

PRACTICAL MANUAL

Processing of Horticultural Crops

(Course No. HPH 317) Credits: 3(1+2)

[For B. Sc. (Hons.) Horticulture 6th Semester Students]

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and

Dr. Ghanshyam Abrol



2018

**College of Horticulture & Forestry
Rani Lakshmi Bai Central Agricultural University
Jhansi, Uttar Pradesh**

Syllabus:

Equipments used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables – tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Visit to processing units.

Name of Student

Roll No.

Batch

Session

Semester

Course Name :

Course No. :

Credit

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in the year.....in the respective lab/field of College.

Date:





Course Teacher

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5	To understand the method of Titrable acidity estimation by AQAC method			
6	To understand the method of ascorbic acid estimation by titration method			
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Exercise- 1

Objective: To understand the purpose of use of processing equipment.

<p>1. Pocket Refractometer:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	
<p>2. Hand Refractometer:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	
<p>3. Fruit Pressure Tester (Penetrometer):</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	
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5. Cabinet Dryer:

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6. Solar Dryer:

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7. Spray Dryer:

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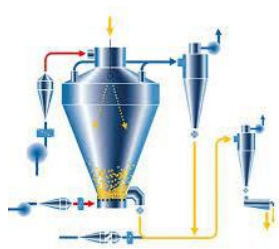
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8. Fluidized Bed Dryer:

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9. Crown corking machine:

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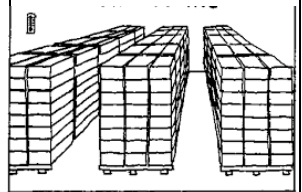
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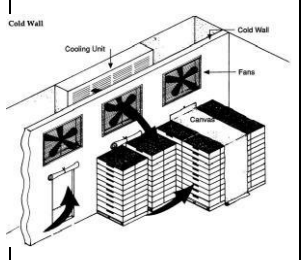
13. Room Cooling:

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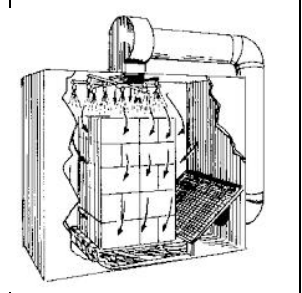
14. Forced Air Cooling:

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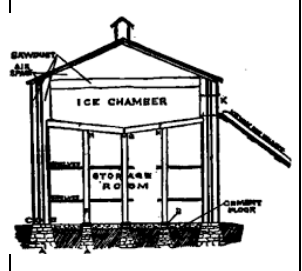
15. Hydro Cooling:

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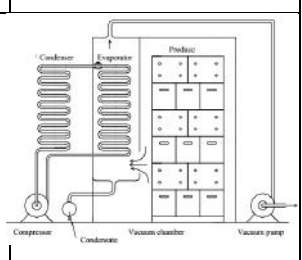
16. Ice Cooling:

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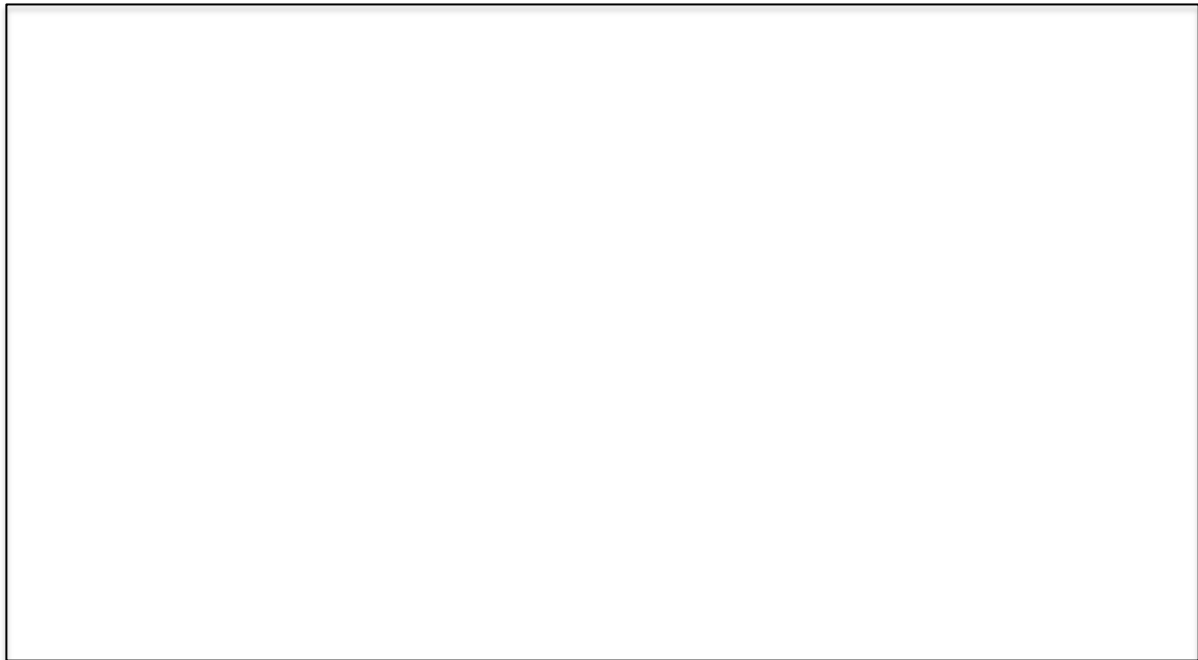


17. Vacuum Cooling:

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Draw a picture of Hand Refractometer:



Conclusion:.....

Temperature correlation for standard model of sugar Refractometer calibrated at 20 °C

Temp. (°C)	Percentage of dry substance													
	5	10	15	20	25	30	35	40	45	50	55	60	65	70
Subtract of dry substance														
15	0.29	0.31	0.33	0.34	0.34	0.35	0.36	0.37	0.37	0.38	0.39	0.39	0.40	0.40
16	0.24	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.31	0.32	0.32
17	0.18	0.19	0.20	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24
18	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16
19	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Add to the reading														
21	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
22	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.14	0.16	0.16	0.16	0.16	0.16	0.16
23	0.20	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.24
24	0.27	0.28	0.29	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.32
25	0.35	0.36	0.37	0.38	0.38	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
26	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
27	0.50	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
28	0.57	0.60	0.61	0.62	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
29	0.66	0.68	0.69	0.71	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
30	0.74	0.77	0.78	0.79	0.80	0.80	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81

Source: Proceeding of the ninth session of the International Commission for Uniform Methods of sugar analysis, London, 1936.

Exercise: 3

Objective: To understand the method of total sugar estimation by Alcohol method

Principle:.....
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Reagents:.....
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Chemical preparation:.....
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Procedure:
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Observation:

Sl. No.	Sample	Titrate value/Reading (ml.)	Total sugar (%)

Exercise: 6

Objective: To understand the method of ascorbic acid estimation by titration method.

Principle:.....

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Reagents:.....

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Chemical preparation:.....

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Procedure:

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Exercise: 7

Objective: To understand the method of protein estimation by Lowry's method.

Methods of protein estimation:

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Principle of protein estimation by Lowry's method:

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Material required:

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Procedure:

Extraction:.....

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Estimation:.....

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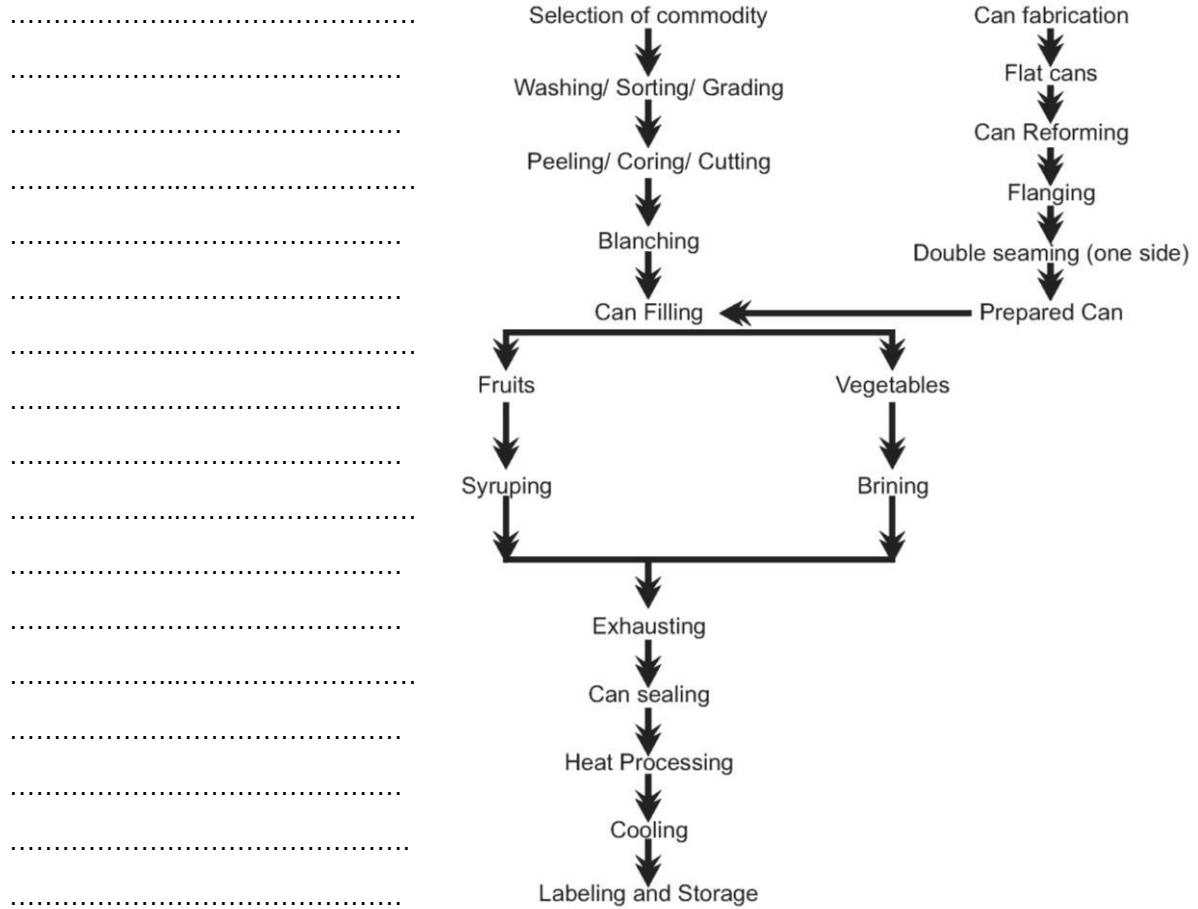
Observation:

Sl. No.	Sample	Reading at 750 nm	Protein content (mg / 100g)

Exercise: 13

Objective: Study the vegetable canning.

Vegetable canning:.....



Precautions:

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Exercise: 15

Objective: Preparation of squash.

Squash:.....

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Sl. No.	Fruit	Ingredient for one litre pulp/juice			
		Sugar (kg)	Water (ltr)	Citric acid (g)	Preservative (g)
1	Orange	1.75	1.0	20	2.5 KMS
2	Mango	1.75	1.0	20	2.5 KMS
3	Lime, lemon	2.00	1.0	-	2.5 KMS
4	Bael	1.80	1.0	25	2.5 KMS
5	Litchi	1.80	1.0	25	2.5 KMS
6	Pineapple	1.75	1.0	20	1.9 KMS
7	Guava	1.80	1.0	20	2.0 KMS
8	Papaya	1.80	1.0	25	2.5 KMS
9	Karonda	1.80	1.0	5	4.0 SB
10	Phalsa	1.80	1.0	5	4.0 SB
11	Jamun	1.80	1.0	15	3.0 SB
12	Plum	1.90	1.0	10	4.0 SB
13	Water melon	0.50	0.25	10	1.5 SB

KMS- Potassium meta-bisulphite, SB- Sodium benzoate

Recipes of squash:

Elaborate Procedure:

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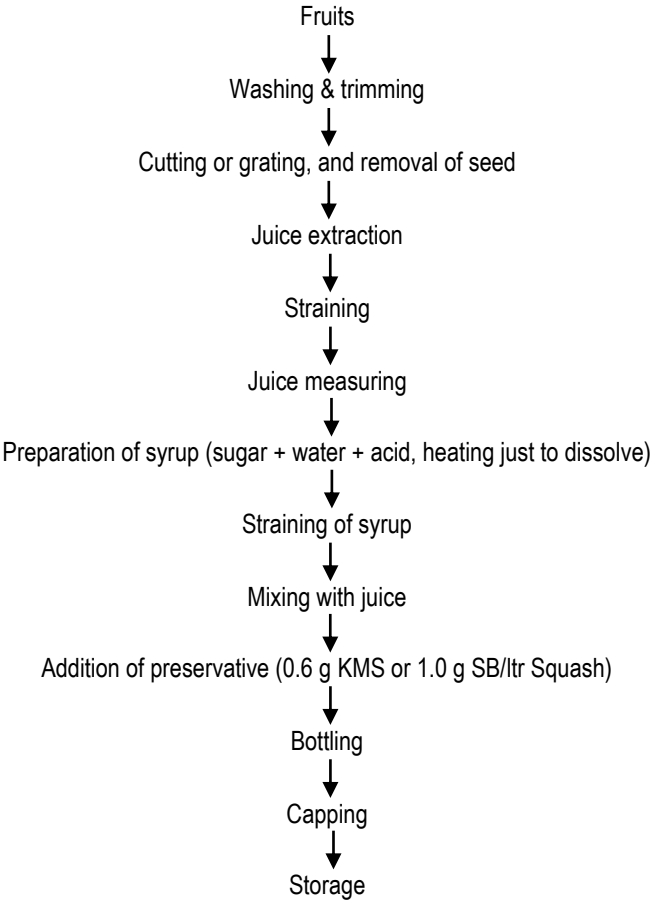
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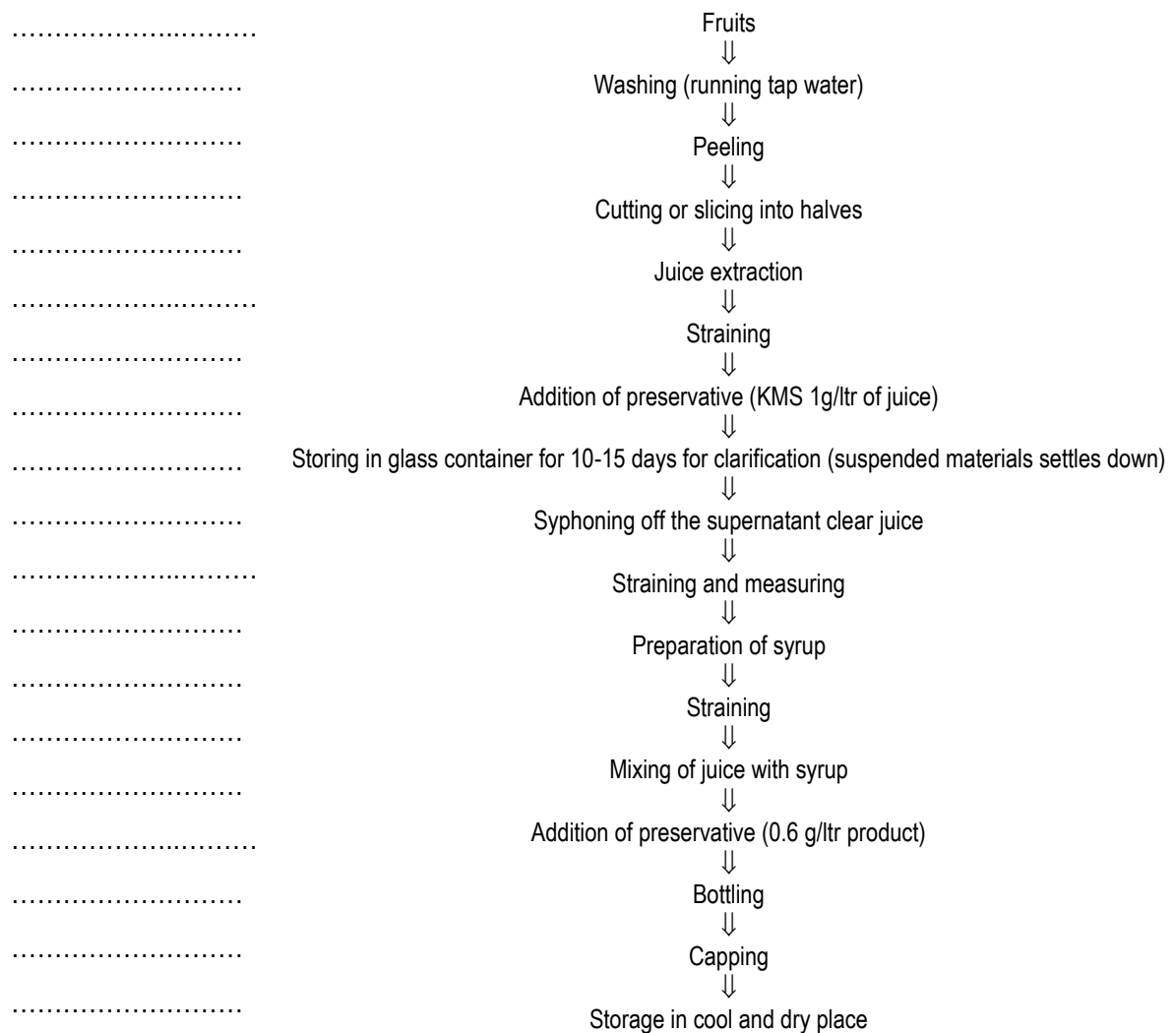
Objective: Preparation of lemon/lime cordial

Cordial:.....

Recipe for lemon/lime cordial

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Lime/lemon juice	1 ltr	3	Water	1 ltr
2	Sugar	1.25 kg	4	KMS	2 g

Elaborate Procedure:



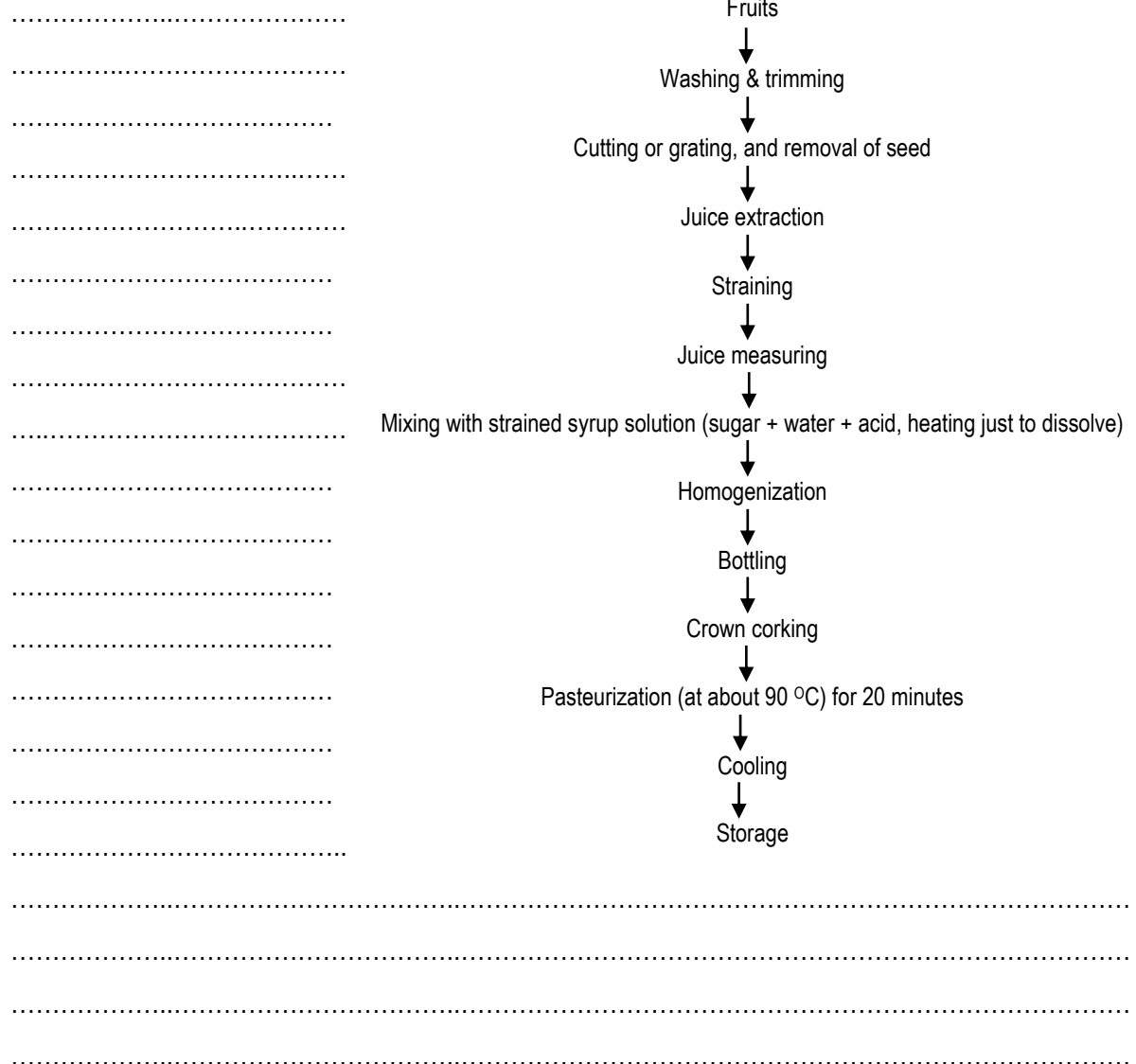
Exercise: 17

Objective: Preparation of RTS (ready to serve) from lime/lemon/mango.

RTS (Ready to serve):

Sl. No.	Fruit	Juice (ltr)	Sugar (kg)	Citric acid (g)	Water (ltr)
1	Bael	1.0	1.20	28	7.7
2	Lemon/lime	0.5	1.30		8.2
3	Guava	1.0	1.25	28	7.7
4	Mango	1.0	1.25	28	7.7
5	Ginger	0.25	1.30	30	8.4
6	Aonla blend (aonla juice: lime juice: ginger juice 10:2:1)	1.3	1.60	22	10.0

Elaborate procedure:



Objective: Preparation of jam.

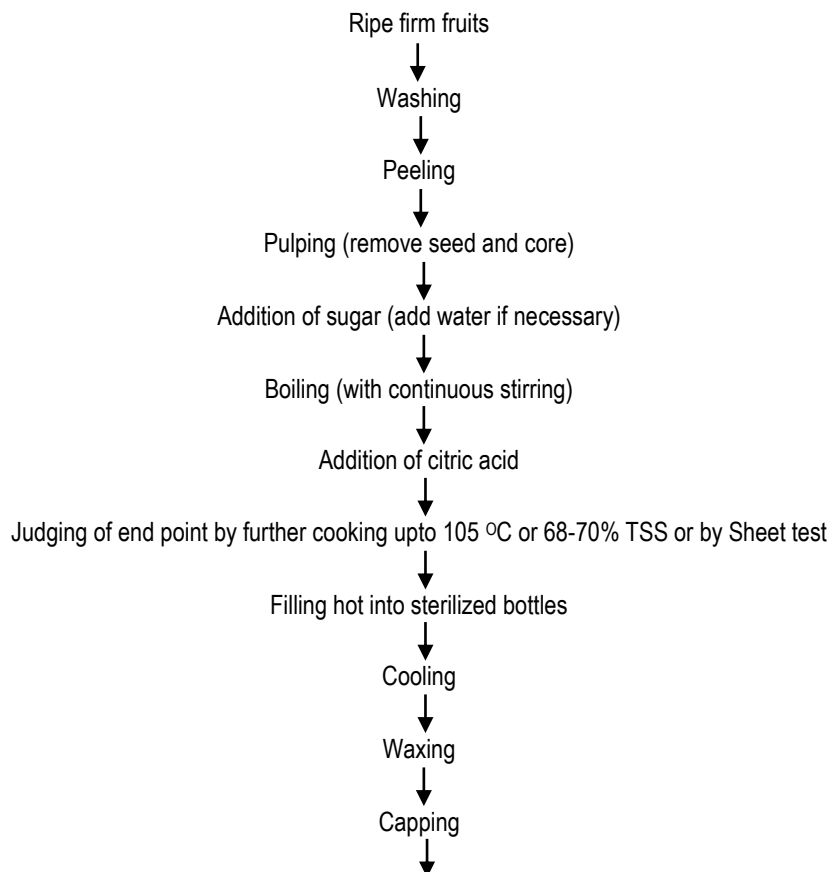
Jam:.....

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Sl. No.	Fruit/ Vegetable	Ingredients for one kg pulp		
		Sugar (kg)	Citric acid (g)	Water (ml)
1	Aonla	0.75	-	150
2	Apple	0.75	2.0	100
3	Apricot	0.60	1.0	100
4	Carrot	0.75	2.5	200
5	Grapes	0.70	1.0	50
6	Guava	0.75	2.5	150
7	Karonda	0.80	-	100
8	Loquat	0.75	1.0	100
9	Mango	0.75	1.5	50
10	Musk melon	0.75	2.5	50
11	Plum	0.80	-	150
12	Peach	0.80	3.0	100
13	Pear	0.75	1.5	100

Elaborate Procedure:

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Problems in jam production:

i) **Crystallization:**.....
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Sticky or gummy jam:.....
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Premature setting:.....
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Surface gaining and shrinkage:.....
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**Microbial
spoilage:**.....
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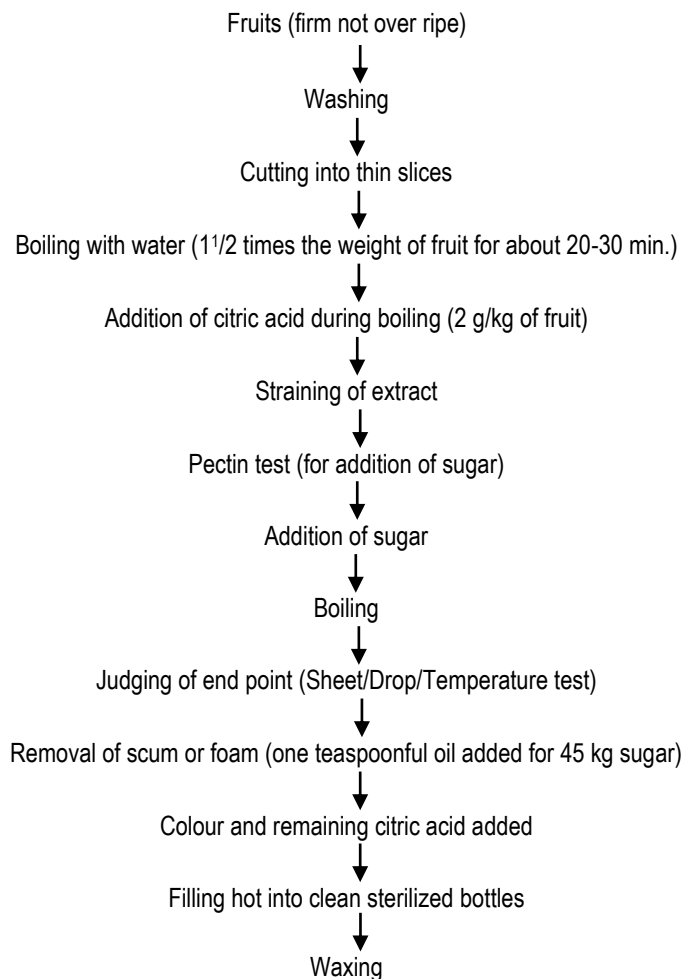
Exercise: 19

Objective: Preparation of jelly from guava/apple/jackfruit.

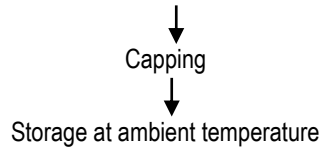
Jelly:

Sl. No.	Fruit	Ingredients for one litre extract	
		Sugar (kg)	Citric acid (g)
1	Guava	0.75	3.0
2	Sour apple	0.75-1.00	2.0
3	Gooseberry	0.80	-
4	Karonda	0.75	-
5	Jamun	0.75	1.0
6	Wood apple	1.00	-
7	Plum	0.75	2.5
8	Loquat	0.80	2.0
9	Papaya	0.75	3.0

Elaborate Procedure:



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Determination of pectin content:

i) **Alcohol test:**.....

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ii) **Jelmer test:**.....

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Judging of end point:

i) **Sheet or Flake test:**

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ii) **Drop test:**

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iii) **Temperature test:**

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Problems in **jelly**
making:.....

Exercise: 20

Objective: Preparation of marmalade.

Marmalade:.....

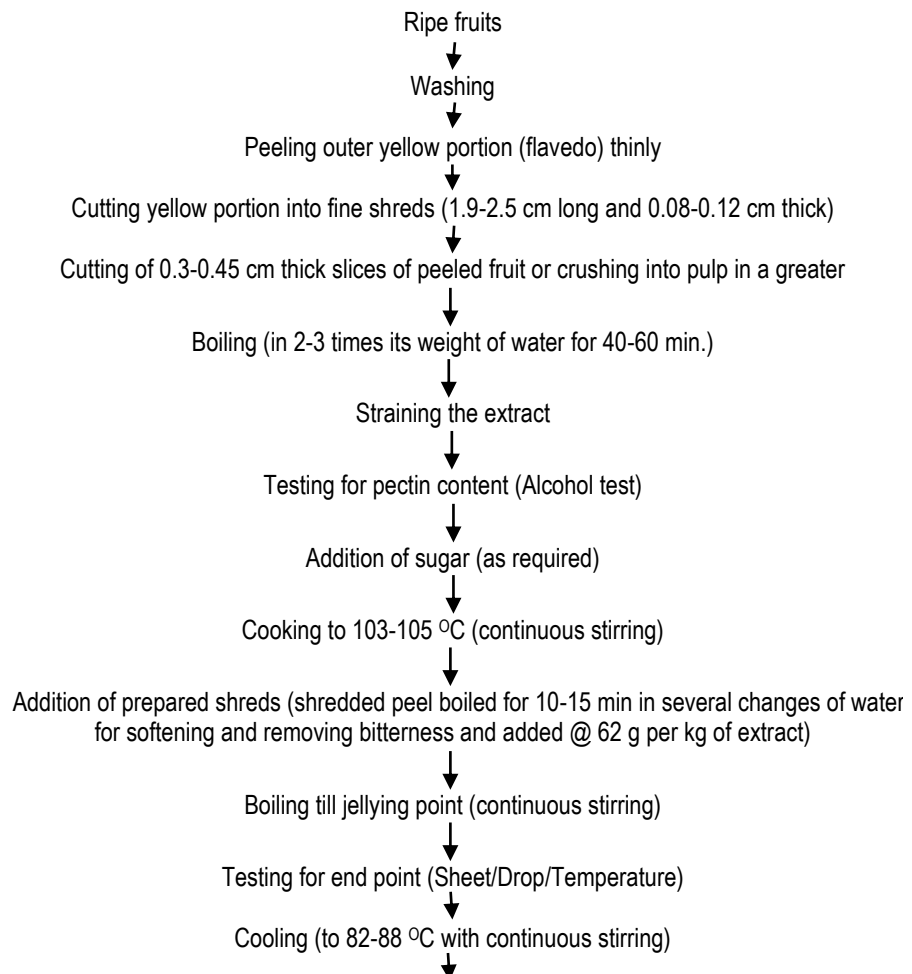
Marmalade recipe:

- Sweet orange (malta) - 1 kg
- Khatta or lime - 0.5 kg

After pectin extraction

- Pectin extract - 1ltr
- Sugar - 750 g
- Shredded peel - 62 g

Elaborate Procedure:



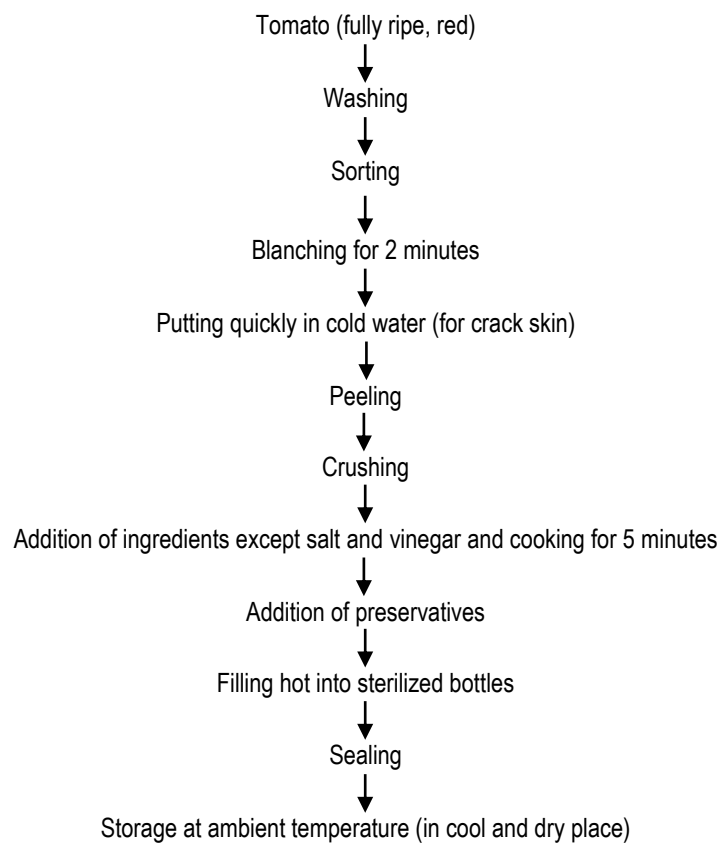
Objective: Preparation of Tomato chutney.

Chutney:.....

Recipe for tomato chutney

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Tomato pulp	1 kg	8	Cinnamon	10 g
2	Sugar	0.5 kg	9	Black pepper	10 g
3	Salt	25 g	10	Large cardamom	10 g
4	Onion chopped	100 g	11	Aniseed	10 g
5	Ginger chopped	10 g	12	Cumin powder	10 g
6	Garlic chopped	5 g	13	Vinegar	100 ml
7	Red chilli powder	10 g	14	Sodium benzoate	0.5 g per kg of final product

Process:



Elaborate procedure:.....

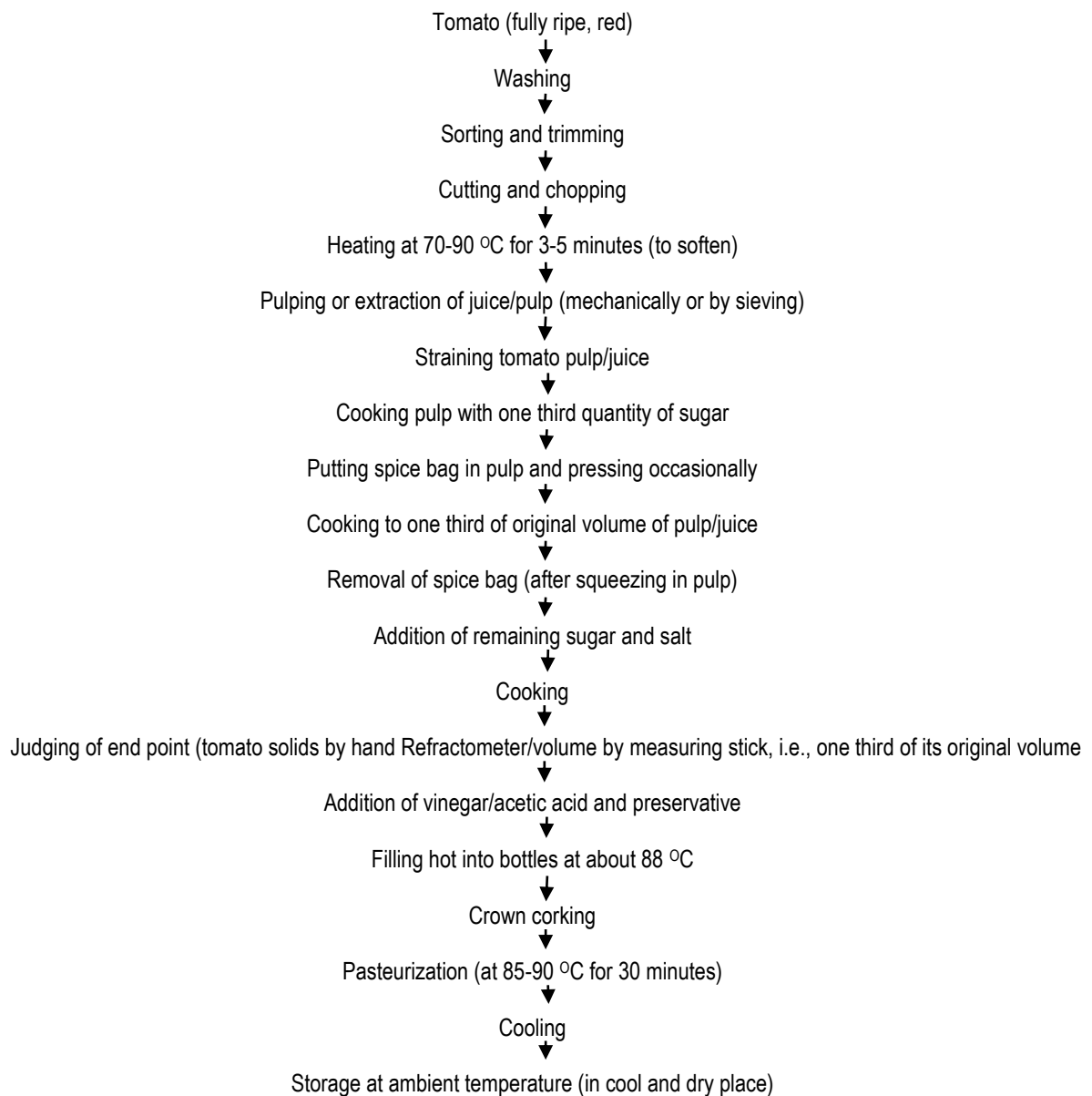
Objective: Preparation of tomato sauce/ketchup.

Sauce/ketchup:.....

Recipe for tomato sauce/ketchup

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Tomato pulp	1 kg	6	Garlic chopped	5 g	11	Aniseed	10 g
2	Sugar	0.75 g	7	Red chilli powder	5 g	12	Cumin powder	10 g
3	Salt	10 g	8	Cinnamon	10 g	13	Clove headless	5 No.
4	Onion chopped	50 g	9	Black pepper	10 g	14	Vinegar	25 ml.
5	Ginger chopped	10 g	10	Large cardamom	10 g	15	Sodium benzoate	0.25 g per kg of final product

Process:



Elaborate procedure:.....

Objective: Preparation of tomato soup

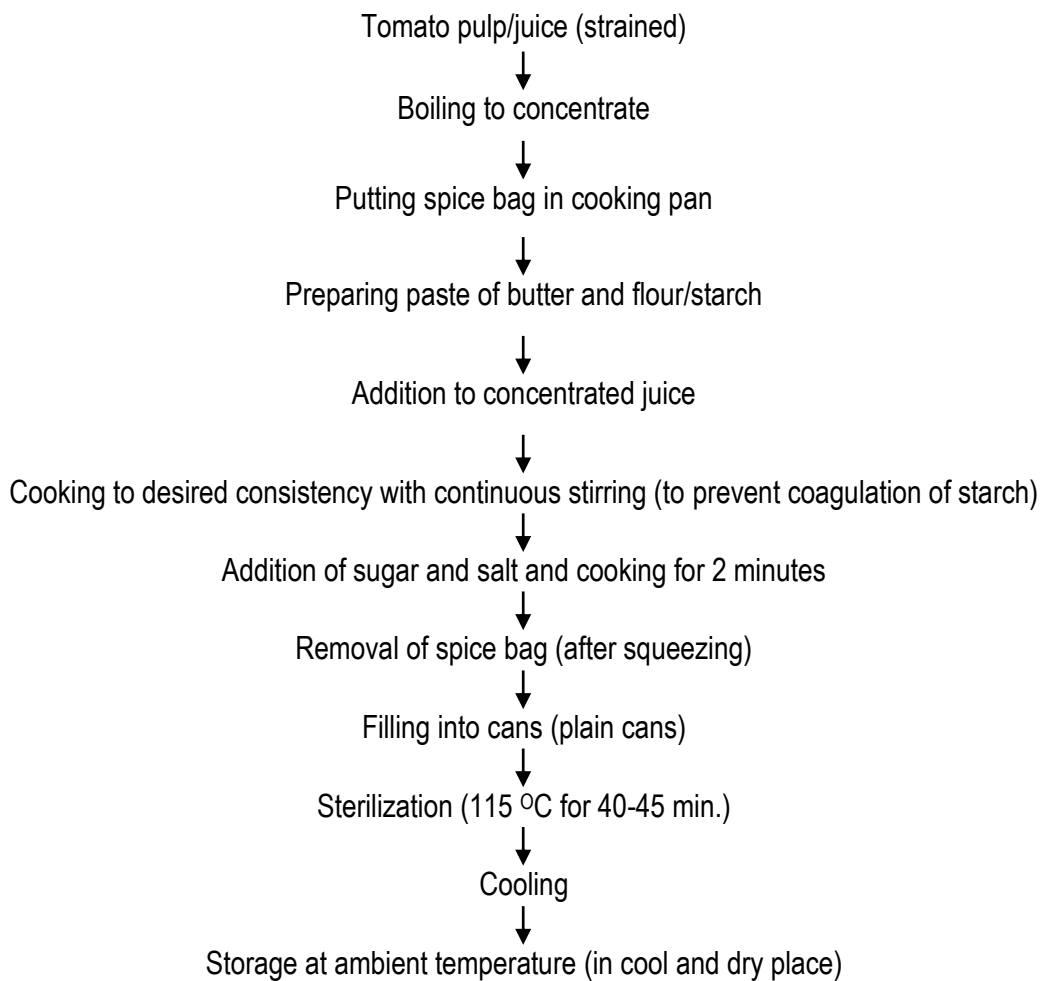
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Recipe for tomato soup

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Tomato pulp	1 kg	7	Cloves	5 No
2	Salt	10 g	8	Cumin	1 g
3	Butter/Cream	20 g	9	Large cardamom	1 g
4	Flour/starch	10 g	10	Black pepper	1 g
5	Onion (chopped)	20 g	11	Cinnamon	1 g
6	Garlic (chopped)	5 g	12	Water	350 ml

Process:



Elaborate procedure:.....

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Exercise: 27

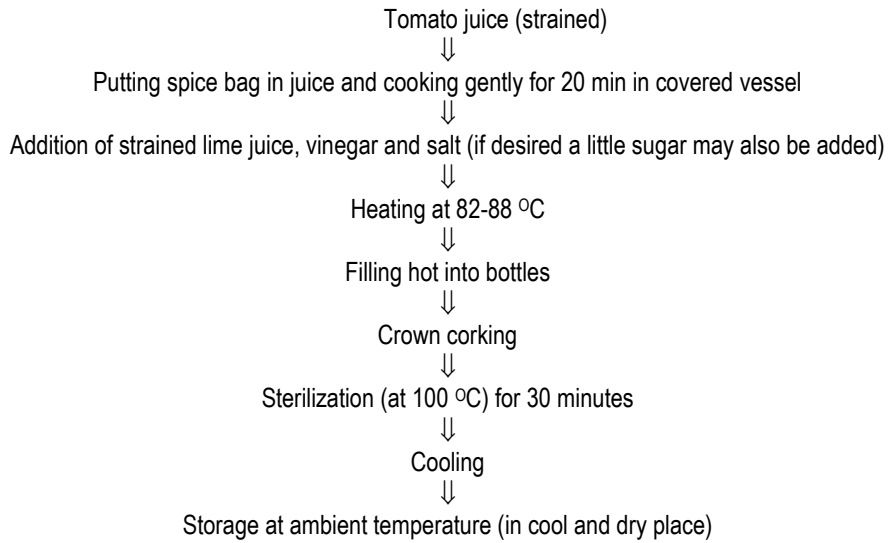
Objective: Preparation of tomato cocktail.

It is prepared just before serving or served from stock.

Recipe:

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Tomato juice	5.0 ltr	7	Black pepper	1.5 g
2	Salt	45 g	8	Coriander seed	1.5 g
3	Lime juice	60 ml	9	Large cardamom	1.5 g
4	Red chilli powder	0.25 g	10	Cinnamon powder	1.5 g
5	Clove (headless)	5 No.		Vinegar (10% acetic acid)	300 ml
6	Cumin	1.5 g			

Process:



Elaborate procedure:.....

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Precautions:

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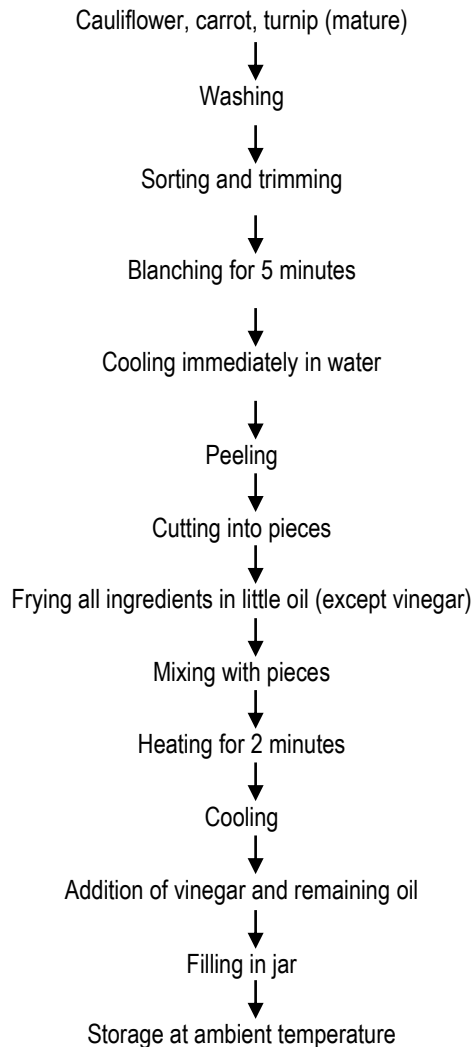
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Objective: Preparation of mixed vegetable pickle.

Recipe for mixed vegetable pickle

Sl. No.	Ingredients	Quantity	Sl. No.	Ingredients	Quantity
1	Cauliflower pieces	1.0 Kg	11	Turmeric	10 g
2	Diced carrot	1.0 Kg	12	Large cardamom	10 g
3	Turnip slices	1.0 Kg	13	Aniseed	10 g
4	Peas	1.0 Kg	14	Cumin	10 g
5	Salt	100 g	15	Fenugreek powdered	10 g
6	Ginger chopped	20 g	16	Cloves	5 No.
7	Onion chopped	50 g	17	Mustard ground	50 g
8	Garlic chopped	10 g	18	Vinegar	200 ml
9	Red chilli	10 g	19	Mustard oil	450 ml
10	Black pepper	10 g			

Process:



Elaborate procedure:.....

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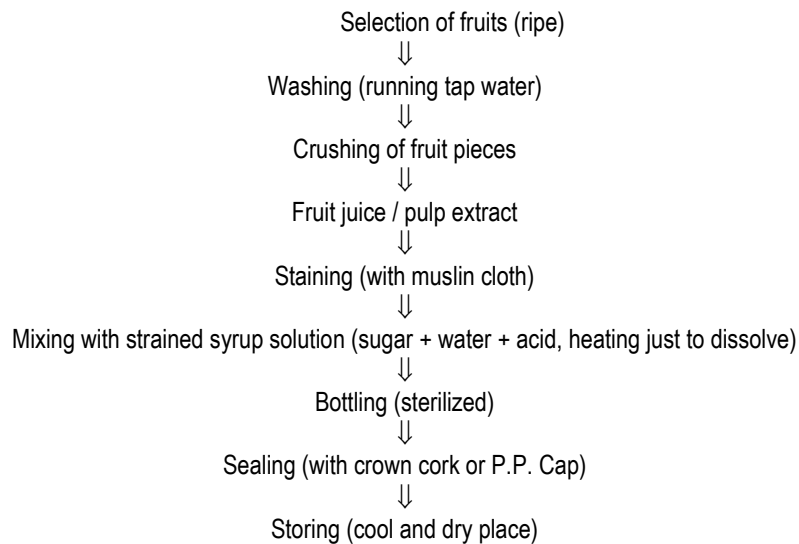
Objective: Preparation of syrup.

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Recipe:

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Process:



Note: Fruit based syrups do not need preservatives, but for longer shelf-life 350 ppm KMS or 600 ppm sodium benzoate may be added before bottling. In case of synthetic syrup, the syrup is strained before adding essence and colour.

Elaborate procedure:.....

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Precautions:
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Exercise: 31

Objective: Preparation of sweet mango chutney

Introduction: The preparation of chutney is similar to that of jam except that spices, vinegar and salt are added in chutney. Mango chutney is an important fruit product exported from India to many countries. Chutney and sauces can be prepared both in home and commercially. They are good appetizer. Fruit such as mango, apple, plum, apricot and vegetable like tomato, cauliflower, turnip or carrot etc. are generally used.

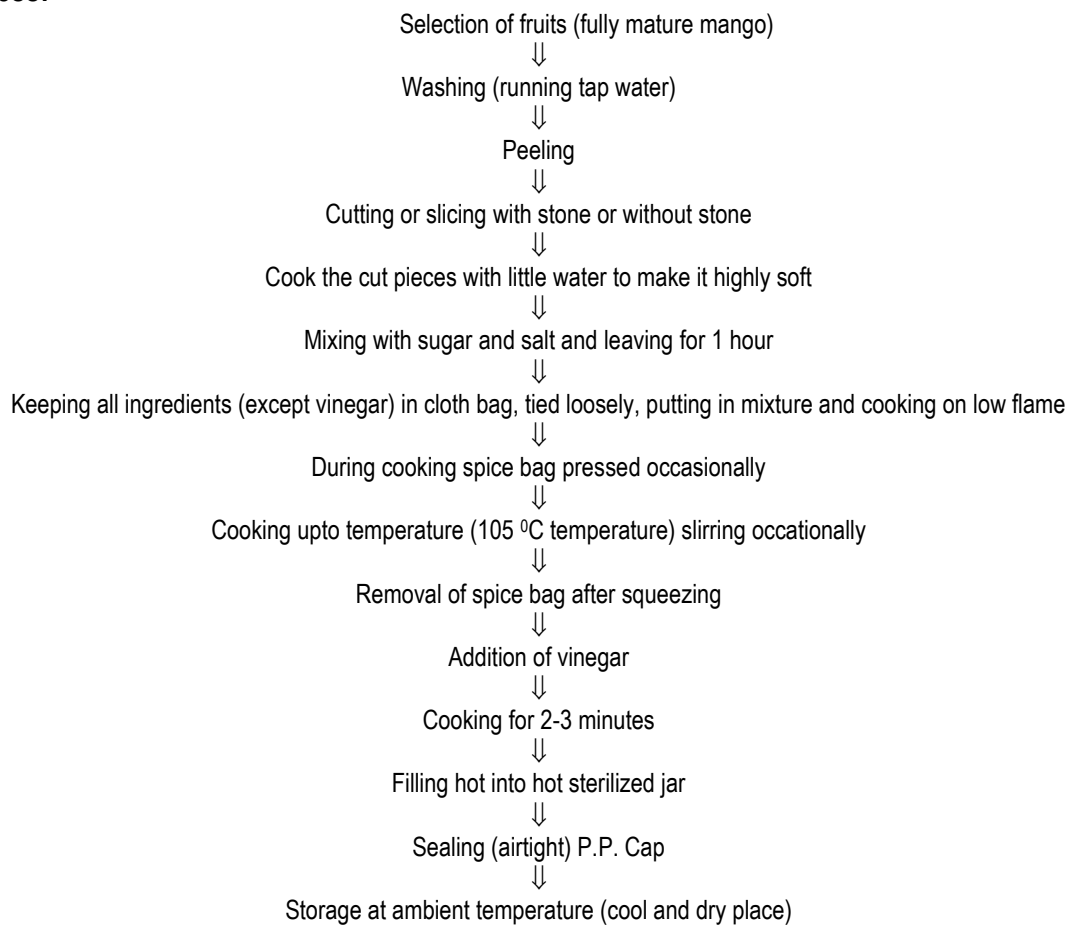
Aim: To learn the process of chutney preparation from mango fruit.

Recipe:

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Process:



Elaborate procedure:.....

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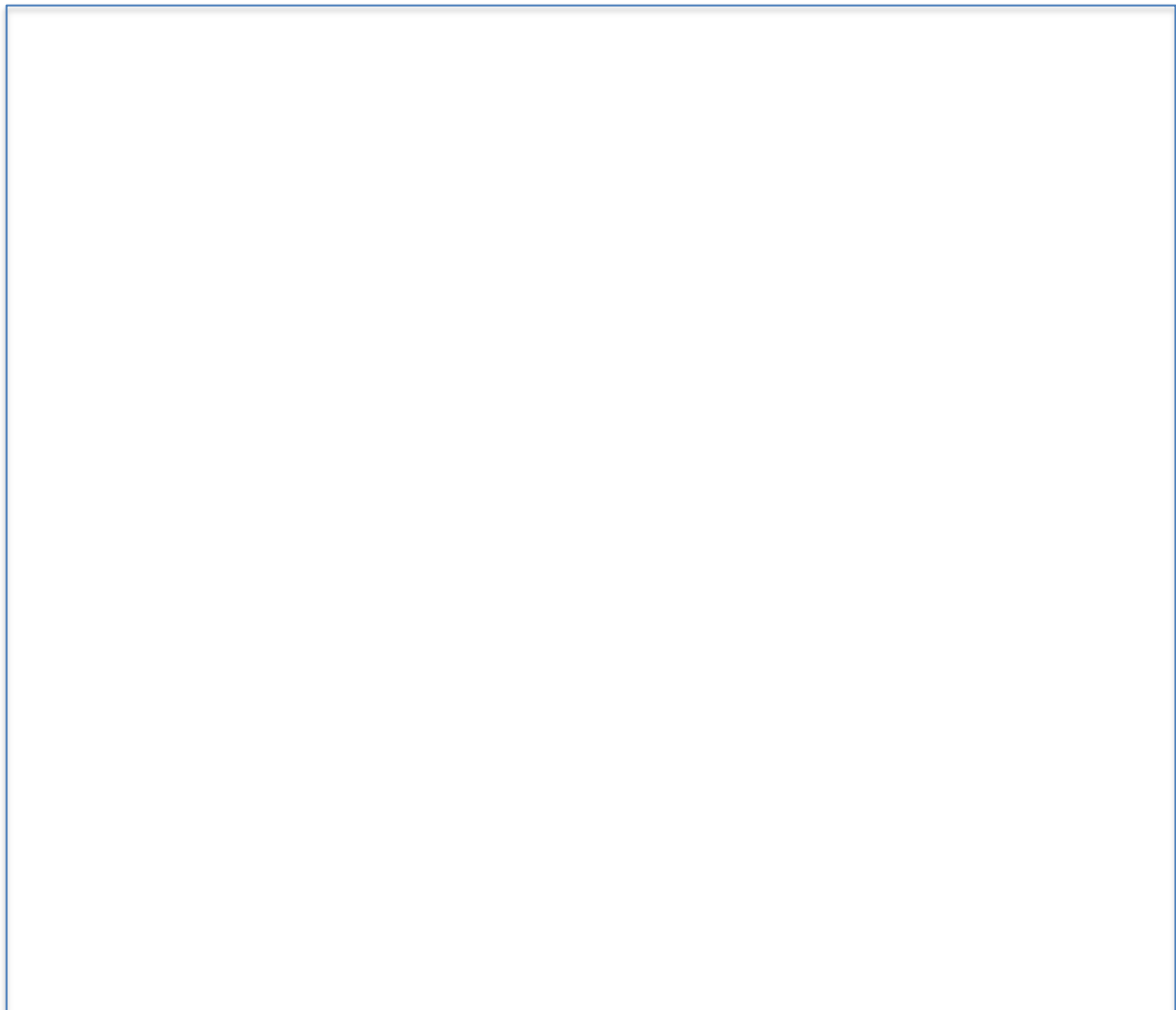
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Objective: Drying and dehydration of fruits and vegetables

Drying:.....
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Dehydration:.....
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Draw a neat sketch of dryer:



Student's Notes

A series of horizontal dotted lines for writing notes.