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Pharmaceutical Standardization Of "*Rasa Sindoora*" Prepared By Electric Muffle Furnace

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ABSTRACT: *Kupipakwa Rasayana*, a superlative form of preparation in *Rasa Shastra*. *Rasa Sindoora* (Red sulfide of mercury) is one of the best formulations of *Kupipakwa Rasayana* in *Ayurveda*. *Rasa Sindoora* has proven its efficacy in a wide spectrum of ailments over the time with different herbal drugs and *Anupaan* in variety of doses. Equal ratio of *Shodhita Parada* (Purified Mercury) and *Shodhita Gandhaka* (Purified Sulphur) were used to prepare *Rasa Sindoora* as per the reference of Rasa Tarangini with wide expansion of therapeutic effect.

Aim- To standardize manufacturing procedure of *Rasa Sindoora*.

Material and method- *Rasa Sindoora* preparation was standardized by preparing three batches using electric muffle furnace (EMF).

Results- In three consecutive batches of *Rasa Sindoora*, The average yield was 104.66 gm in average time of 12.53 hrs. In all three batches average of *Kajjali* melting temperature, flame appearing temperature and corking temperature were 354^{0}C, 484^{0}C and 601^{0}C respectively.

Conclusion- *Rasa Sindoora* preparation was concluded on the basis of three batches in which each batch of 200 gm of *Kajjali* subjected to following intermittent heating pattern that was mild heat (100-250^{0}C) for 4 hrs, Moderate heat (250-450^{0}C) for 4 hrs and strong heat (450-650^{0}C) for 4 hrs. The average yield was 104.66 gm i.e. 52.33%.

Keywords: *Kupipakwa*, *Rasa Sindoora*, *Kajjali*, Electric Muffle Furnace (EMF).

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INTRODUCTION:

Ayurveda is a complete life science. It is not limited to the diseases and their treatment protocol. It also elaborates the ethics for leading a healthy and purposeful life which is good for the individual as well as the society. The substance mostly used in *Ras Shastra* are metals, minerals, herbal poisonous drugs necessitate to be changed into nontoxic, absorbable, assumable, disease curing, health promoting form, therapeutically potent and safe through the process like *Shodhana*, *Marana*, *Jarana* and *Sanskar* etc. *Kupipakwa Rasayana Kalpana* is one of the unique *Kalpana* of *Rasashastra*, it is unique because of its specific process of preparation method and properties like quick action, *Rasayana Karma*, *Yogavahi* & effectiveness in smaller dosage form along with long shelflife.

Out of wide variety of *Rasa yoga*, *Rasa Sindoora* which is well known *Kupipakwa Rasayana* has proven its efficacy in a wide spectrum of ailments over the time with different herbal drug and *Anupan* in variety of doses and it prepared by electric muffle furnace method and have specific *Kramagni* pattern with reference of *Rasa Tarangini*[1]

MATERIAL AND METHODS:

Pharmaceutical process of *Bahirdhoom Rasa Sindoora* includes the purification of active ingredients i.e. *Parada* and *Gandhaka* that were used for preparing *Kajjali*. Other equipment used in work were such as *Kupi* (seven layer mud-smeared cloth bottle), Vertical Electric Muffle Furnace (EMF), Thick and Thin *Shalaka*, Torch, Copper coin, Brick cork etc. in Rasashastra and Bhaishajya Kalpana

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Methods:

Three samples of *Rasa Sindoora* were prepared according to the reference of *RasaTarangini* by using of EMF method and have following stages:

- **Pre-Heating phase-** it includes
  - Purification of *Parada*
  - Purification of *Gandhaka*
  - Preparation of *Kajjali*
  - Preparation of *Kupi*
  - Filling of *Kupi*

- **Purification of *Parada***: Initially 700 gm of impure *Parada* purified according to the reference of *Rasatarangini*[2] finally 610gm of pure *Parada* obtained after complete procedure of purification in process. 5.71% loss was seen when *Parada* purified with lime and 7.58% loss was seen when *Parada* purified with Garlic and *Saindhava Lavana*. Lastly purified *Parada* was filtered through double folded cloth.
- **Purification of *Gandhaka*[3]**: 400 gm of impure *Gandhaka* purified according to the reference of *Rasatarangini*, by doing *Dhalana* process i.e. melting and pouring of *Gandhaka* in *Go-dugdha* for 3 times. At the end finally 388 gm of purified *Gandhaka* obtained. Complete *Shodhana* of *Gandhaka* 3% loss was observed. Reason of loss is due to adherence of *Gandhaka* on cotton cloth, impurities and also during the washing process.
- **Preparation of *Kajjali*:**

According to *RasaTarangini*[4], equal amount of purified *Parada* (320 gm) and purified *Gandhaka* (320 gm) were taken and jet black colour *Kajjali* prepared after 34 hrs of manual triturating method, during this procedure loss was 4 gm and the probable due to is spilling of material. Later on 3 consecutive *Bhawana* (wet grinding) of *Vatankur Swarasa* in 600 gm of *Kajjali* that causes hike in its weight from 600 to 606 gm of *Kajjali* which is carried out.

- **Preparation of *Kupi:***

Once collected *Kupi* (beer bottle) and cleaned it well. Smectite clay was crushed, made into powder and sieved the powder. Water was added in powder and become sloughy. After that piece of cotton cloth was taken for *Kapadmitti*. This piece was cut in the size of bottle and in circular shape for the base of bottle. These cloth pieces were dipped in smectite clay for some time. Initially a circular piece of *Kapadmitti* (clay smeared cloth) was stuck in the base of bottle and dried it. Further first layer of

Kapadmitti was applied on the external surface of the whole bottle and dried it well. This whole process was repeated for 7 times.

- **Filling of *Kupi*:-**

Kajjali was triturated for 30 min. before filling it into the *Kupi* with total capacity of 650 ml. *Kupi* was filled with 200 gm of *Kajjali* with the help of glass funnel.

❖ **Heating phase**

Kajjali filled in *Kupi* and was kept in the EMF. For find the exact temp. of *Kupi*, another thermocouple was placed in EMF and associated with its temp. EMF Temp. started with room temp. and gradually increased with rising of time. Temperature of furnace was recorded periodically. Red hot *Shalaka* was used to clear the mouth of bottle, when it was just block by the *Gandhaka* as outcome of *Jarana* process. Fumes increased in bottle with rising in temperature, after sometime fumes disappeared and flame appeared. The flame was attaining a height of 4-6 inch & after that it was gradually decreased. When blue flame disappeared and fumes minimized, sun rise like appearance was seen inside at the bottom of *Kupi*. After that copper coin test was performed and test was found positive following sealed of bottle with the brick cork. After corking temperature increased i.e. *Tivragni* for 1 hour and furnace was switched off. It was left for self-cooling for 18 hrs.

OBSERVATIONS AND RESULTS

Table no. 1: Showing the observation related to preparation of RS-I:

Time (hour)	**Temperature setting (^{0}C)**	**Reading (^{0}C)**	**Observation**
10:00 a.m.	100^{0}C	23^{0}C	*Kupi* was kept inside the furnace and switch on the furnace.
11:00 a.m.	150^{0}C	101^{0}C	*Kajjali* was dry.
11:45 a.m.	150^{0}C	140^{0}C	Odour of unpleasant sulfur felt.
11:50 a.m.	150^{0}C	148^{0}C	Fumes started to appear.
12:01 p.m.	200^{0}C	151^{0}C	Fumes continue &*Kajjali* was dry.
12:45 p.m.	200^{0}C	186^{0}C	Fumes increased & appear whitish in colour.
1:00 p.m.	250^{0}C	202^{0}C	*Kajjali* was dry.

1:40 p.m.	250^{0}C	240^{0}C	*Kajjali* still dry & yellowish fumes were seen.
2:00 p.m.	300^{0}C	255^{0}C	*Kajjali* still in dry form.
2:25 p.m.	300^{0}C	270^{0}C	Yellowish fumes continue with moistening of *Kajjali*.
3:00 p.m.	350^{0}C	303^{0}C	Yellow fumes with moisten *Kajjali*.
3:10 p.m.	350^{0}C	316^{0}C	*Kajjali* now started to melt with yellowish fumes.
4:00 p.m.	400^{0}C	352^{0}C	*Kajjali* was completely molten with increased yellowish fumes.
5:00 p.m.	450^{0}C	402^{0}C	Yellow fumes increased tenaciousness was found inside the *Kupi*.
5:35 p.m.	450^{0}C	440^{0}C	Yellow fumes increased.
6:00 p.m.	500^{0}C	450^{0}C	Profuse Yellow fumes.
6:20 p.m.	500^{0}C	480^{0}C	*Kajjali* started to boil. When *Shalaka* was inserted inside the *Kupi*, material stick with *Shalaka*& appearing dark yellow fumes. When *Shalaka* comes out, material burnt with blue flame.
6:25 p.m.	500^{0}C	485^{0}C	Fumes increased with whitish yellow in colour.
6:28 p.m.	500^{0}C	489^{0}C	Flame was started. When *Shalaka* inserted 1 *Angula* inside the *Kupi*, wet *Kajjali* stick with *Shalaka*.
7:00 p.m.	550^{0}C	500^{0}C	Flame increased.
7:10 p.m.	550^{0}C	520^{0}C	Flame increased with the height of 5-6 inch.
7:15 p.m.	550^{0}C	530^{0}C	Flame now gradually decreased.
8:00 p.m.	600^{0}C	552^{0}C	Small blue flame appears on the *Kupi*. *Shalaka* test performed frequently every 5 min. Base of the *Kupi* was started in reddish colour.
8:10 p.m.	600^{0}C	560^{0}C	Small blue flame continues inside the Neck of bottle.
8:15 p.m.	600^{0}C	570^{0}C	Small blue flame still continues.
9:55 p.m.	600^{0}C	605^{0}C	*ShitaShalaka* test & copper coin test become positive. Sunrise like appearance was seen inside the *Kupi*. Corking was done.
10:00 p.m.	650^{0}C	650^{0}C	This temperature was maintained for one hour.

Table no.2: Showing the observation related to preparation of RS-II:

Time (hour)	**Temp. setting (^{0}C)**	**Reading (^{0}C)**	**Observation**
7:00 a.m.	100^{0}C	26^{0}C	*Kupisthapana* and Switch on the furnace.
8:45 a.m.	150^{0}C	140^{0}C	Odour of unpleasant sulfur felt.
9:35 a.m.	200^{0}C	170^{0}C	Whitish yellow fumes with pungent smell.
10:05 a.m.	250^{0}C	207^{0}C	Light yellow fumes.
11:00 a.m.	300^{0}C	251^{0}C	*Kajjali was* moistening with Yellowish fumes.
11:55 a.m.	300^{0}C	301^{0}C	Yellow fumes with hard smell.
1:10 p.m.	400^{0}C	362^{0}C	*Kajjali* was completely melted.
2:00 p.m.	450^{0}C	402^{0}C	*Kajjali* was sticky & shiny inside the *Kupi*.
3:08 p.m.	500^{0}C	453^{0}C	Boiling stage of *Kajjali*.
3:45 p.m.	500^{0}C	485^{0}C	Flame appears.
3:50 p.m.	500^{0}C	490^{0}C	Approx 6 inch blue flame.
4:00 p.m.	550^{0}C	505^{0}C	Small flame approx ½ inch.
4:05 p.m.	550^{0}C	509^{0}C	Flame again increased.
5:05 p.m.	600^{0}C	556^{0}C	Small blue flame continues.
6:30 p.m.	600^{0}C	595^{0}C	*ShitaShalaka* test & copper coin test become positive. Sunrise like appearance was seen inside the *Kupi*. Corking was done.
6:35 p.m.	650^{0}C	650^{0}C	This temperature was maintained for 1 hour.

Table no.3: Showing the observation related to preparation of RS-III:

Time (hour)	**Temp. setting (^{0}C)**	**Reading (^{0}C)**	**Observation**
7:00	100	29	*Kupi* was kept in furnace and switched on.
8:40	150^{0}C	140^{0}C	Odour of unpleasant sulfur felt.
9:35	200^{0}C	175^{0}C	Whitish yellow fumes with pungent smell.
10:08	250^{0}C	218^{0}C	Light yellow fumes &*Kajjali* was dry.
10:20	250^{0}C	230^{0}C	*Gandhaka* was collected on the mouth of *Kupi*.
11:25	300^{0}C	275^{0}C	*Kajjali was* moistening with Yellowish fumes.
12:05	350^{0}C	310^{0}C	*Kajjali* started melting with yellowish fumes.
12:50	350^{0}C	350^{0}C	*Kajjali* was completely melted with increased yellowish fumes.
1:45	400^{0}C	396^{0}C	On cleaning the neck of bottle tiny flame appear on the neck inside the bottle for short period and flame came outside the bottle & disappears, it converted into fumes.
2:10	450^{0}C	412^{0}C	Flame again starts inside the bottle.
2:15	450^{0}C	420^{0}C	Flame came outside the bottle (1- 2 inch) and again disappeared (after 15 min).
3:30	500^{0}C	479^{0}C	Flame continuously started.
3:35	500^{0}C	481^{0}C	*Kajjali* started to boil and flame attained 6 inch length.
4:15	550^{0}C	509^{0}C	Tiny flame appears on neck of bottle.
5:05	600^{0}C	558^{0}C	Small blue flame continues inside the bottle.
6:20	600^{0}C	605^{0}C	*ShitaShalaka* test & copper coin test become positive. Sunrise like appearance was seen inside the *Kupi*. Corking was done.
6:25	650^{0}C	650^{0}C	This temperature was maintained for 1 hour.

Table no.4: Showing the results of *Rasa Sindoora* as Sample I, II, III:

Sr.No.	***Rasa Sindoora***	**Wt. of obtained *Rasa Sindoora* from *Kajjali* (gm)**	**% of Wt. of obtained *Rasa Sindoora* from *Kajjali* (%)**	**Wt. of Residue (gm)**	**% of Wt. of Residue**
1.	RS I	103	51.5	1.32	0.66
2.	RS II	106	53	1.34	0.67
3.	RS III	105	52.5	1.25	0.62

Table no.5: Showing the observation in average Yield and average time for heating process of RS:

Preparation	Avg. Yield (in gm)	Avg. Yield (%)	Avg. time for heating process (Hrs)
RS	104.66	52.33	12.53

Table no.6: Showing the observation in average temp. of *Rasa Sindoora* during *Kupipakwa* preparation:

Preparation	Avg. melting temp. of *Kajjali* (^{0}C)	Avg. flame appearing temp. (^{0}C)	Avg. corking temp. (^{0}C)
RS	354	484	601

DISCUSSION

Equal amount of purified *Parada* and purified *Gandhaka* was used for *Kajjali* in *Rasa Sindoora* preparation. 200 gm of *Kajjali* for each sample were taken and filled in the *Kupi* having capacity of 650 ml and placed in EMF. During procedure these Observation found for all three samples: - Odour of unpleasant Sulphur felt at the temp. of 140-148^{0}C, fumes started to appear at 150-175^{0}C, yellowish fumes appeared at 202- 218^{0}C, complete melting of *Kajjali* at 350-362^{0}C, Tenaciousness at the neck of *Kupi* at 402-404^{0}C, boiling of *Kajjali* started at 453-481^{0}C (at that time it is necessary to clean the neck of *Kupi* with *Shalaka* because its neck blocks due to profuse Sulphur), seen as yellowish fumes at the temperature of 450-462^{0}C. After that this fume converted to flame (4-6 inch) at the temperature of 479-489^{0}C. This is due to the temp. Range, which is higher than the boiling point of Sulphur and the free Sulphur in the *Kajjali* starts boiling and burning. After some time, flame gradually decreased and was found to be limited up to the neck of *Kupi*, but when performing the *Shalaka* test by introducing red hot *Shalaka*, it ignites the flame, resulting in sudden accumulation of the flame due to burning of

deposited Sulphur at the neck of *Kupi* & gradually reduced with the lassitude of the deposited Sulphur at the neck of *Kupi*. At this stage *Sheeta Shalaka* test and copper coin test become positive at the temp. around 595-605^{0}C, on this *Kupi* appeared red hot i.e. *Balsurya* like appearance and it is the indicative of compound formation. At the temperature around 595-605^{0}C raised the temperature around 50^{0}C (650^{0}C) to sublimation of drug for 1 hour then it left for self-cooling. For whole procedure and for each sample of *Rasa Sindoora* preparation *Kajjali* melt at average 354^{0}C and average 12.53 hr was taken for whole procedure after that corking done at avg. 601^{0}C and average yield obtained was 104.66 gm i.e. 52.33%. Mercury and sulphur formed compound when they are in 6:1 in ratio. These criteria of forming compound were achieved in *Kupi* during *Rasa Sindoora* preparation and mercury and sulphur formed a compound called *Rasa Sindoora*.

CONCLUSION

In pharmaceutical process of *Rasa Sindoora* required a special intermittent heating pattern, that is mild, moderate and severe heat for average each 4 hrs. in this process the average gain of *Rasa Sindoora* was 104.66 gm from 200gm of *Kajjali* and yield was 52.33%, in process of *Gandhaka Jarana* specially *Bahirdhoom Kupi Paka* have specific oxidation reaction that converts the *Kajjali* into sublimated crystalline compound structure i.e. *Rasa Sindoora*.

Fig. No.1: Showing the process of *Samanya Shodhana* of *Parada*

Fig. No.2: Showing the process of *Gandhaka Shodhana*

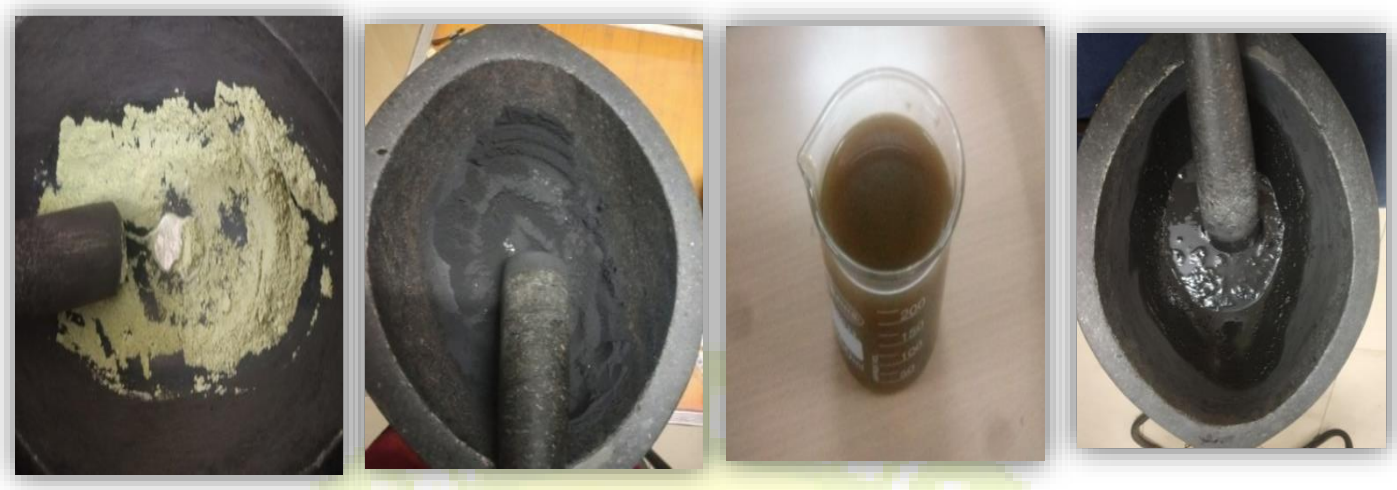


Fig. No.3: Showing the process of *Kajjali* Preparation and the process of *Bhavana* in *Kajjali*

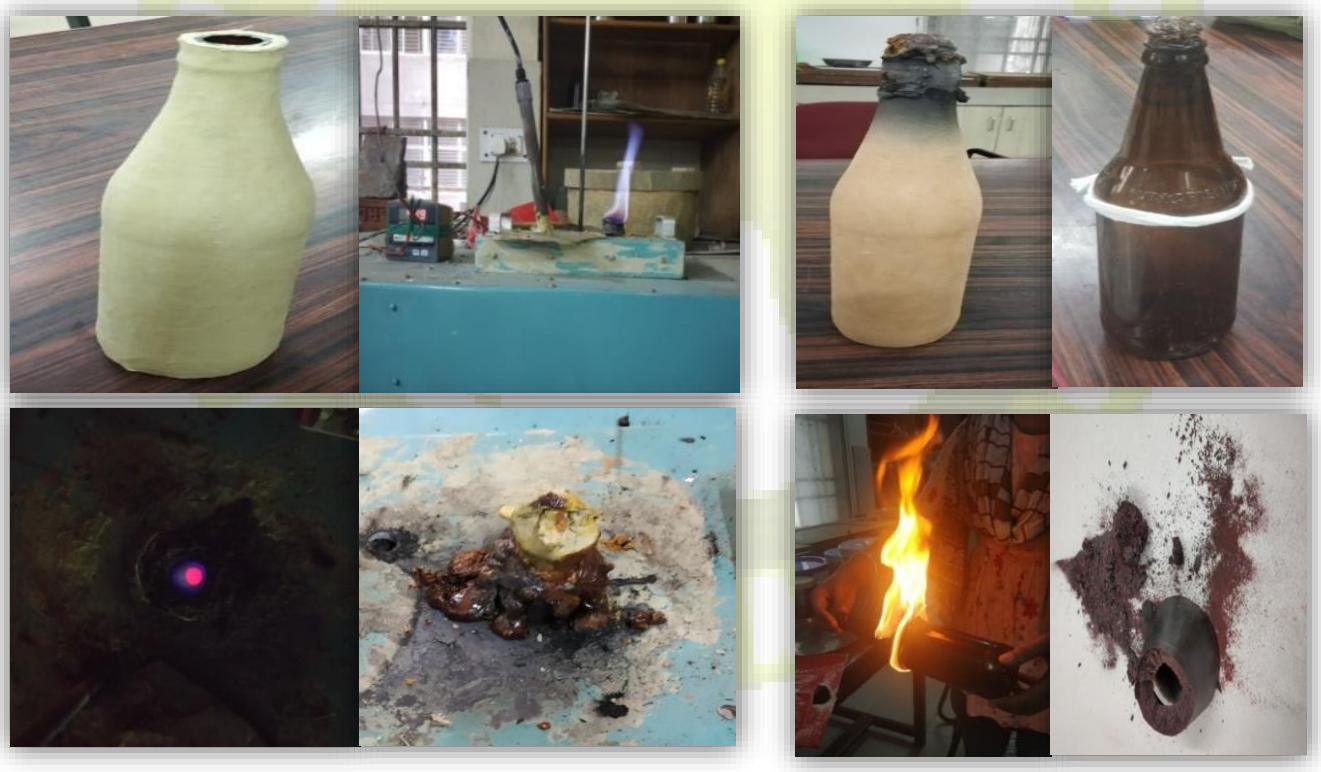
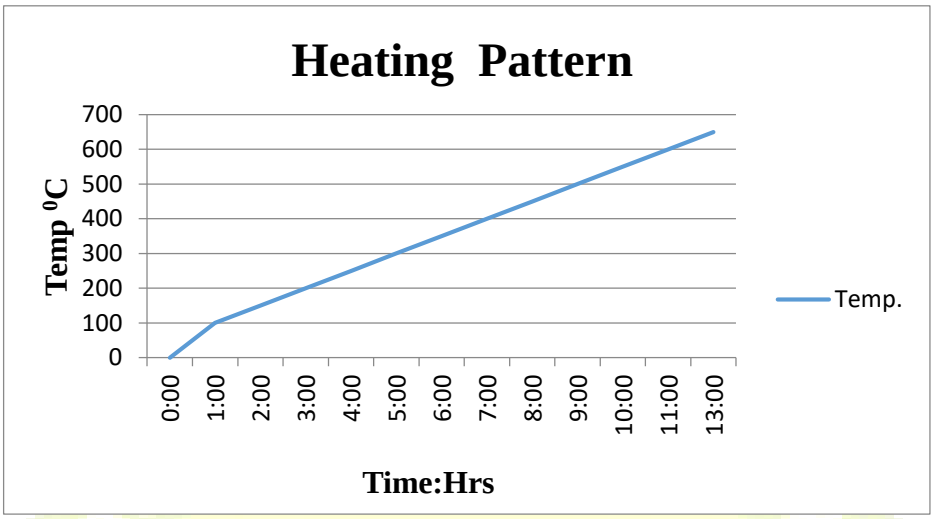


Fig. No.4: Showing the process of *Kupipakwa* Preparation



Graph No. 1: Showing the average heating pattern of RS I, RS II and RS III:

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Conflict of interest :- Nil

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