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Phytochemical and Physico-chemical analysis of *Jayapala Beeja* (*croton tiglium* linn.) with reference to different *Shodhana Samskara*

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ABSTRACT:

A poison shows fatal effects when impure but if used after purification in a proper way it acts as *Rasayana*. Minerals, metals and toxic plant materials used in Ayurvedic formulations are subjected to various processes under the name of *Shodhana* i.e. to detoxify them and make **suitable** for human consumption in therapeutic dosage. It is very interesting to observe that different medias/processes have been explained for the *Shodhana* of a particular substance like *Gomutra* (cow's urine), *Godugdha* (cow milk) and *Kanji* media etc.

But sometimes it is noted that some commonly used drugs show Adverse Drug Reactions (ADR). This may be because of the wrong *Shodhana* procedure adopted or improper *Shodhana*. So at this stage it **becomes** mandatory to compare the effect of different media on chemical constituents after *Shodhana* processes and validate the best *Shodhana* media for that particular toxic substance.

So the present study - A Comprehensive Study on *Sthavara Visha - Jayapala* (*Croton tiglium* Linn.) **Shodhana**, in relation to its toxic principles, was carried out to show the best suitable medium for the purification and to avoid a major toxic hazard.

KEYWORDS: Jayapala Beeja, Shodhana, Physico-chemical analysis

INTRODUCTION

Ayurvedic medications contain herbs, minerals, metals and animal products. It is important to have an awareness regarding the poisonous drugs which when used in the proper, prescribed dose, acts as potent therapeutic agents.

Recently it was a great fact of concern as a ban on the sale of Ayurvedic and other herbal medicines in European markets due to adverse effects of such alternative medicines. After the ban comes into effect, only high quality, long established and scientifically safe herbal medicines were allowed to be sold in the European countries. (Indian Express 3 Feb. 2011)

Mineral sources and some poisonous plants (*Vatsanabha*, *Kupeelu*, *Jayapala* etc.) consist of impurities and toxic substances which are harmful to the human body. Therefore, when these drugs are used in Ayurvedic formulations they should be purified to eliminate such impurities or toxic substances, before used for medicinal purposes.

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It is rightly mentioned in Charaka Samhita that even a poison can be converted into nectar like effective medicine, if it is properly processed and judiciously administered. (Ch. Su. 1/26).

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A poison shows fatal effects when impure but if used after purification in a proper way it acts as *Rasayana*.

Minerals, metals and toxic plant materials used in Ayurvedic formulations are subjected to various processes under the name of *Shodhana* i.e. to detoxify them and make suitable for human consumption in therapeutic dosage. It is very interesting to observe that different medias/processes have been explained for the *Shodhana* of a particular substance like *Gomutra* (cow's urine), *Godugdha* (cow milk) and *Kanji* media etc.

But sometimes it is noted that some commonly used drugs show Adverse Drug Reactions (ADR). This may be because of the wrong *Shodhana* procedure adopted or improper *Shodhana*. So at this stage it becomes mandatory to compare the effect of different media on chemical constituents after *Shodhana* processes and validate the best *Shodhana* media for that particular toxic substance.

Ayurveda has given prime importance to *Mahavishas* and *Upavishas* and the *Chikitsa* for their toxic effects. *Upavishas* are seven in number and *Jayapala* drug is one among them. Even though the whole plant has been mentioned as toxic, its *Beeja* is mentioned particularly as highly toxic.

So the present study - A Comprehensive Study on *Sthavara Visha - Jayapala* (*Croton tiglium* Linn.) *Shodhana*, in relation to its toxic principles, was carried out to show the best suitable medium for the purification and to avoid a major toxic hazard.

SIGNIFICANCE OF THE STUDY:

Even though many toxic drugs are used in Ayurvedic formulations after proper purification. But sometimes it is noted that some commonly used drugs show Adverse Drug Reactions (ADR). This may be because of the wrong Shodhana procedure adopted or improper Shodhana. So at this stage it becomes mandatory to compare the effect of different media and the percentage of toxic principles after Shodhana processes and validate the best Shodhana media.

PREVIOUS WORKS DONE ON JAYAPALA SHODHANA:

Till date only one work has been carried out on Jayapala Shodhana by applying only one Shodhana process of Svedana with Godugdha by Dr. Arthi Shinde-Study of effect of Shodana Process on LD50 of Croton tiglium (Jayapala Beeja) – Tilak Ayurved Mahavidyalaya. Pune – 2005.

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OBJECTIVES OF THE STUDY :

- 1) To carry out *Shodhana* (purification) of *Jayapala* seeds by different 6 methods mentioned in the classics.
- 2) To compare the phytochemical and physicochemical study of *Ashodhita Jayapala Beeja* with *Shodhita* samples of *Jayapala Beeja*.
- 3) To compare the percentage of toxic principle of various processes.

MATERIALS AND METHODS:

MATERIALS:

I. Materials for Literary study:

All sorts of references were collected and compiled from Ayurvedic classics, theses, scientific papers, journals, periodicals and modern texts etc. All the compiled and collected material was compiled in scientific manner.

II. Materials for Applied study:

1. Pharmagognostical study :

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2. Pharmaceutical study - for Shodhana (purification) of Jayapala seeds

- i. Ashodhita Jayapala seeds
- ii. LPG stove
- iii. Stainless steel vessels
- iv. Hand gloves
- v. Stainless steel ladle
- vi. Thermometer
- vii. Measuring jar
- viii. Knife
- ix. Weighing balance
- x. Thread, Cloth etc.

3. Analytical study

- i. Raw Jayapala seeds. : Sample-JS
- ii. Shodhita Jayapala endosperm : Sample-A
- iii. Shodhita Jayapala endosperm : Sample-B
- iv. Shodhita Jayapala endosperm : Sample-C
- v. Shodhita Jayapala endosperm : Sample-D
- vi. Shodhita Jayapala endosperm : Sample-E
- vii. Shodhita Jayapala endosperm : Sample-F

METHODS:

- 1. Identification and Collection of the raw drug Jayapala.
- 2. Pharmagognostical study Authentification of the study drug Jayapala.

- 3. **Pharmaceutical study** *Shodhana* (purification) of *Jayapala* seeds by different methods mentioned in the classics.
- 4. **Analytical study -** To compare the phytochemical and physicochemical study of *Ashodhita Jayapala Beeja* and *Shodhita* samples of *Jayapala Beeja*.

METHODOLOGY:

- 1. Collection and identification of *Jayapala beeja* (Seeds): Raw sample of *Jayapala beeja* was collected from a local herbal drug dealer and identified from our Ayurvedic medical college.
- **2. Pharmagognostical study** Authentificaton of the drug *Jayapala* was done at AYUSH approved research lab.
- **3. Pharmaceutical Study:** In this phase, six different methods of *Jayapala Shodhana* was done as per the reference of *Rasatarangini* 24/310, *Rasatarangini* 24/312, *Rasatarangini* 24/313-314, *Rasatarangini* 24/315-317, *Rasamruta* and two methods of *Yogaratnakara*.
- **4. Analytical Study:** *Ashodhita Jayapala* seeds and *Shodhita Jayapala* seeds obtained by six different methods of *Shodhana* were comparatively analyzed for any differences in Organoleptic, Physico-chemical and Phytochemical parameters.

PHARMACOGNOSTICAL STUDY OF DRUG JAYAPALA :

Pharmacognosy is a branch of Pharmaceutical science, which deals with naturally occurring biological products those derived from plants, animals and mineral origin. The term Pharmacognosy is derived from two Greek words '*Pharmakon*' means 'a drug' and '*Gignosco*' or '*Gnosis*' means, 'to acquire knowledge of'.

In Pharmacognosy a complete and systematic study of a drug is done, which comprises of (i) origin, common names, scientific nomenclature and family, (ii) geographical source (and history), (iii) cultivation, collection, preservation and storage, (iv) Macroscopical, Microscopical and sensory (organoleptic) characters, (v) Chemical composition wherever possible, (vi) Identity, Purity, Strength and Assay, (vii) substitute and adulterants etc. Such systematic study of a drug as complete as possible, is claimed to be the scientific or pharmacognositical evaluation.

Every species has its own characteristic features which determine the authenticity of that particular drug. So it becomes helpful to differentiate closely related species of the same genus or the same family.

In the present study an attempt was made to standardize the seed used for the pharmaceutical process. Here, the drug *Croton tiglium* was authenticated morphologically, macro and microscopically.

Plan of study:

1. Collection of raw materials 2.Plant identification 3.Pharmacognostical study

Materials and Methods:

Collection of raw material: *Jayapala* seeds were collected from Jogappa Shanbag a local vendor in Udupi (Karnataka).

Plant identification: The correct identity and authenticity of family were confirmed by studying its morphological characters and comparing them with the characters mentioned in various Flora^[i] and texts and expert of the department of Dravyaguna, L.R.P., Post graduate Institute and Research Center –Islampur.

Pharmacognostical study:

The study was carried out at the level of three stages i.e. macroscopic, microscopic. Conventional pharmacognostical methods were used for the study of macroscopic, microscopic and powder characters of the *Jayapala* seed.

Macroscopic study:

External features were recorded using Canon Ixus digital camera. Size, Shape, Color, Odour, Taste and Texture etc. were observed and noted).

Method of microscopic study:

- Material: The fresh seeds from fully ripe fruit of *Croton tiglium*.
- Equipments: Zeiss AXIO trinocular microscope attached with Zeiss AxioCam camera, glass slide, cover slip, watch glass, hair brush, mountain brush, blotting paper, blades etc.
- Chemical: saffranine
- ♦ Methods:^[ii]
 - 1. Selection Method. 2.Staining Method.

1. Selection Method:

- Sample was kept in a test tube and sufficient water was added so that sample remains submerged.
- Sample was boiled in water over spirit lamp for few minutes. This result, softening of the hard sample for getting the sample ready for taking sections.
- With the help of new blade thin transverse section were taken.
- Thick, oblique sections were rejected.
- With help of mountain hair brush, selected sections were transferred to watch glass containing water.

2. Staining Method:

- A thin transverse section of the sample was taken and transferred it on a glass slide with help of mountain hair brush.
- The sections were stained with saffranine and then focused the section under microscope and arrangement of cells were studied.
- Transverse sections were photographed using Zeiss AXIO trinocular microscope attached with Zeiss AxioCam camera under bright field light. Magnifications of the figures are indicated by the scale-bars.

Observation and Result obtained:

1. Macroscopic study of dried seed of Croton tiglilum:

Part used: Seed

Identification of seed by sensory evaluation of the characteristic with help of sense organ was done. In this method the shape, size, color, odour were studied. The external features were recorded using Canon Ixus digital camera.

Seed: Albuminous, ovate, oblong, slightly quadrangular, convex on dorsal and somewhat flattened on ventral surface, about 12 mm in length and resemble castor seed in shape, dull cinnamon-brown, often mottled with black due to abrasion in testa, caruncle easily detatched and usually absent, hilum on ventral side less distinct than that of castor seed, raphe runs along ventral surface of seed, terminating in a dark chalaza at opposite extremity, kernel yellowish and oily, consisting of a large endosperm, enclosing papery cotyledons and a small radicle, no marked odour; kernel gives at first oily taste followed by an unpleasant acridityⁱⁱⁱ.(Fig.2)

2. Microscopical study of dried seed of Croton tiglilum:

Shows a hard testa, consisting of an epidermal layer, covered externally with a thick cuticle and composed of oval and tangentially elongated cells, filled with brownish content; epidermis followed by a layer of radially elongated cells, slightly bent at middle, upper half portion filled with reddish-brown and lower half filled with yellow contents; inner most zone consists of tangentially elongated, thin-walled cells; endosperm consist of polygonal parenchymatous cells filled with oil globules, a few cells having rosette crystals of calcium oxalate; central region of endosperm shows a dicotyledonous embryo consisting of thin-walled parenchymatous cells. (Fig.3)

Figure 2. Macroscopy of seed of Croton tiglium

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Fig. 2.1. Seeds







Fig. 2.3. LS of kernelFig. 2.4. TS of kernelFigure 3. Microscopic characters of seed of Croton tiglium



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Fig. 3.1. TS through testa







crystals

Fig 3.3 Detailed TS of cotyledon

AG, aleurone grains; EC, epidermis of cotyledon; ET, epidermis of testa; Rcr, rosette crystals of calcium oxalate; Scl, sclereids; OC, oil cells.

PHARMACEUTICAL STUDY:

The prime objective of pharmaceutical research is to produce a safe, effective and quality drug. Efficacy and safety depend solely on the quality of the drug. The quality of the pharmaceutical product depends not only on the care taken in its

preparation, but also in confirming that the genuine raw materials have been used and the material has been correctly processed.

According to Ayurveda, there is no substance in the world which cannot be used as medicine. Most of the drugs, as such cannot be used for the therapeutic purpose in the biological systems. Hence, to develop an elegant, compatible and convenient dosages forms, which can be applied easily, will be the need of time. These specific modifications are known as '*Samskara*' in Ayurveda, and they can be grouped under the headings of 'Pharmaceutical processes' in contemporary languages.

Minerals, metals and toxic plant materials used in Ayurvedic formulations are subjected to various processes under the name of '*Shodhana*' (detoxifying process) and make suitable for human consumption in therapeutic dosage.

A poison shows fatal effects when impure but if used after purification in a proper way it acts as *Rasayana*.

For the present research study, the aim was to validate the *Shodhana* procedure of *Jayapala* by applying various processes mentioned in the classics and to compare the effect of different media on chemical constituents after *Shodhana* processes and validate the best *Shodhana* media for that particular toxic substance.

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2	S w ed an a	G o d u g d a & T	6 hr s.	Rasat arangi ni 24/31 3-14

Shodhana of Jayapala Beeja in various classics:

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So many methods for *Shodhana* of *Jayapala* are available in the classics of *Rasashastra*. Different media are also used for *Shodhana* treatment. But by scrutinizing all the methods; 6 methods which uses different media or processes have been selected for the present study.

This is done To carry out *Shodhana* (purification) of *Jayapala* seeds by different methods mentioned in the classics. To compare the effect of different media on toxic principles. And find out a best and suitable *Shodhana* process for *Jayapala*.

Procurement of Raw Drugs:

The raw materials for the present study i.e. *Ashodhita Jayapala* Seeds were collected from a local market and *Godugda*, *Gomaya*, *Mahisha Mala* were taken from a local *Goshala*. *Shodhita Tankana* was taken from the pharmacy of the college and *Nimbu* (lime) were bought from the local market. All the drugs were authenticated in the Dept. of Pharmacognosy. L.R.B.P., Post graduate Institute and Research Center –Islampur.

Table no. 1: Distribution of Method.

Ref. of Shodhana Process	Method
Rasatarangini (24/310-312)	Α
Rasatarangini (24/313-314)	В
Rasatarangini (24/315-317)	С
Rasamruta	D
Yogaratnakara	Ε
Yogaratnakara	F

(Source:Primary Data)

Method no. A:

Name of Practical: Jayapala Shodhana

Batch : Sample - A

Reference : *Rasatarangini* (24/310-312)

Principle : Swedana

Date of Commencement: 19/10/2013

Date of Completion: 21/10/2013

Ingredients:

Table no. 2: Detail of the Ingredients for Jayapala Shodhana

Sr. No.	Ingredient	Part used	Quantity
01	Ashodhita Jayapala	Seed	150 gm
02	Godugdha	-	1000 ml

Apparatus: LPG stove, steel pot, gloves, iron rod, thread, cloth, thermometer, measuring jar, knife, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperms were taken in the cotton cloth piece and *Pottali* was prepared. *Pottali* was hanged in the steel vessel through iron rod. Sufficient amount of *Godugdha* was added into the steel vessel to complete immerse the *Pottali*.
- The vessel was kept on the LPG gas stove; heating process was carried out for 3 hrs. (1 *Prahara*). After the *Swedana* process, *Jayapala* endosperm were collected from *Pottali* and washed with hot water and dried in Sun light.
- The same process was repeated for 3 times.

Precautions:

- *Pottali* should be completely immersed in the milk.
- *Pottali* should not touch the bottom of the vessel.
- During *Swedana* process quantity of milk was maintained as such *Pottali* was completely immersed in milk throughout the process.
- Every time fresh *Godugdha* was taken.

In the same way 2nd and 3rd process was repeated, after completing the *Shodhana* process the *Jayapala* endosperm were dried and stored.

Observations:

- During process, bitter smell was observed in whole process of heating.
- After *Shodhana*, *Jayapala* endosperm became soft, dull white colour, converted into whitish color and volume was increased.
- White color *Godugdha* turned into creamish brown and thick in consistency was observed.
- Some oil portion was floating over the *Godugdha*.

S.No.	Parameters	Sample A
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	70 gm
3.	Volume of Godugdha taken (ml)	1000 ml
4.	Wt. of <i>Shodhita Jayapala</i> obtained (gm)	54 gm
5.	Wt. loss of <i>Jayapala</i> endosperm during process (gm)	16 gm
6.	Percentage of <i>Jayapala</i> endosperm obtained (%)	77 %
7.	Volume of <i>Godugdha</i> obtained after <i>Shodhana</i> of <i>Jayapala</i> endosperm (ml)	500 ml

Table no. 3: Observation and Results during Swedana process of Jayapala endosperm.

(Source:Primary Data)

Table no. 4: Temperature observed during Swedana process of Jayapalaendosperm.

Duration	Temperature (°C)
(Hrs : minute)	Sample - A
0:00	24
0:30	100
1:00	100
1:30	100
2:00	100
2:30	100
3:00	100

Method no. B:Name of Practical: Jayapala ShodhanaBatch: Method - BReference: Rasatarangini (24/313-314)Principle: SwedanaDate of Commencement: 18/10/2013

Date of Completion: 19/10/2013

Ingredients:

Table no. 5: Detail of the Ingredients for Jayapala Shodhana

Sr.N o.	Ingredie nt	Part used	Quanti ty
01	Ashodhit a Jayapala	Seeds	150 gm
02	Godugdh a	-	2500 ml
03	Shodhita Tankana	Powd er	20 gm

(Source:Primary Data)

Apparatus: LPG stove, steel pot, gloves, iron rod, *Khalva Yantra*, thread, cloth, thermometer, measuring jar, knife, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperm and *Shodhita Tankana* were mixed in the *Khalva Yantra* and taken in the cotton cloth piece and *Pottali* was prepared. *Pottali* was hanged in the Steel vessel through Iron rod. Sufficient amount of *Godugdha* was added into the steel vessel to completely dip the *Pottali*.
- The vessel was kept on the LPG gas stove; heating process was carried out for 6 hrs. (2 *Prahara*). After completing the *Swedana* process, *Jayapala* endosperm were collected from *Pottali* and washed with hot water and dried in Sun light.

Precautions:

• *Pottali* should be completely immersed in the milk.

- *Pottali* should not touch the bottom of the vessel.
- During *Swedana* process quantity of milk was maintained as such *Pottali* was completely immersed in milk.

Observations:

- During process, bitter smell was observed in whole process of heating.
- After *Shodhana*, *Jayapala* endosperm had became soft, dull white colour, converted into whitish color and volume was increased.
- White color Godugdha turned into creamish brown and thick in consistency was observed.
- Some oil portion was floating over the *Godugdha*.

Table no. 6: Observation and Results during Swedana process of Jayapala endosperm.

S.No.	Parameters	Sample - B
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	86 gm
3.	Volume of Godugdha taken (ml)	2500 ml
4.	Weight of <i>Shodhita Tankana</i> taken (gm)	20 gm
5.	Wt. of <i>Shodhita Jayapala</i> obtained (gm)	54 gm
6.	Wt. loss <i>Jayapala</i> endosperm during process (gm)	32 gm
7.	Percentage of <i>Jayapala</i> endosperm obtained (%)	63 %
8.	Volume of <i>Godugdha</i> obtained after <i>Shodhana</i> of <i>Jayapala</i>	1050 ml

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endosperm (ml)	
1 ()	

Table no. 7: Temperature observed during Swedana process of Jayapalaendosperm.

Duration	Temperature (°C)	
(Hrs : minute)	Sample - B	
0:00	26	
0:30	100	
1:00	100	
1:30	100	
2:00	100	
2:30	100	
3:00	100	

(Source:Primary Data)

Method no. C:

Name of Practical: Jayapala Shodhana

Batch : Method - C

Reference : *Rasatarangini* (24/315-317)

Principle : Swedana

Date of Commencement: 22/10/2013

Date of Completion: 24/10/2013

Ingredients:

Table no. 8: Detail of the Ingredients for Jayapala Shodhana.

Sr. No.	Ingredi ent	Pa rt us ed	Quant ity
01	Ashodhi ta Jayapal a	Se ed	150gm
02	Godugd ha	-	1500m 1

Apparatus: LPG stove, steel pot, gloves, iron rod, thread, cloth, thermometer, measuring jar, knife, *Sharava*, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperm was taken in the cotton cloth piece and *Pottali* was prepared. *Pottali* was hanged in the steel vessel through iron rod. Sufficient amount of *Godugdha* was added into the steel vessel to complete immerse the *Pottali*.
- The vessel was kept on the LPG gas stove; heating process was carried out for 3 hrs. (1 *Prahara*). After the *Swedana* process, *Jayapala* endosperm were collected from *Pottali* and washed with hot water and made into paste.
- Then paste of processed *Jayapala* endosperm was smeared on new *Sharava* (earthen sacker) and kept for 1-2 days for absorbing the oil portion of the paste of *Jayapala* endosperm.
- After that collect the materials from the *Sharava* and dried properly in Sun light and packed in the air tight plastic package.

Precautions:

- *Pottali* should be completely immersed in the milk.
- *Pottali* should not touch the bottom of the vessel.
- During *Swedana* process quantity of milk was maintained as such *Pottali* was completely immersed in milk.
- New earthen sacker should be used after thorough washing and drying for proper absorption of the oil portion of *Jayapala* paste.

Observations:

- During process, bitter smell was observed in whole process of heating.
- After *Shodhana*, *Jayapala* endosperm had became soft, dull white colour, converted into whitish color and volume was increased.
- White color *Godugdha* turned into creamish brown and thick in consistency was observed.
- Some oil portion was floating over the *Godugdha*.

Table no. 9: Observation and Results during Swedana process of Jayapalaendosperm.

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S.No.	Parameters	Sample - C
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	68 gm
3.	Volume of <i>Godugdha</i> taken (ml)	1500 ml
4.	Wt. of <i>Shodhita Jayapala</i> obtained (gm)	52 gm
5.	Wt. loss <i>Jayapala</i> endosperm during process (gm)	16 gm
6.	Percentage of <i>Jayapala</i> endosperm obtained (%)	76 %
7.	Volume of <i>Godugdha</i> obtained after <i>Shodhana</i> of <i>Jayapala</i> endosperm (ml)	600 ml

Table no. 10: Temperature observed during Swedana process of Jayapala

endosperm.

Duration	Temperature (°C)
(Hrs : minute)	Sample - C
0:00	28
0:30	100
1:00	100
1:30	100
2:00	100
2:30	100
3:00	100

(Source:Primary Data)

Method no. D:

Name of Practical	: Jayapala Shodhana
Batch	: Method - D
Reference	: Rasamruta
Principle	: Swedana and Bhavana
	25/10/2012

Date of Commencement: 25/10/2013

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Date of Completion: 28/10/2013

Ingredients:

Table no. 11: Detail of the ingredients for Jayapala Shodhana.

Sr.No	Ingredien t	Par t use d	Quantit y
01	Ashodhita Jayapala	See d	150 gm
02	Godugdha	-	1500 ml
03	Nimbu Swarasa	-	QS

(Source:Primary Data)

Apparatus: LPG stove, steel pot, iron rod, thread, cloth, thermometer, measuring jar, knife, *Khalva Yantra*, *Sharava*, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperm was taken in the cotton cloth piece and *Pottali* was prepared. *Pottali* was hanged in the steel vessel through iron rod. Sufficient amount of *Godugdha* was added into the steel vessel to complete immerse the Pottali.
- The vessel was kept on the LPG gas stove; heating process was carried out for 3 hrs. (1 Prahara). After the *Swedana* process, *Jayapala* endosperm were collected from Pottali and dried and powdered.
- *Bhavana* with *Nimbu Svarasa* was given for three days, and then dried properly in sun light and packed in the air tight plastic package.

Precautions:

- *Pottali* should be completely immersed in the milk.
- *Pottali* should not touch the bottom of the vessel.
- During *Swedana* process quantity of milk was maintained as such *Pottali* was completely immersed in milk.

Observations:

• During process, bitter smell was observed in whole process of heating.

- After *Shodhana*, *Jayapala* endosperm had became soft, dull white colour, converted into whitish color and volume was increased.
- White color Godugdha turned into creamish brown and thick in consistency was observed.
- Some oil portion was floating over the Godugdha.

 Table no. 12: Observation and Results during Swedana process of Jayapala

 endosperm.

S.No.	Parameters	Sample - D
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	75 gm
3.	Volume of Godugdha taken (ml)	1500 ml
4.	Volume of Nimbu Swarasa (ml)	Q.S.
5.	Wt. of <i>Shodhita Jayapala</i> obtained (gm)	56 gm
6.	Wt. loss of <i>Jayapala</i> endosperm during process (gm)	19 gm
7.	Percentage of <i>Jayapala</i> endosperm obtained (%)	75 %
8.	Volume of <i>Godugdha</i> obtained after <i>Shodhana</i> of <i>Jayapala</i> endosperm (ml)	800 ml

(Source:Primary Data)

Table no. 13: Temperature observed during *Swedana* process of *Jayapala* endosperm.

Duration		Temperature (°C)	
(Hrs : minute)		Sample - D	
0:00		26	
0:30		100	
	1:00	100	
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1:30	100
2:00	100
2:30	100
3:00	100

(Source:Primary Data)

Method no. E:

Name of Practical: Jayapala Shodhana

Batch	: Method - E
Reference	: Yogaratnakara
Principle	: Sthapana and Bhavana
Date of Comme	ncement: 15/10/2013
Date of Comple	tion: 20/10/2013
Ingredients:	

Table no. 14: Detail of the Ingredients for Jayapala Shodhana.

Sr. No.	Ingredient	Part used	Quantity
01	Ashodhita Jayapala	Seed	150 gm
02	Mahisha Mala	-	1000 gm
03	Nimbu Swarasa	-	QS

(Source:Primary Data)

Apparatus: Cloth, measuring jar, knife, *Khalva Yantra*, *Sharava*, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperms were wrapped in the cotton cloth piece and tied as a *Pottali* and it was kept in the *Mahisha Mala* for three days.
- *Jayapala* endosperm were collected from *Pottali* and washed with hot water and made into paste.

- Then paste of processed *Jayapala* endosperm was smeared on new *Sharava* (earthen sacker) and kept for 1-2 days for absorbing the oil portion of the paste of *Jayapala* endosperm.
- After that collect the materials from the *Sharava* and then *Bhavana* with *Nimbu Svarasa* is given for three days, and then dried properly in sun light and packed in the air tight plastic package.

Precautions:

• Pottali should be completely covered with Mahisha Mala.

Observations:

- During process, bitter smell was observed in whole process of heating.
- After *Shodhana*, *Jayapala* endosperm had became soft, greyish white color, converted into whitish color and volume was increased.

Table no. 15: Observation and Results during *Swedana* process of *Jayapala* endosperm.

S.No.	Parameters	Sample - E
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	75 gm
3.	Wt. of Mahisha Mala taken (gm)	1000 gm
4.	Wt. of <i>Shodhita Jayapala</i> obtained after <i>Bhavana</i> with <i>Nimbu Swarasa</i> (gm)	58 gm
5.	Wt. loss <i>Jayapala</i> endosperm during process (gm)	17 gm
6.	Percentage of <i>Jayapala</i> endosperm obtained (%)	77 %
7.	Weight of <i>Mahisha Mala</i> obtained after <i>Shodhana</i> of <i>Jayapala</i> endosperm (gm)	930 gm

(Source:Primary Data)

Method no. F:

Name of Practical : Jayapala Shodhana

Batch	: Method - F	
Reference	: Yogaratnakara	
Principle	: Swedana	
Date of Commencement: 29/10/2013		
Date of Completion: 29/10/2013		
Ingredients:		

Sr. No.	Ingredient	Part used	Quantity
01	Ashodhita Jayapala	Seed	150 gm
02	Gomaya Rasa	-	1500 ml

Apparatus: LPG stove, steel pot, iron rod, thread, cloth, thermometer, measuring jar, knife, weighing balance etc.

Procedure:

- Remove the outer cover (testa) and cotyledon of the *Jayapala* endosperm with the help of knife.
- *Jayapala* endosperm was taken in the cotton cloth piece and *Pottali* was prepared. *Pottali* was hanged in the steel vessel through iron rod. Sufficient amount of *Gomaya Rasa* was added into the steel vessel to completely immerse the *Pottali*.
- The vessel was kept on the LPG gas stove; heating process was carried out for 3 hrs. (1 *Prahara*). After the *Swedana* process, *Jayapala* endosperm were collected from *Pottali* and washed with hot water and dried in Sun light.

Precautions:

- Pottali should be completely immersed in the Gomaya Rasa.
- *Pottali* should not touch the bottom of Vessel.

• During *Swedana* process quantity of *Gomaya Rasa* was maintained as such *Pottali* was completely immersed in *Gomaya Rasa*.

Observations:

- During process bitter smell was observed in whole process of heating
- After *Shodhana*, *Jayapala* endosperm had became soft, dull white color, converted into grayish whitish color and volume was increased.
- Some oil portion was found floating over the Gomaya Rasa.

Table no. 17: Observation and Results during *Swedana* process of *Jayapala* endosperm.

S.No.	Parameters	Sample - F
1.	Weight of <i>Ashodhita Jayapala</i> seed taken (gm)	150 gm
2.	Wt. of <i>Ashodhita Jayapala</i> endosperm without outer cover and cotyledon (gm)	78 gm
3.	Volume of <i>Gomaya Rasa</i> taken (ml)	1500 ml
4.	Wt. of <i>Shodhita Jayapala</i> obtained (gm)	62 gm
5.	Wt. loss <i>Jayapala</i> endosperm during process (gm)	16 gm
6.	Percentage of <i>Jayapala</i> endosperm obtained (%)	79 %
7.	Volume of <i>Gomaya Rasa</i> obtained after <i>Shodhana</i> of <i>Jayapala</i> endosperm (ml)	1000 ml

(Source:Primary Data)

 Table no. 18: Temperature observed during Swedana process of Jayapala

 endosperm.

	Duration	Temperature (°C)
(Hrs : minute)		Sample - F
	0:00	27
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0:30	100
1:00	100
1:30	100
2:00	100
2:30	100
3:00	100

(Source:Primary Data)

Conclusion:

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