PRACTICAL MANUAL

Processing of Horticultural Crops

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

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

Dr. Amit Kumar Singh

and

Dr. Ghanshyam Abrol

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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.

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Batch .....

Session .....

Semester .....

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Date: Course Teacher

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34	Visit to processing unit			
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36	Drying of flowers			

Exercise- 1

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

1. Pocket Refractometer: …… …… …… …… …… …… …… ……	
2. Hand Refractometer: …… …… …… …… …… …… …… ……	
3. Fruit Pressure Tester (Penetrometer): …… …… …… …… …… …… …… ……	
4. Spectrophotometer: …… …… …… …… …… …… …… ……	

5. Cabinet Dryer: …….. ……..…… ……..…… ……..…… ……..…… ……..…… ……..……	
6. Solar Dryer: …….. ……..…… ……..…… ……..…… ……..…… ……..…… ……..……	
7. Spray Dryer: …….. ……..…… ……..…… ……..…… ……..…… ……..…… ……..……	
8. Fluidized Bed Dryer: …….. ……..…… ……..…… ……..…… ……..…… ……..…… ……..……	
9. Crown corking machine: .…….. ……..…… ……..…… ……..…… ……..…… ……..…… ……..……	

10. Can Sealer: …….....

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11. Polyethylene Sealer: …….....

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12. Grading Equipment: …….....

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Advantages of Grading: ……..

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13. Room Cooling: ……

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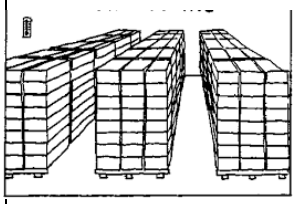

14. Forced Air Cooling: ……

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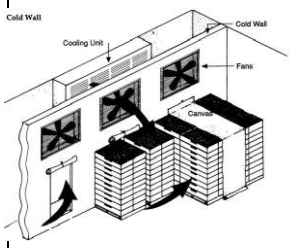

15. Hydro Cooling: ……

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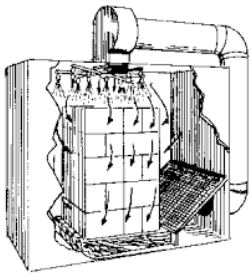

16. Ice Cooling: ……

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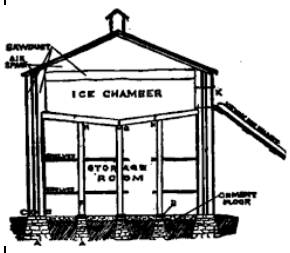

17. Vacuum Cooling: ……

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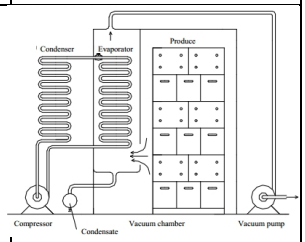

Exercise: 2

Objective: Determination of maturity on the basis of Total Soluble Solids (TSS) content.

Principle:……..……...……..

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Materials required:……..……..……

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Procedure:……..……..……

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Observation:

Crops	Upper position	Middle position	Lower position	Average

Draw a picture of Hand Refractometer:

Conclusion:……..……..……...

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Temperature correlation for standard model of sugar Refractometer calibrated at 20 ^{0}C

Temp. (^{o}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 (%)

Calculation

$$\textbf{Total sugars as invert sugars (\%)} = \frac{\text{Factor} \times \text{Dilution}}{\text{Titre} \times \text{Weight of sample taken}} \times 100$$

% Sucrose = (% total invert sugars - % reducing sugars) x 0.95
% Total sugars = (% reducing sugars + % sucrose)

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Precaution: ……

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Exercise: 4

Objective: To understand the method of reducing sugar estimation.

Principle:……..……...……..

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Reagents:……...……..……

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Chemical preparation:…...……

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Procedure: ……..……..……

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Observations:

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

Calculation:

$$\textbf{Reducing sugars (\%)} = \frac{\text{Factor} \times \text{Dilution}}{\text{Titre value} \times \text{Weight of sample taken}} \times 100$$

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Precaution: ....

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Exercise: 5

Objective: To understand the method of Titrable acidity estimation by AOAC method.

Principle:……..……...……..

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Reagents:……...……..……...……

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Chemical preparation:…...……

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Procedure: ……..……..……

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Observation:

Sample No.	Micro-burette reading			Acidity (%)
	Initial	Final	Average	

Calculation:

$$\text{Titrable Acidity (\%)} = \frac{d \times 0.064 \text{ (if NaOH solution is 0.1 } N\text{)} \times C}{a \times b} \times \frac{100}{10}$$

Where,

a= weight of sample.

b= volume of aliquot taken for examination.

c= volume made with distilled water.

d= average burette reading for sample.

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Precautions: ……

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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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Observation:

Sample No.	DFV	Titrate value (ml)	Ascorbic acid content (mg/100g)

Calculation: D.F.V. (Dye Factor Value) = 0.5/ Titrate Reading (ml)

$$\textbf{Ascorbic Acid (mg/100g)} = \frac{\text{D.F.V.} \times \text{Titrate Value} \times \text{Volume make up}}{\text{Aliquot taken} \times \text{Weight of the sample}} \times 100$$

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Precautions: ……

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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)

Calculations: Express the amount of protein mg / 100g in sample.

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Precautions: ……

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Exercise: 8

Objective: To understand the method of starch estimation by titrimetric method.

Principle:……..……..……..……..

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Reagents:……..……..……..……

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Chemical preparation:…...……

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Procedure: ……..……..……

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Observations:

Sl. No.	Sample	Titrate value/Reading (ml.)	Amount of starch (g/100g of fresh weight)

Calculation:

Amount of starch (g / 100 g of fresh weight) = A × B × C × 100 / T × D × 1000

A- Titrate value B- Total volume of starch hydrolyze C- Factor used as constant (0.9)
D- Weight of the sample T- Titer value obtained

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Precaution: ……

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Experiment: 9

Objective: Estimation of crude fibre.

Principle:……..……..……..……..

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Reagents:……..……..……

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Chemical preparation:…...……

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Procedure: ……..……..……

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Observation

Sample No.	W	Wt. of the sample	Crude fiber (%)

Calculation: Amount of Crude fiber (%) = W × 100 / Weight of the sample taken

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Precaution: ……

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Exercise 10

Objective: Estimation of chlorophylls.

Principle:……..……..……..……..

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Reagents:……..……..……..……

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Chemical preparation:…...……

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Procedure: ……..……..……

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Observation: ……

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Calculation: Calculate the amount of chlorophyll present in the extract mg chlorophyll per g tissue using the fallowing equation:

mg chlorophyll a / g tissue = 12.7 (A_{663}) – 2.69 (A_{645}) × V / 1000 × W
mg chlorophyll b / g tissue = 22.9 (A_{645}) – 4.68 (A_{663}) × V / 1000 × W and
mg total chlorophyll / g tissue = 20.2 (A_{645}) – 8.02 (A_{663}) × V/1000 × W

Where, A= absorbance at specific wavelengths,
V= final volume of chlorophyll extract in 80 per cent acetone and
W= fresh weight of tissue extracted.

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Precaution:……

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Exercise: 11

Objective: Estimation of lycopene.

Describe Lycopene: ……

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Reagents:……

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Procedure:……

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Calculation:

Absorbance (1 unit) = 3.126 µg Lycopene / ml

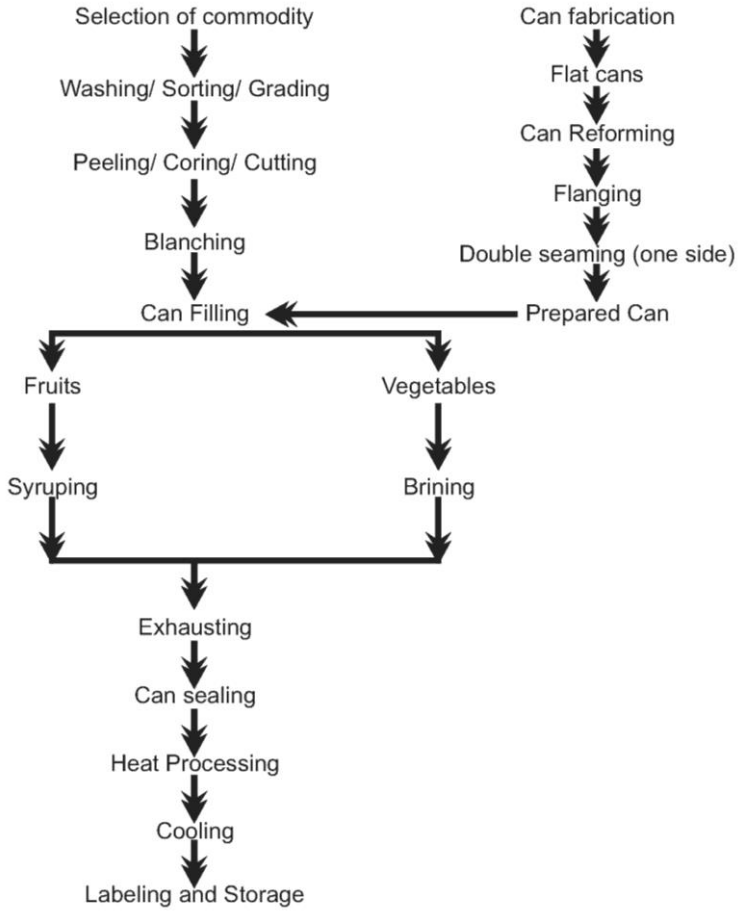
mg Lycopene in 100 g sample = 31.206 × Absorbance / Weight of sample (g)

Precautions: ……

Exercise: 12

Objective: Study the fruit canning.

Fruit canning:……



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Precautions: ……

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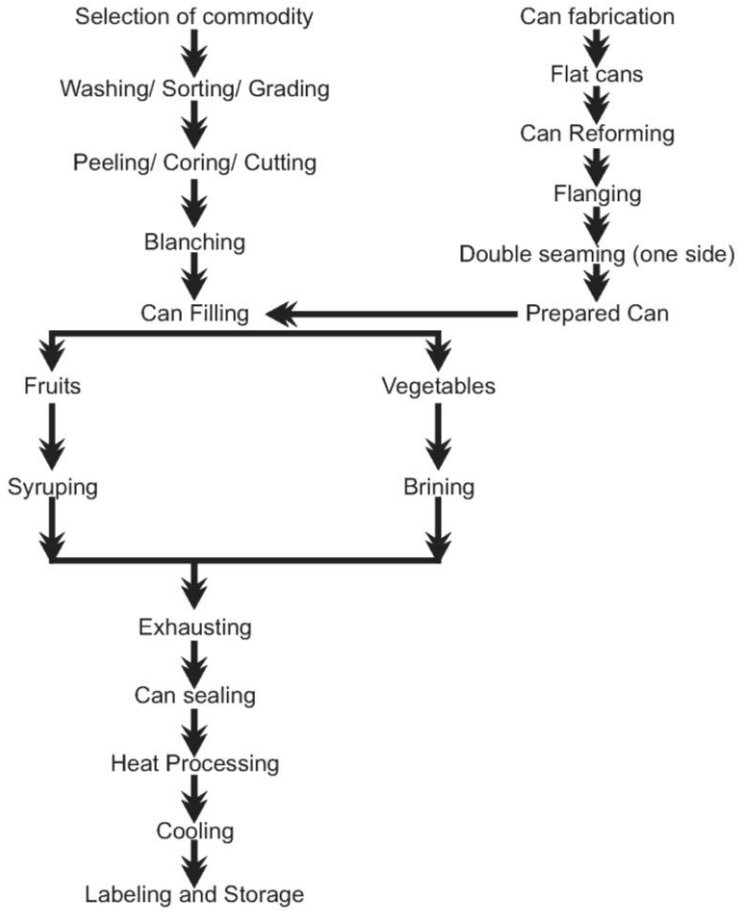
Exercise: 13

Objective: Study the vegetable canning.

Vegetable canning:……



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Precautions: ……

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Exercise: 14

Objective: Study the juice canning.

Juice canning:……

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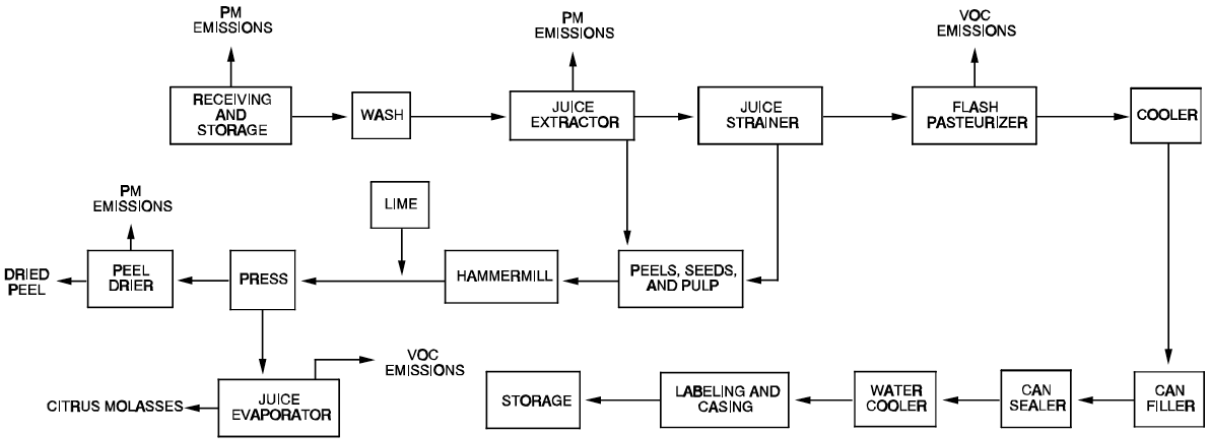

JUICE CANNING

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					

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Recipes of squash:

Elaborate Procedure:

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Fruits
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Washing & trimming
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Cutting or grating, and removal of seed
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Juice extraction
↓
Straining
↓
Juice measuring
↓
Preparation of syrup (sugar + water + acid, heating just to dissolve)
↓
Straining of syrup
↓
Mixing with juice
↓
Addition of preservative (0.6 g KMS or 1.0 g SB/ltr Squash)
↓
Bottling
↓
Capping
↓
Storage

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Precaution:…..……

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Exercise: 16

Objective: Preparation of lemon/lime cordial

Cordial:……

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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:

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Fruits
⇓
Washing (running tap water)
⇓
Peeling
⇓
Cutting or slicing into halves
⇓
Juice extraction
⇓
Straining
⇓
Addition of preservative (KMS 1g/ltr of juice)
⇓
Storing in glass container for 10-15 days for clarification (suspended materials settles down)
⇓
Syphoning off the supernatant clear juice
⇓
Straining and measuring
⇓
Preparation of syrup
⇓
Straining
⇓
Mixing of juice with syrup
⇓
Addition of preservative (0.6 g/ltr product)
⇓
Bottling
⇓
Capping
⇓
Storage in cool and dry place

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Precaution:…..……

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Exercise: 17

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

RTS (Ready to serve):……

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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:

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Fruits
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Washing & trimming
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Cutting or grating, and removal of seed
↓
Juice extraction
↓
Straining
↓
Juice measuring
↓
Mixing with strained syrup solution (sugar + water + acid, heating just to dissolve)
↓
Homogenization
↓
Bottling
↓
Crown corking
↓
Pasteurization (at about 90 ^{o}C) for 20 minutes
↓
Cooling
↓
Storage

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Precaution:……

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Exercise: 18

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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Ripe firm fruits

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Washing

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Peeling

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Pulping (remove seed and core)

↓

Addition of sugar (add water if necessary)

↓

Boiling (with continuous stirring)

↓

Addition of citric acid

↓

Judging of end point by further cooking upto 105 ^{o}C or 68-70% TSS or by Sheet test

↓

Filling hot into sterilized bottles

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Cooling

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Waxing

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Capping

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Storage (at ambient temperature)

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Precaution:……

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Sheet or Flake test:……

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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:

Fruits (firm not over ripe)

↓

Washing

↓

Cutting into thin slices

↓

Boiling with water (1½ times the weight of fruit for about 20-30 min.)

↓

Addition of citric acid during boiling (2 g/kg of fruit)

↓

Straining of extract

↓

Pectin test (for addition of sugar)

↓

Addition of sugar

↓

Boiling

↓

Judging of end point (Sheet/Drop/Temperature test)

↓

Removal of scum or foam (one teaspoonful oil added for 45 kg sugar)

↓

Colour and remaining citric acid added

↓

Filling hot into clean sterilized bottles

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Waxing

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Capping

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Storage at ambient temperature

Determination of pectin content:

i) Alcohal test:……..……..

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ii) Jelmeter 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:……..……

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Exercise: 20

Objective: Preparation of marmalade.

Marmalade:……………………………………………………………………………………………

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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:

Ripe fruits
↓
Washing
↓
Peeling outer yellow portion (flavedo) thinly
↓
Cutting yellow portion into fine shreds (1.9-2.5 cm long and 0.08-0.12 cm thick)
↓
Cutting of 0.3-0.45 cm thick slices of peeled fruit or crushing into pulp in a greater
↓
Boiling (in 2-3 times its weight of water for 40-60 min.)
↓
Straining the extract
↓
Testing for pectin content (Alcohol test)
↓
Addition of sugar (as required)
↓
Cooking to 103-105 ^{O}C (continuous stirring)
↓
Addition of prepared shreds (shredded peel boiled for 10-15 min in several changes of water for softening and removing bitterness and added @ 62 g per kg of extract)
↓
Boiling till jellying point (continuous stirring)
↓
Testing for end point (Sheet/Drop/Temperature)
↓
Cooling (to 82-88 ^{O}C with continuous stirring)
↓

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Flavoring (Orange oil)

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Filling into sterilized bottles

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Sealing

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Storage at ambient temperature

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Problems in marmalade making:

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Exercise: 21

Objective: Preparation of preserve.

Preserve:……………………………………………………………………………………………………

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Elaborate Procedure:

Mature fruits

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Washing

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Preparation for sugar treatment

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Keeping fruit and sugar in alternate layers (1 kg fruit: 1 kg sugar) or steeping fruit in syrup of 40 % TSS for a day

↓

Removal of fruit

↓

Increasing consistency of syrup to 60 % TSS by boiling

↓

Steeping of fruit (for a day)

↓

Repeating the process and raising the strength of syrup by 5 % TSS to 70 % TSS on alternate days

↓

Steeping in 70 % TSS for a week

↓

Preserve

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Draining

↓

Filling in Jar or Container

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Covering fruit with freshly prepared sugar syrup of 68 % TSS

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Sealing (Airtight)

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Storage

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Problems in preparation of preserve

Floating of fruits in Jar:.……
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Stickiness: ……...……
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Toughness of fruit skin or peel: …...……..
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Fermentation: ……
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Exercise: 22

Objective: Preparation of candy.

Candy:……………………………………………………………………………………………………

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Elaborate Procedure:

Mature fruits

↓

Washing

↓

Preparation for sugar treatment

↓

Keeping fruit and sugar in alternate layers (1 kg fruit: 1 kg sugar) or steeping fruit in syrup of 40 % TSS for a day

↓

Removal of fruit

↓

Increasing consistency of syrup to 60 % TSS by boiling

↓

Steeping of fruit (for a day)

↓

Repeating the process and raising the strength of syrup by 5 % TSS to 70 % TSS on alternate days

↓

Steeping in 75 % TSS for a week

↓

Draining

↓

Shade drying (prior to drying, fruits dipped in boiling water to remove adhering syrup)

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Packing

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Storage

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Problems in preparation of candy:

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Exercise: 23

Objective: Preparation of Tomato chutney.

Chutney:……

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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:

Tomato (fully ripe, red)
↓
Washing
↓
Sorting
↓
Blanching for 2 minutes
↓
Putting quickly in cold water (for crack skin)
↓
Peeling
↓
Crushing
↓
Addition of ingredients except salt and vinegar and cooking for 5 minutes
↓
Addition of preservatives
↓
Filling hot into sterilized bottles
↓
Sealing
↓
Storage at ambient temperature (in cool and dry place)

Elaborate procedure:……

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Precautions:……

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Exercise: 24

Objective: Preparation of tomato sauce/ketchup.

Sauce/ketchup:……

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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:

Tomato (fully ripe, red)
↓
Washing
↓
Sorting and trimming
↓
Cutting and chopping
↓
Heating at 70-90 ^{O}C for 3-5 minutes (to soften)
↓
Pulping or extraction of juice/pulp (mechanically or by sieving)
↓
Straining tomato pulp/juice
↓
Cooking pulp with one third quantity of sugar
↓
Putting spice bag in pulp and pressing occasionally
↓
Cooking to one third of original volume of pulp/juice
↓
Removal of spice bag (after squeezing in pulp)
↓
Addition of remaining sugar and salt
↓
Cooking
↓
Judging of end point (tomato solids by hand Refractometer/volume by measuring stick, i.e., one third of its original volume
↓
Addition of vinegar/acetic acid and preservative
↓
Filling hot into bottles at about 88 ^{O}C
↓
Crown corking
↓
Pasteurization (at 85-90 ^{O}C for 30 minutes)
↓
Cooling
↓
Storage at ambient temperature (in cool and dry place)

Elaborate procedure:……

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Precautions:

Exercise: 25

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:

Tomato pulp/juice (strained)

↓

Boiling to concentrate

↓

Putting spice bag in cooking pan

↓

Preparing paste of butter and flour/starch

↓

Addition to concentrated juice

↓

Cooking to desired consistency with continuous stirring (to prevent coagulation of starch)

↓

Addition of sugar and salt and cooking for 2 minutes

↓

Removal of spice bag (after squeezing)

↓

Filling into cans (plain cans)

↓

Sterilization (115 ^{o}C for 40-45 min.)

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Cooling

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Storage at ambient temperature (in cool and dry place)

Elaborate procedure:……

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Precautions: ……

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Exercise: 26

Objective: Preparation of tomato puree and paste

Introduction:.....

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Process:

Tomato juice
⇓
Cooking to desired consistency (open cooker/vacuum pan)
⇓
Judging of end point for puree or paste (tomato solids by hand Refractometer or volume by measuring stick)
⇓
Filling hot into bottles or cans (82-88 ^{O}C)
⇓
Sterilization in boiling water for 20 minutes
⇓
Cooling
⇓
Storage at ambient temperature (in cool and dry place)

Elaborate procedure:.....

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Precautions: ……

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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:

Tomato juice (strained)

⇓

Putting spice bag in juice and cooking gently for 20 min in covered vessel

⇓

Addition of strained lime juice, vinegar and salt (if desired a little sugar may also be added)

⇓

Heating at 82-88 ^{O}C

⇓

Filling hot into bottles

⇓

Crown corking

⇓

Sterilization (at 100 ^{O}C) for 30 minutes

⇓

Cooling

⇓

Storage at ambient temperature (in cool and dry place)

Elaborate procedure:……

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Precautions: ……

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Exercise: 28

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:

Cauliflower, carrot, turnip (mature)

↓

Washing

↓

Sorting and trimming

↓

Blanching for 5 minutes

↓

Cooling immediately in water

↓

Peeling

↓

Cutting into pieces

↓

Frying all ingredients in little oil (except vinegar)

↓

Mixing with pieces

↓

Heating for 2 minutes

↓

Cooling

↓

Addition of vinegar and remaining oil

↓

Filling in jar

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Storage at ambient temperature

Elaborate procedure:……

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Precautions: ……

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Exercise: 29

Objective: Preparation of syrup.

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Recipe:

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Process:

Selection of fruits (ripe)
⇓
Washing (running tap water)
⇓
Crushing of fruit pieces
⇓
Fruit juice / pulp extract
⇓
Staining (with muslin cloth)
⇓
Mixing with strained syrup solution (sugar + water + acid, heating just to dissolve)
⇓
Bottling (sterilized)
⇓
Sealing (with crown cork or P.P. Cap)
⇓
Storing (cool and dry place)

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: 30

Objective: Preparation of sweet mango pickle.

Introduction: Pickling is the most ancient method of preservation of fruits or vegetables. Pickles are good appetizer and add to the palatability of a meal. Pickles of mango, lime, cauliflower, cabbage etc. are available. This is a suitable product for home scale preservation. There are three types of pickles viz. oil pickle, salt pickle and vinegar pickle.

Aim: To learn the preparation of sweet mango pickle.

Recipe: ……

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Process:

Selection of fruits (fully mature green)
⇓
Washing (running tap water)
⇓
Peeling
⇓
Cutting or slicing
⇓
Putting slices in jar (sterilized)
⇓
Add the salt in jar
⇓
Putting in sun (for 1 week shake the jar at least twice a day to mix the salt)
⇓
Mixing the spices
⇓
Add the sugar or jiggery in the jar
⇓
Seal the jar (with P.P. Cap)
⇓
Storage at ambient temperature (cool and dry place)

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:

Selection of fruits (fully mature mango)
⇓
Washing (running tap water)
⇓
Peeling
⇓
Cutting or slicing with stone or without stone
⇓
Cook the cut pieces with little water to make it highly soft
⇓
Mixing with sugar and salt and leaving for 1 hour
⇓
Keeping all ingredients (except vinegar) in cloth bag, tied loosely, putting in mixture and cooking on low flame
⇓
During cooking spice bag pressed occasionally
⇓
Cooking upto temperature (105 ^{0}C temperature) slirring occationally
⇓
Removal of spice bag after squeezing
⇓
Addition of vinegar
⇓
Cooking for 2-3 minutes
⇓
Filling hot into hot sterilized jar
⇓
Sealing (airtight) P.P. Cap
⇓
Storage at ambient temperature (cool and dry place)

Elaborate procedure:……..……

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Precautions: ……

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Exercise: 32

Objective: Drying and dehydration of fruits and vegetables

Drying:……...…....……

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Dehydration:…...……

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Draw a neat sketch of dryer:

Exercise: 33

Objective: Dehydration of fruits and vegetables

Introduction: In dehydration process a single layer of fruit or vegetables, whole, sliced or cut into pieces are spread on trays which are placed inside the dehydrator.

Schedule for drying and dehydration of fruits:

Fruits	Preparation and pretreatment	Sulphuring time	Drying temperature	Drying ratio (%)
Banana	Wash, peel, cut in to slices length wise or cross wise, 12 mm thick	30 minutes	55-60 ^{O}C or sun drying	15-20
Mango	Wash, peel, cut into 12 mm thick slices	2 hours	45-50 ^{O}C or sun drying	8-10

Schedule for drying and dehydration of vegetables:

Fruits	Preparation and pretreatment	Sulphuring time	Drying temperature	Drying ratio
Cauliflower	Wash, remove stalks, covering leaves and stems, break flowers apart into pieces of suitable size	Blanch 4-5 min. immerse for 1 hour in 1% KMS sol. and drain	55-60 ^{O}C or sun drying	35:1
Cabbage	Wash, remove outer leaves and core, cut into fine shreds	Blanch 5-6 min. immerse for 10 min in 0.5% KMS sol. and drain	55-60 ^{O}C or sundry	18:1
Green peas	Wash, remove shell and collect the grain	Blanch or steam for 3-4 min. immerse in 0.5% KMS sol. and drain	60-65 ^{O}C or sundry	7:1
Potato	Wash, peel and cut into 10 mm thick slices	Blanch in boiling water or steam for 3-4 min. and immerse in 0.5% KMS solution	60-65 ^{O}C sundry	7:1

Precautions: …...……

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Exercise: 34

Objective: Visit to processing unit.

Exercise: Write a brief report on the visit to the processing unit with full details of the unit.

Exercise: 35

Objective: Handling, grading and packaging of cut flowers.

Introduction: The handling, grading and packaging of cut flowers are most important factors for the purpose of local marketing as well as export point of view.

Aim: To study the proper handling, grading and packaging of cut flowers.

How to handle the cut flowers:

a) ……

b) ……

c) ……

d) ……

How to grading the cut flowers:

a) ……

b) ……

c) ……

d) ……

How to pack the cut flowers by the help of packaging materials.

a) ……

b) ……

c) ……

d) ……

e) ……

What do you mean by post-harvest management of cut flowers?

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Exercise: 36

Objective: Drying of flowers

Introduction: Flowers in dried condition can be kept for a long time. Flowers if properly dried can retain its original shape and colour and look very attractive. Dried flowers have great demand in domestic as well as in the international market.

Requirements: ……..……..……

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Type of flower	Type of dryer	Drying condition		Effect of drying		Remarks
		Temp (^{o}C)	Time (min.)	Retention of shape	Retention of colour	
	Cabinet dryer					
	Microwave oven					

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Student's Notes