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Influence of Storage Condition and Time on Total Soluble Solids and Total Acidity of Noni Fruit Exudate

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ABSTRACT

Noni *(Morinda citrifolia)* fruit contains high water content (90 per cent) and its dry matter mostly comprises of soluble solids, dietary fibres and proteins. Drip extraction method was used to make the noni fruit exudate which involves natural fermentation process. During storage, fermented noni fruit exudate has change in total soluble solids (TSS) (g) and total acidity (g/l), that helps to enhance the flavour and taste of the noni fruit exudate. In this study, the influence of storage condition (refrigeration and room temperature) and storing time (3 months) on total soluble solids and total acidity of noni fruit exudate was studied. TSS was high initially and reduced in the first month and saturated over the next following months of storage in both storage condition, whereas total acidity was found increasing at every month in both the storage conditions and shown significant difference in room temperature.

Keywords: Noni fruit exudate, TSS, Total acidity, Refrigeration, Room temperature

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INTRODUCTION

Noni (*Morinda citrifolia)* have a broad range of therapeutic effects such as antimicrobial, analgesic, anti- inflammatory, anti-cancer, antihelmintic, hypotensive and hypolipidemic activity. It was found that fermentation process increases the phytochemical content and consequently, improved the health (Konsue *et al.,* 2018). A vital volatile compound, 3-methyl-2/3-butenyl ester was recognized in the ripened and fermented noni juice, that has promising antioxidant and antitumor activity (Vilas *et al.,* 2015). Nayak *et al.* (2011) found that fermented noni juice can lower blood sugar level and regulate liver functions. Similarly, Lin *et al.* (2013) reported that fermented noni juice can regulate the activity of antioxidant-related enzymes in the body in addition to regulating the release of inflammatory factors. Fermentation of noni fruit juice takes place by its intrinsic enzymes and natural mutualistic microorganisms (Yang *et al.,* 2007). Considering physical characteristics, the color of fresh noni juice was brighter than fermented noni juice which turns to dark brown after fermentation that could be due to enzymatic browning. Fermentation also led to decreasing of pH as well as increasing of acidity (Nelson, 2012). TSS and Total acidity are key characteristics that determines the taste, texture and feel of fruit segments. Hence in this study, noni fruit exudate stored in different storage condition was studied to determine the effect storage condition on TSS and total acidity of the noni fruit exudate.

MATERIALS AND METHODS

Initially, the exudate was slowly drip extract or seep from the fruit in a closed receptacle/container over 2-8 weeks, during which the exudate ferments as bacteria alters the sugars into acetic acid and different chemical compounds, adding astringency and a slight sensation of sourness. The slower the fermentation process, the more sugars are transformed into increasingly complex chemical responses, causing the beverage to sour further. In retail production, the juice is squeezed from the fruit and then pasteurized and either retained in holding tanks for fermentation or refrigerated before the sale. The fermentation process tends to unwind the harsh flavour of noni juice, making it more palatable to consumers but correspondingly bringing up an unpleasant sourness and a small concentration of ethanol (Nelson and Elevitch, 2006).

In this study, the collected noni fruits were washed, cleaned and the surface of the fruit was dried with absorbent tissue paper and bottled in a fruit collection container for 8 weeks or more time. The pictures are shown in plate: 2. Drip extraction took place and the extracted exudate was purified by filtering. The clear noni fruit exudate was bottled into two PET containers and stored in the refrigerator (NJ_1) at 4^0C and room temperature (25^0 C ± 2^0 C) (NJ_2). The total soluble solids and total acidity of the noni fruit exudate was studied at an equal interval of one month for three months.

Estimation of Total soluble solids

3ml of the sample filtered using whatman no: 1 filter paper and was taken in a cleaned and dried crucible. The residue was dried in an oven and the difference in weight was measured.

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Estimation of Total acidity

Principle: Acidity in the sample was measured by titrating a given sample against a standard alkali solution of known concentration using phenolphthalein as an indicator to a light pink colour. However, for highly coloured products accurate determination of end point may be difficult by using indicator, thus for such samples, acidity is measured by titrating the sample against a standard alkali to a pH 8.1 using pH meter or the sample is further diluted to almost colourless. The acidity was expressed in terms of predominant acid present in the product using standard expression.

Procedure

10 mL of sample was taken into a beaker and 5 drops of phenolphthalein was added to it. The contents were titrated against 0.1 N NaOH. The colour change was noted.

Calculations

The total acidic content of the sample was calculated using the formula:

$TA\ (g/L\ H2T) = V_{NaOH} \times N_{NaOH} \times (0.150/2) \times 1000/10$ .....Eq 1

$TA\ (g/L\ H2T) = V_{NaOH} \times 0.75$

(mL of alkali – V_{NaOH} used, N_{NaOH} - 0.1 and Vol. of sample = 10ml)

RESULTS AND DISCUSSION

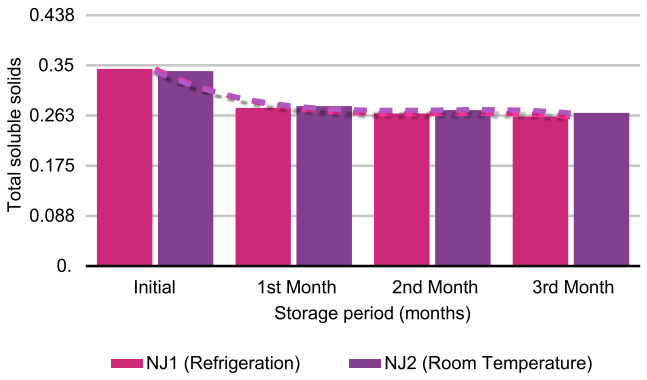
The study was conducted to observe the influence of storage condition (refrigeration and room temperature) and storing time (3 months) at regular intervals on total soluble solids and total acidity of noni fruit exudate.

Table 1: Total Soluble Solids of noni fruit exudate during storage in different storage temperature

Sl. No	Duration of Storage	Total soluble solids (g)	
		NJ_1	NJ_2
1	Initial	0.344	0.340
2	After 1 Month	0.276	0.279
3	After 2 Month	0.266	0.272
4	After 3 Month	0.261	0.267

NJ_1 - Noni exudate at refrigeration Temperature (40 C)
NJ_2 - Room temperature (250 C ± 20 C)

Fig 1: TSS of noni fruit exudate during storage at different storage condition



Total soluble solids (TSS) were initially 0.34g and reduced in the first month and saturated over the next following two months of storage at both storage temperatures. The decrease in TSS may be due to comparatively high pH which was conducive for the growth of microorganism (Afreen *et al.*, 2019). There was no significant difference at 5 % level between the two storage temperatures. It is concluded that the storage temperature doesn't influence the TSS of noni fruit exudate. The change in TSS of two storage temperature during storage is given in the fig. 1.

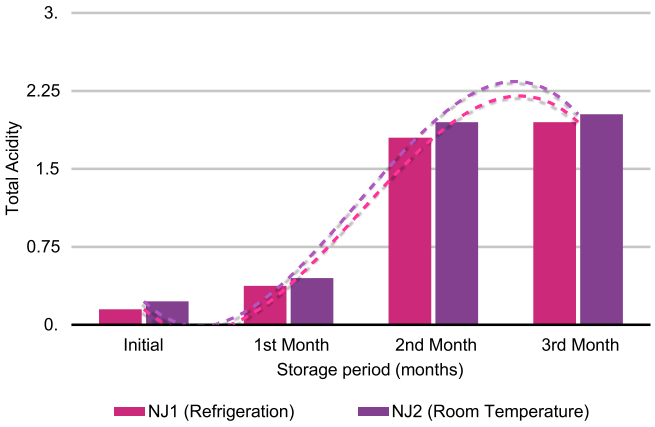
Total acidity of the noni fruit exudate during storage at different storage temperature was increasing every month. At first month (NJ_1 - 0.375 g/L, NJ_2 - 0.450 g/L) of storage the increase in total acidity was relatively low when compared to second (NJ_1 - 1.8 g/L, NJ_2 - 1.95 g/L) and third (NJ_1 - 1.95 g/L, NJ_2 - 2.025 g/L) month of storage which is shown in the Fig. 2.

Table 2: Total Acidity of noni fruit exudate during storage in different storage temperature

Sl. No	Duration of Storage	Total soluble solids (g)	
		NJ_1	NJ_2
1	Initial	0.150	0.225_a
2	After 1 Month	0.375	0.450_a
3	After 2 Month	1.800	1.950_a
4	After 3 Month	1.950	2.025_a

NJ_1 - Noni exudate at refrigeration Temperature (40 C)
NJ_2 - Room temperature (250 C ± 20 C)

Fig 2: Total acidity of noni fruit exudate during storage at different storage condition



Storage temperature significantly ($p \leq 0.05$) influenced total acidity. Noni exudate stored in room temperature has shown higher total acidity than the noni fruit exudate in refrigeration temperature. When the temperature increases within a solution, molecular vibrations rise, which results in ionization and the formation of hydrogen ions (H+) resulting in increase in acidity. The flavour of fruits depends on the interaction of sugars, organic acids, phenolics, tannins and aroma volatiles (Prasanna *et al.*, 2007; Emongor, 2010). In general, the concentration of acids decline during ripening, but the total number of acids increase (Paliyath and Murr, 2008; Seymour *et al.*, 2013; Emongor, 2015). During storage the increase in

total acidity might be due to oxidation of sugar molecules into organic acid which increased the titratable acidity (Adiyaman *et al.,* 2019).

CONCLUSION

In this study, the influence of storage temperatures (refrigeration and room temperature) and storing time (3 months) on total soluble solids and total acidity of noni fruit exudate has shown that TSS was high initially and reduced in the first month and saturated over the next following months of storage in both storage condition, hence it is concluded that storage condition doesn't impact the TSS content in noni fruit exudate, whereas in total acidity, it was increasing at every month in both the storage temperatures and shown significant difference at room temperature.

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