

## Study The Effect of Pretreatments on Osmotic Dehydration of Papaya Slices

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### ABSTRACT

The present study is carried out the effect of pretreatments on osmotic dehydration in 55°Brix and 65°Brix sugar solutions at 55°C syrup temperature. The osmotic dehydration is a process of partial removal of water from the sample by immersing in the osmotic solution. The osmotic dehydration is a preservation technique to remove the water which is present into the sample. The yield of maximum water loss, mass reduction and solid gain in osmo-convective of papaya slices. The optimum operation condition was found to be temperature of 55°C of syrup concentration for 65°Brix sugar solution after 180 minutes.

**Keywords:** Dehydration, papaya slices, optimization, water loss, solid gain and mass reduction.

Received 28/07/2018

Revised 25/10/2018

Accepted 30/11/2018

### Citation of this article

Vishwajeet Singh & Rajdeep Kudesia. Performance of Microsatellite Inter-Simple Sequence Repeat Marker for Molecular Diversity of *Dolichos lablab*. Int. Arch. App. Sci. Technol; Vol 9 [4] December 2018. 95-100

### INTRODUCTION

Osmotic dehydration (OD) is one of most important complementary treatment and food preservation technique in the processing of dehydrated foods, since it presents some benefits such as reducing the damage of heat to the flavor, color, inhibiting the browning of enzymes and decrease the energy costs [1,7]. Osmotic dehydration results in increased shelf-life, little bit loss of aroma in dried and semidried food stuffs, lessening the load of freezing and to freeze the food without causing unnecessary changes in texture [5]. It has been reported that osmotic dehydration reduced up to 50% weight of fresh vegetables and fruits [6]. Osmotic dehydration involves the immersion of foods (fish, vegetables, fruits and meat) in osmotic solution such as salts, alcohols, starch solutions and concentrated sugars, which some extent to dehydrates the food [3]. Different types of solutes such as fructose, corn syrup, glucose, sodium chloride and sucrose are used as osmotic agent for OD [2]. Low molar mass saccharides (sucrose, glucose and fructose) make easy the sugar uptake due to high diffusion of molecules [4].

### MATERIAL AND METHODS

Papaya slices were first selected for pretreatments (T<sub>1</sub> Control or Untreated, T<sub>2</sub> Potassium metabisulfite, T<sub>3</sub> Sodium bisulfate and T<sub>4</sub> Blanching) during the process, osmosis was carried out in sugar solution at a varying concentration of 55°Brix and 65°Brix. Osmosis was conducted manually at regular intervals to maintain uniform temperature. At each

experimental condition, osmotic dehydration was carried out for 180 minutes to each design time (after every 30 min intervals).

## RESULTS AND DISCUSSION

### Effect on water loss, solid gain and mass reduction

The effect of sugar concentration (55°Brix & 65°Brix) and time on water loss, solid gain, mass reduction at constant temperature of 55°C and solution to product ratio 5:1 during osmotic dehydration for Treatments T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> are shown in fig. 1 to 9.

### Effect of osmotic solution concentration and time on water loss for T<sub>2</sub>

In osmotic papaya sample (T<sub>2</sub>) the water loss were found 5.055% and 5.71% at 55°Brix and 65°Brix respectively on 30 minutes difference. On each 30 minutes difference, the values of water loss for 55°Brix were found 7.634%, 10.20%, 11.92%, 13.19% and 14.51% respectively. While the water loss for 65°Brix on 30 minutes difference were found 8.82%, 11.86%, 16.15%, 19.15% and 21.63% respectively.

Water loss in osmosis increased with increase in sugar concentration, this was because as increase in the concentration of sugar solution resulted in osmotic gradient, which increased the driving force for water remove between solution and fruit and thereby giving higher mass transfer rates.

### Effect of osmotic solution concentration and time on mass reduction for T<sub>2</sub>

The values mass reductions were found 4.33%, 6.67%, 8.83%, 10.17%, 11.17% and 12.17% at 55°Brix. While the values at 65°Brix were found 5.33%, 8.0%, 10.5%, 13.83%, 16.17% and 17.67 % for T<sub>2</sub> sample after 30 minutes of intervals.

Mass reduction in osmosis increased with increase in syrup temperature and concentration of solution. At initial stage increasing temperature and sugar concentration of solution raises water loss more than solid gain which causes an increase in mass reduction. However later increase in solid gain blocks layers of the product, which reduce the concentration gradient between the product and osmotic solution, posing an additional resistance to mass exchange and lowering the rates of water loss and consequently mass reduction.

### Effect of osmotic solution concentration and time on solid gain for T<sub>2</sub>

Solid gain values showed variability among the treatments. Solid gain in osmosis decrease with the increase in the sugar concentration and syrup temperature, it might be due to high viscosity of more concentrated sugar solution, which imported resistance to the solute penetration at solution and gel interface. The solid gain values were found 0.72%, 0.968%, 1.37%, 1.76%, 2.032% and 2.341% for T<sub>2</sub> sample after each 30 minute intervals at 55°Brix. While the values of solid gain were found 0.393%, 0.823%, 1.364%, 2.32%, 3.15% and 3.96% at 65°Brix after each 30 minutes of intervals.

The value of solid gain were much lower than the water loss for all the process parameters during osmotic dehydration, because sucrose having larger ionic radius could not diffuse easily through the cell membrane and thus the approach to osmotic equilibrium was achieved primarily by flow of water from cell. It was observed that solid gain goes on decreasing as sugar concentration goes on increasing.

### Effect of osmotic solution concentration and time on water loss for T<sub>3</sub>.

In osmotic papaya sample (T<sub>3</sub>) the water loss were found 6.37% and 7.17% at 55°Brix and 65°Brix respectively on 30 minutes difference. On each 30 minutes difference, the values of water loss for 55°Brix were found 9.87%, 14.35%, 18.49%, 22.29% and 27.291% respectively. While the water loss for 65°Brix on 30 minutes difference were found 12.402%, 16.63%, 20.31%, 23.11% and 26.798% respectively.

### Effect of osmotic solution concentration and time on Mass Reduction for T<sub>3</sub>.

The values mass reductions were found 4.0%, 7.17%, 11.83%, 15.00%, 17.67% and 20.83% at 55°Brix. While the values at 65°Brix were found 6.8%, 10.67%, 14.00%, 16.17%, 18.5% and 20.67% for T<sub>3</sub> sample after 30 minutes of intervals.

### Effect of osmotic solution concentration and time on Solid Gain for T<sub>3</sub>.

The solid gain values were found 2.374%, 2.701%, 2.512%, 3.497%, 4.627% and 6.46% for T<sub>3</sub> sample after each 30 minute intervals at 55°Brix. While the values of solid gain were found 0.667%, 1.73%, 2.63%, 3.64%, 4.43% and 6.131% at 65°Brix after each 30 minutes of intervals.

**Effect of osmotic solution concentration and time on water loss for T<sub>4</sub>.**

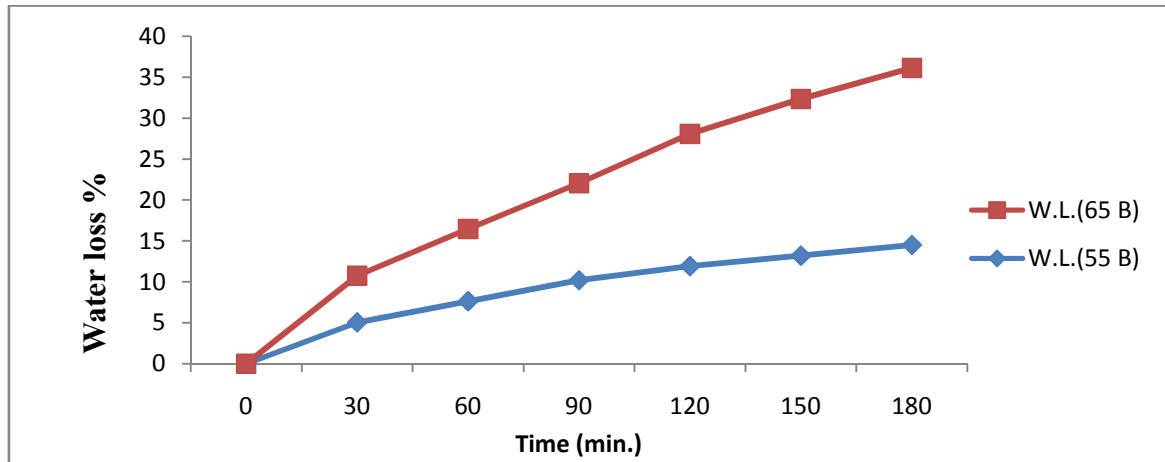
In osmotic papaya sample (T<sub>4</sub>) the water loss were found 10.123% and 8.93% at 55°Brix and 65°Brix respectively on 30 minutes difference. On each 30 minutes difference, the values of water loss for 55°Brix were found 17.33%, 19.26%, 22.86%, 25.76% and 27.58% respectively. While the water loss for 65°Brix on 30 minutes difference were found 14.22%, 20.35%, 21.83%, 26.54% and 30.32% respectively.

**Effect of osmotic solution concentration and time on mass reduction for T<sub>4</sub>.**

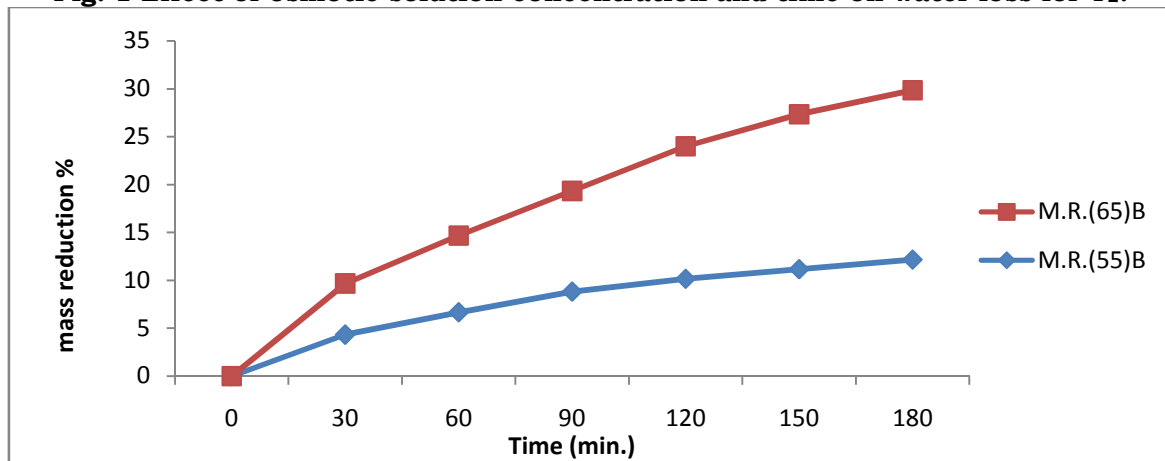
The values mass reductions were found 8.67%, 13.83%, 15.17%, 17.5%, 19.5% and 20.67% at 55°Brix. While the values at 65°Brix were found 7.5%, 11.83%, 16.17%, 17.17%, 20.17% and 22.33% for T<sub>4</sub> sample after 30 minutes of intervals.

**Effect of osmotic solution concentration and time on Solid Gain for T<sub>4</sub>.**

The solid gain values were found 1.7113%, 3.501%, 4.1%, 5.36%, 6.26% and 6.912% for T<sub>4</sub> sample after each 30 minute intervals at 55°Brix. While the values of solid gain were found 1.43%, 2.39%, 4.19%, 4.66%, 4.37% and 7.99% % at 65°Brix after each 30 minutes of intervals.



**Fig. 1 Effect of osmotic solution concentration and time on water loss for T<sub>2</sub>.**



**Fig. 2 Effect of osmotic solution concentration and time on mass reduction for T<sub>2</sub>.**

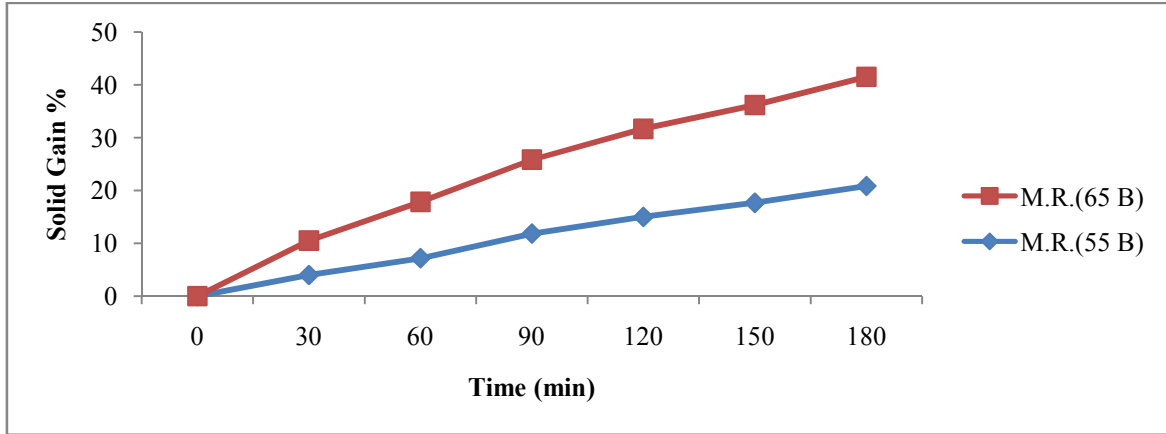


Fig. 3 Effect of osmotic solution concentration and time on solid gain for T<sub>2</sub>.

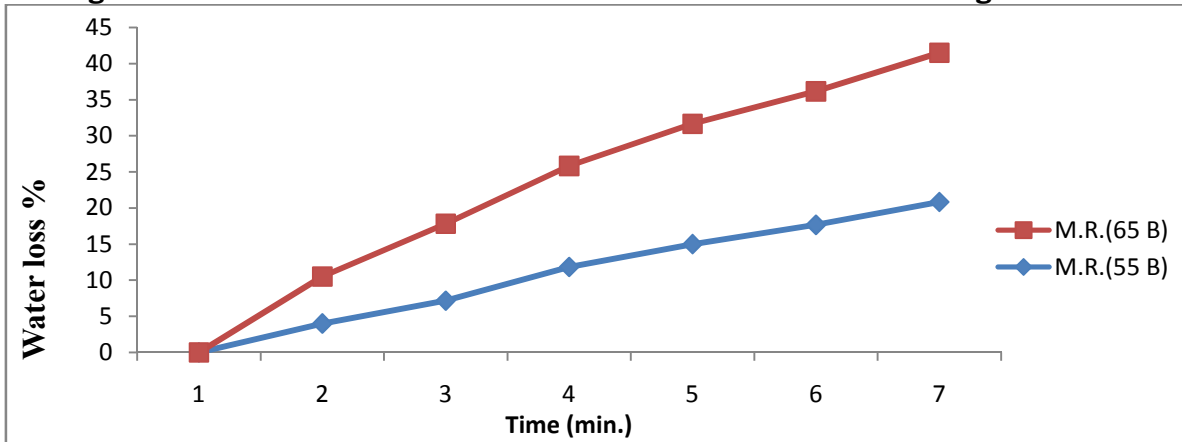


Fig. 4 Effect of osmotic solution concentration and time on water loss for T<sub>3</sub>.

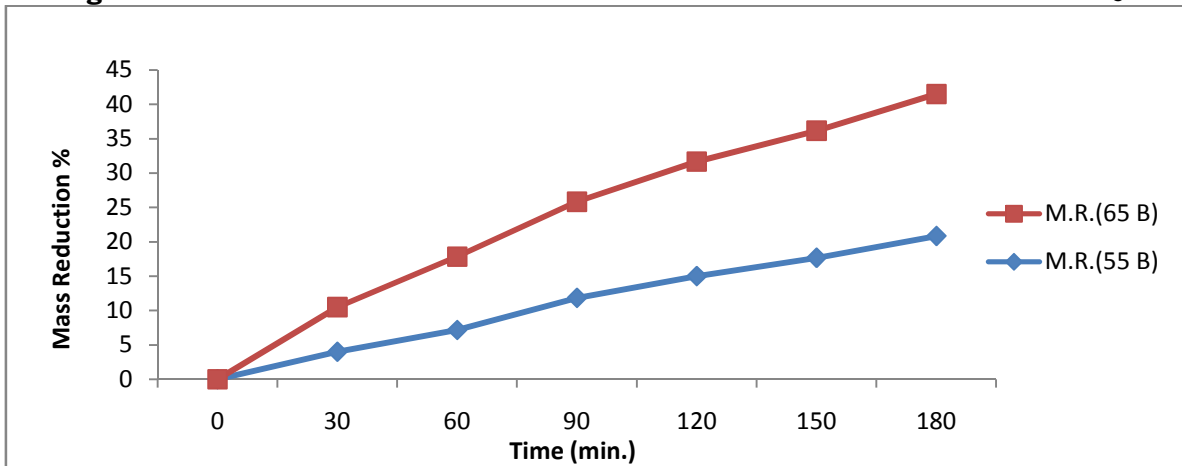
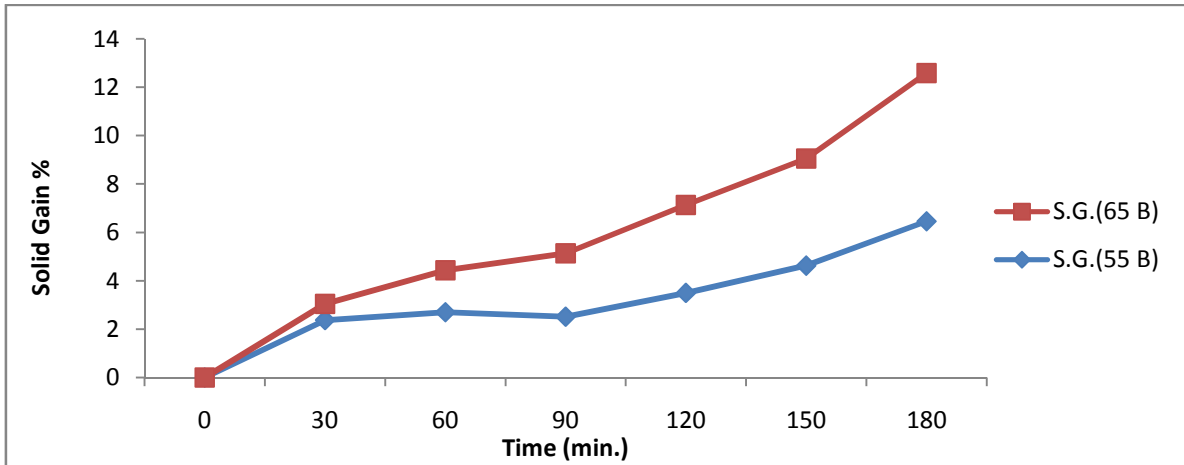
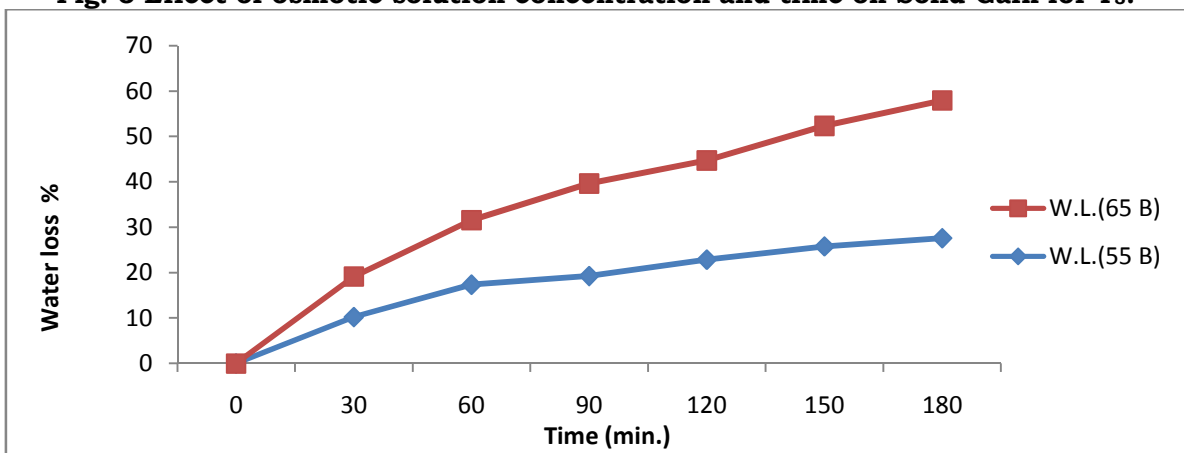


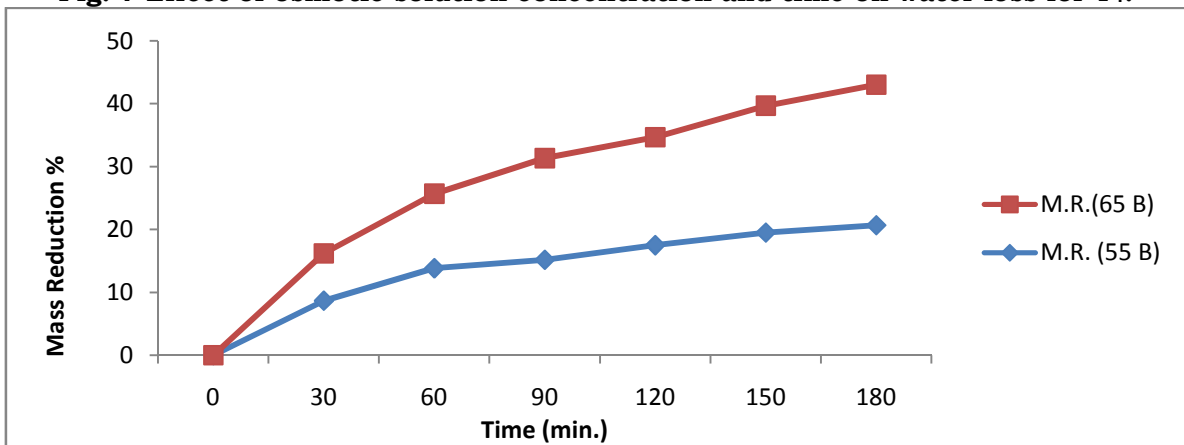
Fig. 5 Effect of osmotic solution concentration and time on Mass Reduction for T<sub>3</sub>.



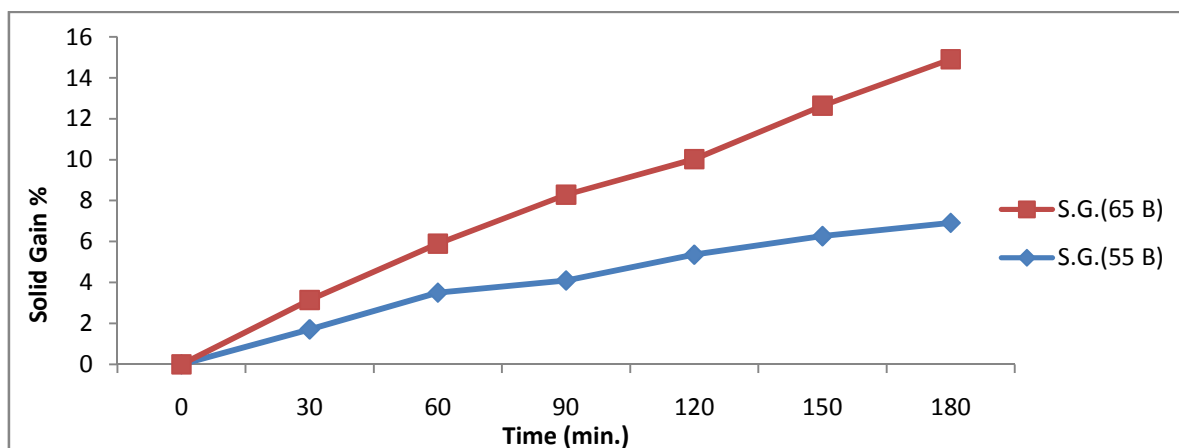
**Fig. 6 Effect of osmotic solution concentration and time on Solid Gain for T<sub>3</sub>.**



**Fig. 7 Effect of osmotic solution concentration and time on water loss for T<sub>4</sub>.**



**Fig. 8 Effect of osmotic solution concentration and time on Mass Reduction for T<sub>4</sub>.**



**Fig. 9 Effect of osmotic solution concentration and time on Solid Gain for T<sub>4</sub>.**

### SUMMARY AND CONCLUSION

Papaya was treated at different brix of sugar solution at 55°Brix and 65°Brix. During the osmotic dehydration process dependent variables were carried out such as Water loss, Solid gain and Mass reduction. In this study, it can be concluded that the slices which are treated with 65°Brix sugar solution at 55°C temperature show the maximum dependent variables.

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