

## Optimization of the Effect of Process Parameters and Study of Quality Characteristics of Osmotic Dehydrated Amla Slices

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**Abstract:** The osmotic dehydration technique not only enables the storage of the fruits for a longer period, but also preserves flavour, nutritional characteristics and prevents microbial spoilage. Osmotic Dehydration is done by immersing Vegetable & Fruits, whether in pieces or whole, in salt or sugar aqueous solution of high osmotic pressure. The amla (*Phyllanthus emblica*) is an effective source of Vitamin C. The ascorbic acid (Vitamin C) content in the amla fruit is one of the highest contents of all plants. The amla plant has been used in Indian medicine for years. In Ayurvedic medicine, the amla plant is used to treat minor hemorrhage and to help foster cardiovascular health. The study conducted for Amla slices during osmotic dehydration followed by tray drying and the influence of process variables on the quality characteristics. The samples were osmodehydrated at in combination of sugar (25- 60°Brix) and salt (5%, 7.5% and 10%) solution at temperature of 30°C in 4:1 and 8:1 ratio. The treated sample slices were spread on stainless steel trays of the tray dryer and they were dried in tray dryer at temperature 50<sup>o</sup> C. The samples were weighed at an interval of 30 minutes. The sample took around 2 to 3 hours depending on the drying temperature to reach equilibrium moisture content. It was observed that the weight reduction, solid gain and weight loss increased with increase of the parameters like time, concentration of the sugar solution and ratio of the solution to sample. The quality parameters such as reducing sugars and ash content were determined.

**Key Words:** Osmotic Dehydration, Amla, Tray Dryer, Weight Reduction, Solid Gain and Weight loss.

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### I. Introduction

#### Osmotic Dehydration:

Osmotic dehydration is a process of partial removal of water by soaking foods, mostly fruits and vegetables, in hypertonic solutions (Shi and Maguer 2002). The driving force for the diffusion of water from plant tissue into solution is difference between osmotic pressures of hypertonic solution and plant tissue. The diffusion of water is accompanied by simultaneous counter diffusion of solutes from solution into tissue (Lazarides *et al.* 1995) Leakage of natural solutes from plant tissue occurs because the cell membranes of plant tissue responsible for osmotic transport is not perfectly selective but this flow is negligible, although it may be important for the organoleptic and nutritional properties of the product (Heng *et al.* 1990, Mizrahi *et al.* 2001, Sahoo *et al.* 2007, Singh *et al.* 2008). The food which has been osmotically dehydrated can be further processed by freezing, freeze drying vacuum drying and air drying (Nanjundaswamy *et al.* 1978). Sugar, glucose, fructose, corn syrup and sodium chloride are the common osmotic agents and out of this sodium chloride solution is commonly used for vegetables and sucrose solution for fruits.

#### Amla:

Amla or Indian gooseberry (*Emblica officinalis* Garten) has wide popularity all over the world because of the medicinal properties. The medicinal preparations are so highly regarded that many scientists have focussed attention on discovering the nutritional and medicinal principles of amla. The high level of ascorbic acid makes it good as an antiscorbutic, diuretic, laxative and antibiotic [Mehta (1995)]. The fruit is also reported to possess pronounced expectorant, antiviral and cardiogenic activities. It also possesses hypoglycemic activity [Kalra (1988)].

### II. Materials And Methods

- Osmotic dehydration
- Drying- Tray drying.
- Quality analysis.
- Chemical analysis- Analysis of reducing sugars, Ash content.

**Different Treatment to be performed at each Temperature:**

Temperature(°c)	30
Ratio of solution to sample	4:1 , 8:1
Concentration of osmotic solution	25 – 60° brix
Concentration of salt solution (%)	5, 7.5, 10%
Time	2 hours

Fresh amla were purchased locally and thoroughly washed with water to remove adhering soil and other debris. They were blanched and cut into pieces of 1.5 cm size. Sugar and salt are the osmotic agent was purchased from the local supermarket. The osmotic solution is prepared by mixing the sugar and salt with proper amount of pure water. The osmotic dehydration was conducted in a 500 ml beaker which was placed in a water bath. Sample were cut into small pieces and weighed and then placed into dehydration vessel containing sugar solution of varying concentration (25-60° Brix) and salt(5, 7.5, 15%). The vessel was placed into the water bath at constant temperature. The solution and sample ratio is 4:1and 8:1. After each half an hour (30 min) the pieces were taken and weighed. In each of the experiment fresh osmotic syrup were used. The treated sample slices were spread on stainless steel trays of the tray dryer and they were dried in tray dryer at temperature 50° C. The samples were weighed at an interval of 30 minutes. The samples took around 2 to 3 hours depending on the drying temperature to reach equilibrium moisture content. The average moisture and dry matter content of the sample were determined by drying in hot air oven. In order to follow adequately the osmotic dehydration kinetics, individual analysis for each sample were carried out and from these; weight reduction (WR), solid gain (GN) and weight loss (WL) data were obtained, according to the following expression given by Ozen *et al.* (2002) and Singh *et al.* (2007)

$$\text{Weight reduction, } WR = \frac{W_0 - W}{W_0} \times 100 \quad (1)$$

$$\text{Solid gain, } SG = \frac{M - M_0}{W_0} \times 100 \quad (2)$$

$$\text{Weight loss, } WL = WR + SG \quad (3)$$

Where,

W<sub>0</sub> – Initial sample weight (g),

W – Sample weight after osmotic dehydration (g),

M<sub>0</sub> – Initial solid content in the fresh sample (g),

M – Solid content in the sample after osmotic dehydration (g).

**III. Results And Discussion**

This chapter deals with the experiments conducted on osmotic dehydration of amla. The results obtained are tabulated and discussed in detail.

**Concentration of the osmotic agent: sugar (°brix) and salt (5%)-(4:1):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	50	50.5	50.38	49.14	50.55	49.80	49.82	49.51
30	49.58	48.63	45.45	47.68	48.93	47.63	47.23	46.32
60	48.37	47.14	30.11	45.12	47.62	45.82	44.38	43.89
90	47.98	46.82	37.62	43.95	45.20	43.64	42.78	43.12
120	47.69	39.42	36.18	41.32	42.35	41.28	41.12	41.63

**Concentration of the osmotic agent: sugar (°brix) and salt (7.5%):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	50.07	50.73	51.57	50.0	50.14	50.56	51.16	50.53
30	47.83	48.10	48.08	47.91	45.98	45.13	46.78	45.62
60	45.28	45.38	45.13	44.30	41.36	40.89	41.32	40.80
90	43.61	43.12	43.86	40.18	38.12	37.63	38.49	35.31
120	40.99	40.41	40.4	35.80	34.36	33.11	35.42	30.48

**Concentration of the osmotic agent: sugar (°brix) and salt (10%):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	50.39	49.98	50.32	50.11	48.35	49.77	50.48	50.12
30	47.83	45.28	47.91	46.73	44.18	45.99	45.76	44.96
60	45.40	42.73	44.32	41.28	40.92	41.18	41.69	41.38
90	41.32	34.84	40.18	37.94	37.64	34.32	38.14	37.63
120	36.70	35.12	36.79	34.32	34.96	34.10	34.68	34.18

**WEIGHT REDUCTION-(4:1):**

**Concentration of the osmotic agent: Salt (5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	0.84	3.70	9.78	2.97	3.20	4.35	5.19	6.44
60	3.26	6.65	23.36	8.18	5.79	7.99	10.91	11.35
90	4.04	7.28	25.32	10.56	10.58	12.36	14.13	12.90
120	4.62	21.9	28.18	15.91	16.22	17.10	17.46	15.91

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	4.47	5.18	6.77	4.18	8.29	10.38	8.56	9.72
60	9.57	10.55	12.48	11.40	17.51	18.80	19.23	19.26
90	12.90	15.0	14.95	19.64	23.97	25.27	24.76	30.12
120	18.13	20.34	21.65	28.4	31.47	34.25	30.77	39.68

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.85	10.64	9.80	9.34	9.85	9.20	10.99	10.29
60	3.26	8.93	23.36	8.18	5.79	7.99	10.91	11.35
90	4.04	7.28	25.32	10.56	10.58	12.36	14.13	12.90
120	4.62	21.9	28.18	15.91	16.22	17.10	17.46	15.91

**Ratio 8:1-Concentration of the osmotic agent: sugar (°brix) and salt (5%):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	50.12	50.25	50.31	50.5	50.3	50.47	50.17	50.75
30	48.36	48.13	48.23	48.10	48.13	48.73	48.69	48.96
60	47.44	47.09	47.11	47.39	47.5	46.19	47.38	47.33
90	46.23	45.98	46.30	46.23	46.73	44.98	45.85	46.18
120	45.10	44.73	45.22	45.18	45.78	43.26	44.98	45.29

**Concentration of the osmotic agent: sugar (°brix) and salt (7.5%):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	49.8	50.4	50.2	50.2	50.2	49.7	50.5	50.3
30	48.9	49.2	49.3	49.18	49.2	48.3	48.6	48.7
60	47.6	48.8	48.9	48.3	48.9	47.6	46.3	47.1
90	46.9	47.6	48.1	47.6	47.6	46.3	45.8	46.38
120	45.7	46.5	47.3	46.8	45.4	45.1	44.1	44.43

**Concentration of the osmotic agent: sugar (°brix) and salt (10%):**

Conc Time (mins)	25	30	35	40	45	50	55	60
0	50.10	50.63	50.23	50.61	50.3	50.32	50.12	50.71
30	47.62	47.88	47.30	47.97	47.22	47.11	47.67	47.38
60	45.14	45.36	45.68	45.73	45.34	45.48	45.40	45.60
90	43.29	43.99	43.29	43.98	43.16	43.55	43.79	43.99
120	40.46	40.12	40.91	40.79	41.01	40.98	41.12	41.69

**WEIGHT REDUCTION: 8:1:-**

**Concentration of the osmotic agent: Salt (5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	3.51	4.22	5.74	3.05	4.12	4.29	4.25	2.99
60	5.35	6.29	9.41	6.38	5.65	5.74	5.74	5.63
90	7.76	8.49	11.14	8.03	7.41	8.36	8.30	7.00
120	10.0	10.98	12.59	9.75	8.96	10.1	10.13	8.76

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix)**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	1.81	2.38	1.79	2.03	1.99	2.82	3.76	3.18
60	4.42	3.17	2.59	3.78	2.59	3.82	8.32	6.36
90	5.82	5.56	4.18	5.18	5.18	6.84	9.31	7.79
120	8.23	7.74	7.78	6.77	9.56	9.25	12.67	11.67

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix)**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	4.95	5.43	5.83	5.22	6.12	6.38	4.89	6.57
60	9.90	10.41	9.06	9.64	9.86	9.62	9.42	10.1
90	13.59	13.11	13.82	13.10	14.19	13.45	12.63	13.25
120	19.24	20.79	18.55	19.40	18.47	18.56	17.96	17.78

The weight reduction of Amla increased from (0.84-10.0%), (3.7-10.98%), (2.78-12.59%), (2.97-9.75%), (3.2-8.96%), (4.35-10.1%), (5.19-10.13%), (6.44-8.76%) for all the treatments with increase in temperature 30°C with increase in sugar and salt (5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The weight reduction of Amla increased from (4.47-8.23%), (5.18-7.74%), (6.77-7.78%), (4.18-6.77%), (8.29-9.56%), (9.25-10.38%), (8.56-12.67%), (9.72-11.67%) for all the treatments with increase in temperature 30°C with increase in sugar and salt(7.5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The weight reduction of Amla increased from (5.08-19.24%), (9.40-20.79%), (4.79-18.55%), (6.75-19.40%), (8.62-18.47%), (7.59-18.56%), (8.69-17.96%), (9.15-17.78%) for all the treatments with increase in temperature 30°C with increase in sugar and salt(10%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1.

**SOLID GAIN: Ratio- 4:1-Concentration of the osmotic agent: Salt (5%) and sugar (°brix)**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.13	10.08	10.23	10.08	10.36	10.28	10.06	10.36
60	11.20	11.28	11.12	11.21	11.19	11.02	11.28	11.48
90	12.30	12.34	12.39	12.10	12.23	12.11	12.36	12.39
120	13.21	13.12	13.46	13.43	13.06	13.42	13.49	13.54

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.32	10.43	10.38	10.43	10.55	10.18	10.36	10.42
60	11.12	11.68	11.45	11.56	11.38	11.49	11.59	11.63
90	12.19	12.49	12.30	12.38	12.61	12.68	12.88	12.78
120	13.39	13.54	13.68	13.16	13.20	13.71	13.90	13.81

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.36	10.43	10.38	10.55	10.09	10.53	10.49	10.19
60	11.28	11.55	11.69	11.43	11.28	11.42	11.63	11.68
90	12.39	12.38	12.81	12.82	12.45	12.51	12.16	12.73
120	13.46	13.60	13.73	13.69	13.64	13.68	13.28	13.19

M = solid content in sample after osmotic dehydration.

Mo = solid content in fresh sample, 0.84g,

Wo = initial sample weight, 50g

**Concentration of the osmotic agent: Salt (5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	18.58	18.48	18.78	18.48	19.04	18.88	18.44	19.04
60	20.72	20.88	20.56	20.74	20.7	20.36	20.88	21.28
90	22.92	23.0	23.10	22.52	22.78	22.54	23.04	23.10
120	24.74	24.56	25.24	25.18	24.44	25.16	25.16	25.40

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	18.96	19.18	19.08	19.18	19.42	18.68	19.04	19.16
60	20.56	21.68	21.22	21.44	21.08	21.30	21.50	21.58
90	22.70	23.30	20.92	23.08	23.54	23.68	24.08	23.88
120	25.10	25.40	25.68	24.64	24.72	25.74	26.12	25.94

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	19.04	19.18	19.08	19.42	18.50	19.38	19.30	18.70
60	20.88	21.42	21.70	21.18	20.88	21.16	21.58	21.68
90	23.10	23.08	23.94	23.96	23.22	23.34	22.64	23.78
120	25.24	25.52	25.78	25.70	25.60	25.68	24.88	24.70

Concentration of the osmotic agent: Salt (5%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	18.58	18.48	18.78	18.48	19.04	18.88	18.44	19.04
60	20.72	20.88	20.56	20.74	20.7	20.36	20.88	21.28
90	22.92	23.0	23.10	22.52	22.78	22.54	23.04	23.10
120	24.74	24.56	25.24	25.18	24.44	25.16	25.16	25.40

Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	18.96	19.18	19.08	19.18	19.42	18.68	19.04	19.16
60	20.56	21.68	21.22	21.44	21.08	21.30	21.50	21.58
90	22.70	23.30	20.92	23.08	23.54	23.68	24.08	23.88
120	25.10	25.40	25.68	24.64	24.72	25.74	26.12	25.94

Concentration of the osmotic agent: Salt (10%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	19.04	19.18	19.08	19.42	18.50	19.38	19.30	18.70
60	20.88	21.42	21.70	21.18	20.88	21.16	21.58	21.68
90	23.10	23.08	23.94	23.96	23.22	23.34	22.64	23.78
120	25.24	25.52	25.78	25.70	25.60	25.68	24.88	24.70

RATIO 8:1-Concentration of the osmotic agent: Salt (5%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.42	10.35	10.48	10.59	10.62	10.53	10.48	10.51
60	11.38	11.40	11.54	11.63	11.52	11.64	11.51	11.39
90	12.54	12.39	12.47	12.48	12.61	12.49	12.63	12.45
120	13.70	13.61	13.58	13.36	13.73	13.58	13.56	13.62

Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.38	10.49	10.27	10.39	10.45	10.51	10.43	10.55
60	11.46	11.34	11.31	11.45	11.36	11.49	11.55	11.38
90	12.27	12.45	12.52	12.62	12.51	12.62	12.34	12.24
120	13.53	13.36	13.49	13.54	13.63	13.78	13.28	13.46

Concentration of the osmotic agent: Salt (10%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	10.52	10.37	10.61	10.68	10.45	10.51	10.43	10.55
60	11.67	11.45	11.42	11.41	11.38	11.49	11.55	11.38
90	12.36	12.61	12.55	12.36	12.59	12.62	12.34	12.24
120	13.61	13.57	13.68	13.45	13.33	13.78	13.28	13.46

M = solid content in sample after osmotic dehydration.

Mo = solid content in fresh sample, 0.84g,

Wo = initial sample weight, 50g

Concentration of the osmotic agent: Salt (5%) and sugar (°brix):

Conc Time (mins)	25	30	35	40	45	50	55	60
30	19.16	19.02	19.28	19.50	19.56	19.38	19.28	19.34
60	21.08	21.12	21.42	21.58	21.38	21.60	21.36	21.10
90	23.40	23.10	23.26	23.28	23.54	23.30	23.58	23.22
120	25.72	25.54	25.48	25.04	25.78	25.48	25.44	25.56

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins) \	25	30	35	40	45	50	55	60
30	19.08	19.30	18.86	19.10	19.22	19.34	19.18	19.42
60	21.24	21.00	20.94	21.22	21.04	21.30	21.44	21.08
90	22.86	23.22	23.30	23.56	23.28	23.50	23.00	22.80
120	13.58	25.04	25.30	25.40	25.58	25.88	24.88	25.24

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins) \	25	30	35	40	45	50	55	60
30	19.36	19.06	19.54	19.68	19.22	19.38	19.60	19.10
60	21.66	21.22	19.16	19.14	21.08	21.24	21.36	21.22
90	23.04	23.54	23.42	23.04	23.50	22.82	23.30	23.28
120	25.54	25.46	25.68	25.22	24.98	25.08	25.56	25.04

The solid gain of Amla increased from (18.58-25.72%), (18.48-25.54%), (18.78-25.48%), (18.48-25.04%), (19.04-25.78%), (18.88-25.48%), (18.44-25.44%), (19.04-25.56%) for all the treatments with increase in temperature 30°C with increase in sugar and salt (5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The solid gain of Amla increased from (18.96-23.58%), (19.18-25.04%), (19.08-25.30%), (19.18-25.40%), (19.42-25.58%), (18.68-25.88%), (19.04-24.88%), (19.16-25.24%) for all the treatments with increase in temperature from 30°C with increase in sugar and salt(7.5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The solid gain of Amla increased from (19.04-25.54%), (19.18-25.46%), (19.08-25.68%), (19.42-25.22%), (18.50-24.98%), (19.38-25.08%), (19.30-25.56%), (18.70-25.04%) for all the treatments with increase in temperature from 30°C with increase in sugar and salt(10%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1.

**WEIGHT LOSS: Ratio 4:1-Concentration of the osmotic agent: Salt (5%) and sugar:**

Conc Time (mins) \	25	30	35	40	45	50	55	60
30	19.42	22.18	28.56	21.45	22.24	17.23	23.63	25.48
60	23.98	27.53	42.92	28.88	26.49	28.35	31.79	32.63
90	26.96	30.28	48.42	33.08	33.36	34.9	37.17	36.0
120	29.36	46.46	53.42	41.09	40.66	42.26	42.62	41.31

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins) \	25	30	35	40	45	50	55	60
30	23.43	24.36	25.85	23.36	27.71	29.06	27.6	28.88
60	30.13	32.23	33.7	32.84	38.59	40.1	40.73	40.84
90	35.6	38.3	35.87	42.72	47.51	48.95	48.84	54.0
120	43.23	45.74	47.43	53.04	56.19	59.99	56.89	65.62

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins) \	25	30	35	40	45	50	55	60
30	20.06	28.88	24.36	20.5	20.01	19.78	23.01	23.7
60	23.26	40.84	32.23	23.29	23.31	24.72	26.93	30.93
90	26.31	54.0	38.3	26.66	26.58	26.76	33.61	39.37
120	30.68	65.62	45.74	29.54	29.62	32.5	40.06	44.82

**Ratio 8:1-Concentration of the osmotic agent: Salt (5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	22.67	23.24	25.02	22.55	23.68	23.67	23.53	22.33
60	26.43	27.41	30.83	27.96	27.03	27.34	27.1	26.73
90	31.16	31.59	34.4	31.31	30.95	31.66	31.88	30.22
120	35.72	36.52	38.07	34.79	34.74	35.58	35.57	34.32

**Concentration of the osmotic agent: Salt (7.5%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	20.89	21.68	20.65	21.13	21.21	22.16	22.94	22.6
60	25.66	24.17	23.53	25.00	23.63	25.12	29.76	27.44
90	21.68	28.78	27.48	28.74	28.46	30.34	32.31	30.59
120	28.81	32.78	31.08	32.17	35.14	35.13	37.55	36.91

**Concentration of the osmotic agent: Salt (10%) and sugar (°brix):**

Conc Time (mins)	25	30	35	40	45	50	55	60
30	24.31	24.49	25.37	24.9	25.34	25.76	24.49	25.67
60	31.56	31.63	28.22	28.78	30.94	30.86	30.78	31.32
90	36.63	36.65	37.24	36.14	37.69	36.27	35.93	36.53
120	44.78	46.25	44.23	44.62	43.45	43.64	43.52	42.82

The weight loss of Amla increased from (19.42-35.72%), (22.18-36.52%), (28.56-38.07%), (21.45-34.79%), (22.24-34.74%), (17.23-35.58%), (23.63-35.57%), (25.48- 34.32%) for all the treatments with increase in temperature 30°C with increase in sugar and salt(5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The weight loss of Amla increased from (23.43-28.81%), (24.36-32.78%), (25.85-31.08%), (23.36-32.17%), (27.71-35.14%), (29.06-35.13%), (27.6-37.55%), (28.88-36.91%), for all the treatments with increase in temperature 30°C with increase in sugar and salt(7.5%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1. The weight loss of Amla increased from (20.06-44.78%), (28.88-46.25%), (24.36-44.23%), (20.5-44.62%), (20.01-43.45%), (19.78-43.64%), (23.01-43.52%), (23.7-42.82%), for all the treatments with increase in temperature 30°C with increase in sugar and salt(10%) concentration from 25-60°brix and solution to sample ratio from 4:1 to 8:1.

**Chemical analysis – Ash content for the osmotic dehydration of Amla: [Ranganna S (1986)]**

S.No	Concentration of the sample	Ash content(g)
1	Control (raw Amla sample)	0.3
2	Concentration of salt(15%), 30°C, 4:1	0.14
3	Concentration of sugar(45°brix), 30°C, 4:1	0.23
4	Concentration of sugar(50°brix), salt(10%), 30°C, 4:1	0.18

From the above table, it was observed that the ash content for the concentration of salt(15%) is 0.14g, Concentration of sugar(45°brix) is 0.23g, Concentration of sugar(50°brix) and salt(10%) is 0.18g was analyzed for the raw Amla sample to the osmotic dehydrated of Amla at 30°C, 4:1 ratio. When compared to other concentrations of sugar and salt, concentration of sugar (45°brix), 30°C, 4:1 is high.

**Chemical analysis – Analysis of Reducing Sugars for the osmotic dehydration of Amla:[Lane, J. H. and Eynon, L. (1923)]**

S.No	Concentration of the sample	Reducing Sugar
1	Concentration of sugar(60°brix), 30°C, 4:1	22.3
2	Concentration of sugar(40°brix), 30°C, 4:1	21.5
3	Concentration of sugar(50°brix), 30°C, 8:1	22.1
4	Concentration of sugar(60°brix), salt (5%)30°C, 8:1	23.5



From the above table, the Reducing sugar for the Concentration of sugar(60°brix), 30°C, 4:1 is 22.3, Concentration of sugar(40°brix), 30°C, 4:1 is 21.5, Concentration of sugar(50°brix), 30°C, 8:1 is 22.1, Concentration of sugar(60°brix), salt (5%)30°C, 8:1 is 23.5 was analyzed for the osmotically dehydrated Amla. [AOAC (2000) Official methods of analysis].

#### IV. Conclusion

It was concluded that the study conducted for Amla slices during osmotic dehydration followed by tray drying and the influence of process variables on the quality characteristics. The samples were osmo dehydrated in combination of sugar (25- 60°Brix) and salt (5%, 7.5%,10%) solution at temperature 30°C in 4:1 and 8:1 ratio. It was observed that the weight reduction, solid gain and water loss increased with increased in the parameters like concentration of sugar solution, salt solution and ratio of solution to sample and time

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