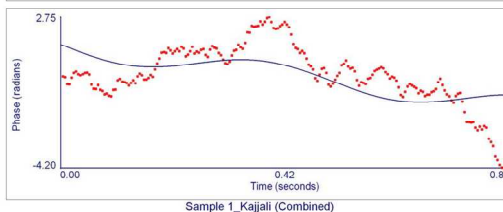
Polydispersity: 0.060

Baseline Index: 0.0

Elapsed Time: 00:02:30

Lognormal Distribution

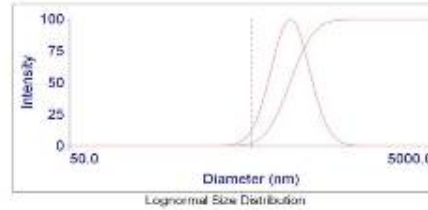
Instrument Parameters:		Sample Count Rate	= 15 kcps	Voltage	= 4.00 volts
Ref. Count Rate	= 1084 kcps	Electric Field	= 10.52 V/cm	User1	= 0.00
Wavelength	= 658.0 nm	User2	= 0.00		
Field Frequency	= 2.00 Hz				
Cycles Per Run	= 10				



Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	1189.3	54.1	0.005	0.0
2	945.3	56.8	0.005	0.0
3	808.6	44.0	0.254	2.7
4	852.4	27.9	0.121	0.0
5	741.7	301.5	0.186	0.0
Mean	913.0	235.0	0.110	0.5
Std. Error	77.3	71.7	0.048	0.5
Combined	822.0	201.1	0.060	0.0

Run	Mobility	Zeta Potential (mV)	Rel. Residual
1	-0.63	-47.36	0.1383
2	-0.43	-32.83	0.0818
3	-0.62	-47.04	0.0778
4	-0.23	-17.24	0.0776
5	-0.48	-36.49	0.0742
Mean	-0.23	-17.38	0.0899
Std. Error	0.22	16.81	0.0121
Combined	-0.18	-13.96	0.0534

Elapsed Time 00:02:30
 Median Diam. 822.0 nm
 Mean Diam. 866.2 nm
 Polydispersity 0.060
 GSD 1.273



d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)
552.0	26	5	773.3	97	40	967.0	80	75
803.4	44	10	797.4	98	45	1007.0	70	80
840.3	58	15	822.0	100	50	1055.2	50	85
870.9	70	20	847.3	98	55	1119.7	44	90
898.7	80	25	873.7	97	60	1222.1	28	95
924.4	87	30	901.9	93	65			
949.1	93	35	932.7	87	70			

SHOWING REPORTS OF ZETA PALS OF KAJJALI

Measurement Parameters:
 Temperature = 25.0 deg. C
 Liquid = Water
 Viscosity = 0.890 cP
 Ref. Index Fluid = 1.330
 Angle = 90.00
 Wavelength = 658.0 nm
 Baseline = Auto (Slope Analysis)

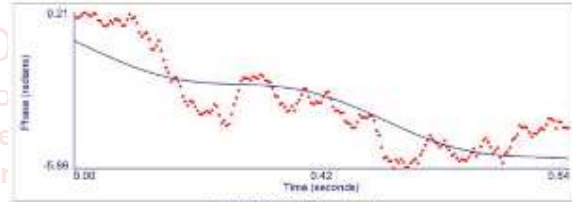
Run Completed: = 5
Run Duration: = 00:00:30
Total Elapsed Time: = 00:02:30
Average Count Rate: = 374.8 kcps
Ref. Index Resol: = 1.533
Ref. Index Imag: = 0.000
Dust Filter: = Off

Measurement Parameters:
 Mean Zeta Potential = -8.89 mV
 Zeta Potential Model = Huckel
 Mean Mobility = -0.12 (µS) / (V/cm)
 pH = 7.50
 Conductance = 2.5
 Concentration = 0.01 mg/mL

Liquid = Ethanol
 Temperature = 25.0 °C
 Viscosity = 1.084 cP
 Refractive Index = 1.357
 Dielectric Constant = 24.30
 Particle Size = 375.0 nm

Instrument Parameters:
 Sample Count Rate = 38 kcps
 Ref. Count Rate = 1123 kcps
 Wavelength = 658.0 nm
 Field Frequency = 2.00 Hz
 Cycles Per Run = 10

Voltage = 4.00 volts
 Electric Field = 10.56 V/cm
 User1 = 0.00
 User2 = 0.00

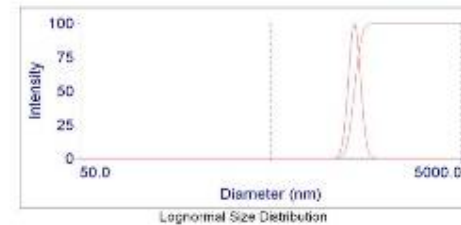


Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	1097.3	77.6	0.005	7.5
2	1151.7	487.7	0.178	6.9
3	1494.2	105.7	0.005	0.0
4	1801.8	113.3	0.005	0.0
5	1423.5	278.2	0.038	2.6
Mean	1353.7	212.5	0.047	3.4
Std. Error	98.2	77.3	0.034	1.8
Combined	1375.1	87.2	0.005	0.0

Sample_2_HMST (Combined)

Run	Mobility	Zeta Potential (mV)	Rel. Residual
1	-0.52	-28.85	0.1179
2	0.37	27.78	0.1265
3	0.64	49.27	0.0423
4	-0.73	-54.50	0.0390
5	-0.34	-25.75	0.0588
Mean	-0.12	-8.89	0.0890
Std. Error	0.28	19.88	0.0172
Combined	-0.14	-10.79	0.0429

Elapsed Time 00:02:30
 Median Diam. 1375.1 nm
 Mean Diam. 1378.5 nm
 Polydispersity 0.005
 GSD 1.073



d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)
1224.3	26	6	1350.8	97	40	1442.2	80	75
1255.1	44	10	1382.9	99	45	1455.4	70	80
1278.1	58	15	1375.1	100	50	1478.5	58	85
1295.7	70	20	1387.4	99	55	1505.4	44	90
1311.2	80	25	1399.9	97	60	1544.5	28	95
1325.2	87	30	1413.0	93	65			
1338.2	93	35	1427.0	87	70			

ZETA PALS OF HOMOGENEOUS MIXTURE OF SOOTA TAILA.

Measurement Parameters:			
Temperature	= 25.0 deg. C	Runs Completed	= 5
Liquid	= Water	Run Duration	= 00:00:30
Viscosity	= 0.890 cP	Total Elapsed Time	= 00:02:00
Ref Index Fluid	= 1.330	Average Count Rate	= 47.6 kcps
Angle	= 90.00	Ref. Index Real	= 1.533
Wavelength	= 658.0 nm	Ref. Index Imag	= 0.000
Baseline	= Auto (Slope Analysis)	Dust Filter	= Off

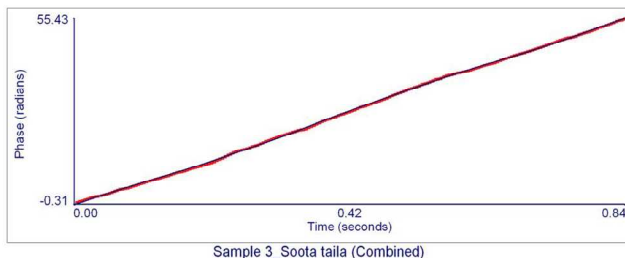
Measurement Parameters:			
Mean Zeta Potential	= -11.35 mV	Liquid	= Ethanol
Zeta Potential Model	= Huckel	Temperature	= 25.0 °C
Mean Mobility	= -0.15 (μs) / (V/cm)	Viscosity	= 1.084 cP
pH	= 7.50	Refractive Index	= 1.357
Conductance	= 1 μS	Dielectric Constant	= 24.30
Concentration	= 0.01 mg/mL	Particle Size	= 375.0 nm

Sample_3_Soota taila (Combined)

Effective Diameter: 1927.4 nm
Polydispersity: 0.275
Baseline Index: 0.0
Elapsed Time: 00:02:00

Lognormal Distribution

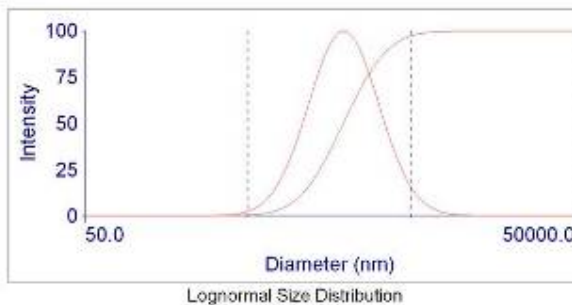
Instrument Parameters:			
Sample Count Rate	= 488 kcps	Voltage	= 4.00 volts
Ref. Count Rate	= 1083 kcps	Electric Field	= 10.61 V/cm
Wavelength	= 658.0 nm	User1	= 0.00
Field Frequency	= 2.00 Hz	User2	= 0.00
Cycles Per Run	= 10		



Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	1687.1	983.0	0.345	0.0
2	2198.5	1211.4	0.304	0.0
3	4747.0	2588.6	0.350	0.0
4	1973.4	1107.6	0.315	0.0
5	2100.2	558.7	0.070	0.0
Mean	1987.1	965.2	0.259	0.0
Std. Error	116.2	143.3	0.064	0.0
Combined	1927.4	1011.0	0.275	0.0

Run	Mobility	Zeta Potential (mV)	Ref. Residual
1	0.36	26.84	0.0382
2	-0.19	-14.11	0.0447
3	-0.74	-55.91	0.0285
4	0.12	9.11	0.0503
5	-0.30	-22.69	0.0312
Mean	-0.15	-11.35	0.0386
Std. Error	0.19	14.14	0.0041
Combined	-0.20	-15.14	0.0095

Elapsed Time	00:02:00
Median Diam.	1927.4 nm
Mean Diam.	2176.4 nm
Polydispersity	0.275
GSD	1.637



d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)	d(nm)	G(d)	C(d)
856.6	26	5	1701.4	97	40	2687.1	80	75
1024.5	44	10	1811.3	99	45	2919.1	70	80
1156.5	58	15	1927.4	100	50	3212.1	58	85
1272.6	70	20	2050.9	99	55	3628.2	44	90
1382.5	80	25	2183.4	97	60	4336.8	26	95
1488.6	87	30	2330.2	93	65			
1594.2	93	35	2495.5	87	70			

ZETA PALS OF SOOTA TAILA.



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AND PG CENTRE
 KOPPA, DISTRICT: CHIKMAGALUR, KARNATAKA, 577126

Reference Number: QC/ST/28/2023

Date: 10th August 2023

Purpose: Analysis for Kajjali, Homogenous mixture of Soota Taila (HMST) and Soota Taila.....

Result:

I. Soota Taila

A. Organoleptic Characters

Colour	Yellowish green/Amber
Odour	Characteristic aromatic
Texture	Viscous oil

B. Physico-chemical Parameters

Loss on Drying at 105°C	0.01%
Saponification value	187.95%
Iodine value	111.67%
Acid value	2.02%
Peroxide value	5.15%
Ester value	185.93
Refractive index at 30°C	1.451
Specific gravity	0.9435
Weight (gm) per ml	0.9373 gm/ml
Viscosity at 30°C	94.6031 cP
Rancidity test (Kanis test)	Negative
Total aerobic counts	Nil
Total fungal count	Nil

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Laboratory is not liable to bear any legal action or dispute based on this report

PHYSICO-CHEMICAL ANALYSIS OF SOOTA TAILA.

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II. Kajjali and Homogenous mixture of Soota taila (HMST)

A. Organoleptic Characters

	Kajjali	HMST
Colour	Black	Green
Odour	Odorless	Characteristic
Taste	Tasteless	Tasteless
Texture	Fine powder	Fine powder

B. Physico-chemical parameters

	Kajjali	HMST
Loss on Drying at 105°C	0.28%	0.39%
Total ash	0.19%	18.74%
Acid insoluble ash	0.01%	0.76%
Water soluble ash	0.60%	4.15%
Alcohol soluble extractives	0.60%	8.17%
Water soluble extractives	0.10%	26.05%
pH (5% aqueous solution)	5.61± 0.10	5.88± 0.10

C. Elemental Analysis

	Kajjali	HMST
Mercury	61.25%	9.25%
Mercurous	2.15%	0.50%
Mercuric	58.95%	8.73%
Free Mercury	0.15%	0.02%
Sulphur	28.17%	7.50%
Sulphide	24.35%	7.12%

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Sulphite	3.82%	0.38%
Sulphate	0.00%	0.00%
Free Sulphur	0.00%	0.00
Arsenic	---	1.12%

D. Microbial contamination

	Kajjali	HMST
Total aerobic count	Nil	Nil
Total fungal count	Nil	Nil

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PHYSICO-CHEMICAL ANALYSIS OF KAJJALI AND HMST

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