

Evaluation of quality assessment during storage of ready-to-serve (RTS) blended from papaya, ginger and honey

Abstract

The present investigation was carried out at P.G. Laboratory of Department of Horticulture, School of Agriculture, ITM University, Gwalior (M.P.) during the year 2021. The blended beverages of fruits, medicinal plants and spices are rich source of nutrients, medicinal properties and flavours to meet the consumers demand in National and International markets. 10 % of blend comprising 80 % papaya pulp, 10 % ginger juice and 10 % honey (T₆) was found best on 9- point hedonic scale by semi-trained judges including males and females for the preparation of RTS with 13% TSS, 0.20% acidity and 70 ppm SO₂ than other blend combinations. Result revealed that the TSS, acidity, reducing sugars and total sugars increased whereas, pH, vitamin-A, vitamin-C, non-reducing sugar and organoleptic score decreased continuously up to the end of the storage period under ambient temperature (23.1-28.7⁰C). Moreover, it had been observed that RTS beverage could be stored for 4 months with acceptable sensory quality into polypet bottles.

Keywords: Papaya, Ginger, Honey, RTS, Polypet bottles, Organoleptic quality, Storage.

Introduction

Blending is one of the best method to improve nutritional quality of a juice. It can improve the vitamin and mineral contents depending upon the kind and quality of fruits and vegetables used (Carvalho *et al.* 2007). Ready-to-serve (RTS) beverages have been increasingly gaining popularity throughout the country due to their health and nutritional benefits apart from providing pleasing flavor and taste. Fruit based RTS beverages and juices are not only rich in essential minerals, vitamins and other nutritive factors but also have a delicious and have a universal appeal (Manan *et al.* 1992). The incorporation of sensory, nutritional and medicinal properties of two or more plant species into beverage is possible by blending technology of beverage processing.

Papaya (*Carica papaya* Linn.) is belongs to the family of Caricaceae is commonly known as papaya in English, Papita in Hindi and Erandakarkati in Sanskrit. The plant is native to Tropical America and was introduced to India during 16th century. The plant is recognised by its weak and usually unbranched soft stem yielding copious white latex and crowded by a terminal cluster of large and long stalked leaves, is rapidly growing and can grow up to 20 m tall. Traditionally leaves have been used for treatment of a wide range of ailments, like in treatment of malaria, dengue, jaundice, immunomodulatory and antiviral activity. Both leaf and fruit of the papaya possess carotenoids namely β - carotene, lycopene, anthraquinones glycoside, as compared to matured leaves and hence possess medicinal properties like anti-inflammatory hypoglycaemic, anti-fertility, abortifacient, hepatoprotective, wound healing, recently its antihypertensive and antitumor activities have also been established. Leaves being an important part of several traditional formulations are undertaken for standardization for various parameters like moisture content, extractive values, ash values, swelling index, etc (Yogiraj *et al.* 2014). Now-a-days papaya is widely

used in processing industry due to having low shelf life e.i. candy, sweet and other processed products.

Honey, a natural biological product evolved from nectar and of great benefit to human beings both as medicine and food, is consumed in every country of the world in some form. Honey contains glucose, fructose, and water, in addition to small quantities of proteins, minerals, organic acids, and vitamins. It is liked for its characteristic flavor, sweetness, and texture.

Ginger scientifically known as *Zingiber officinale* Rosc. belongs to the family of Zingiberaceae. Ginger is contraindicated in people suffering from gallstones as the herb promotes the release of bile from the gallbladder. Ginger may also decrease joint pain from arthritis, though studies on comparison of vitamin C content in common fruits this have been inconsistent, and may have blood thinning and cholesterol lowering properties that may make it useful for treating heart disease (Sasi Kumar *et al.* 2013). It is widely used for preparation of various type of beverages.

Material and method

2.1 Raw Materials

Papaya (Local variety), ginger (Local variety) and honey purchased from local market near ITM University were used for the RTS preparation.

2.2 Extraction of Papaya, Honey and Ginger Juice

The process adopted for the extraction of papaya pulp and ginger juice is given in Fig. 1 and Fig. 2, respectively.

Fig.-1: Flow chart for extraction of pulp from papaya fruits

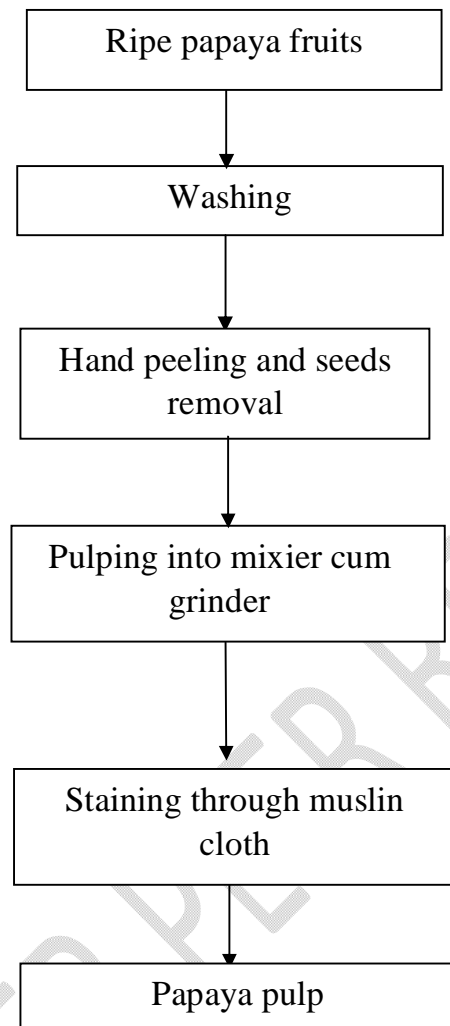
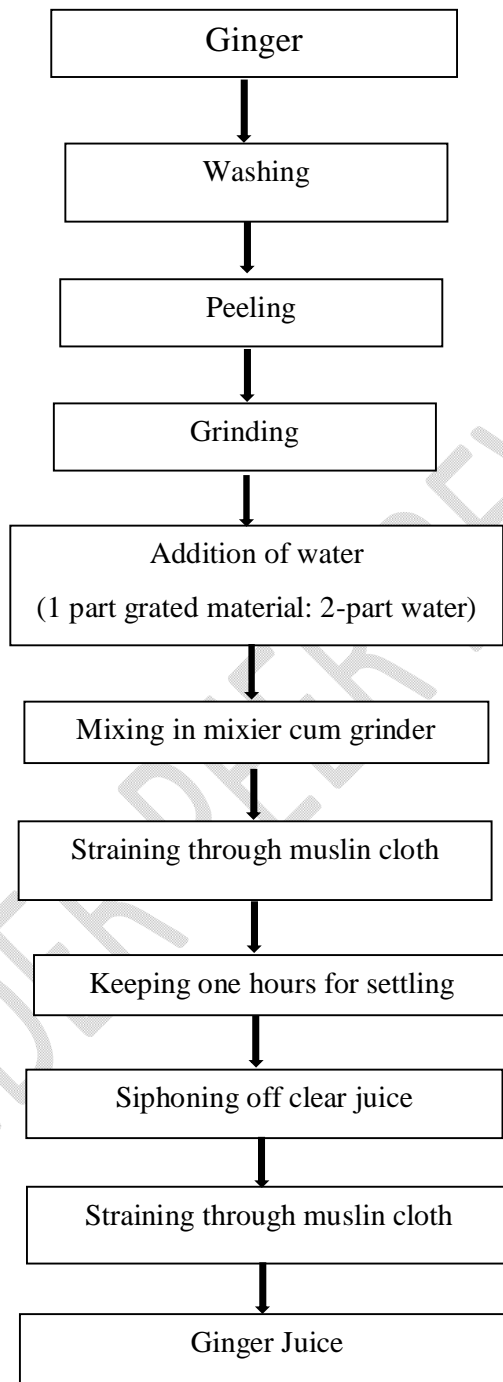


Fig.-2: Flow chart for extraction of ginger juice



2.3 Standardization of blends for RTS

The following combinations of papaya pulp, ginger juice and honey were evaluated to standardize the blend for the development of palatable and quality RTS.

T1 10 % blend comprising 100 % papaya pulp + 0 % ginger juice + 0 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

T2 10 % blend comprising 0 % papaya pulp + 100 % ginger juice + 0 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

T3 10 % blend comprising 0 % papaya pulp + 0 % ginger juice + 100 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

T4 10 % blend comprising 33.33 % papaya pulp + 33.33 % ginger juice + 33.33 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

T5 10 % blend comprising 70 % papaya pulp + 15 % ginger juice + 15 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

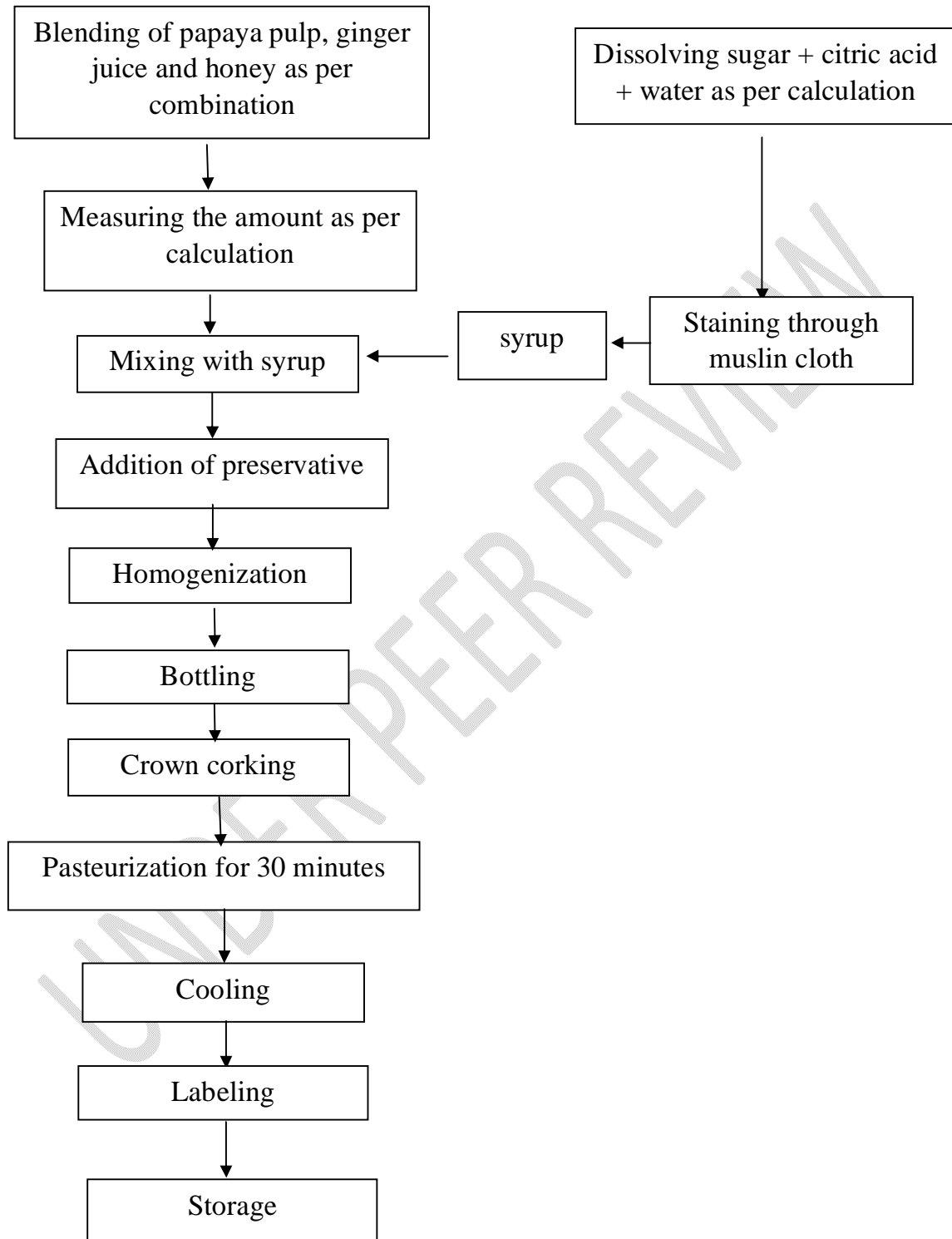
T6 10 % blend comprising 80 % papaya pulp + 10 % ginger juice + 10 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

T7 10 % blend comprising 90 % papaya pulp + 5 % ginger juice + 5 % honey and adjusted to 13 % TSS, 0.20 % acidity and 70 ppm SO₂.

2.4 Preparation of RTS

RTS comprising 10% blend, 13% TSS and 0.20% acidity were prepared from different treatments. The prepared RTS was organoleptically evaluated on 9-point hedonic scale to find out the best combination of blend for large scale preparation. The technique used for RTS making is shown in Fig. 3.

Fig.-3: Flow sheet for preparation of papaya + ginger + honey blended RTS.



2.5 Storage Studies

About 5 litres of RTS was prepared with best combination of blend and filled into polypet bottles of 200 ml capacity leaving 1.6 cm head space, capped and put for storage studies under ambient condition (23.1- 28.7⁰C). During storage observation on changes in TSS, acidity, pH, vitamin-A, vitamin-C, reducing sugars, non-reducing sugar, total sugars and organoleptic quality were recorded at monthly interval. Observations were recorded for changes in TSS, pH, acidity and vitamin-C , vitamin-A , sugars and organoleptic quality at monthly intervals. These observations are detailed below.

The TSS of the sample of determined by using hand refractometer (Model: ERMA INC. TOKYO JAPAN) having the range of 0-32%. The values of TSS recorded at ambient temperature were corrected at 20°C with the help of reference table and the mean value was expressed as per cent. TSS content of the sample (**Ranganna, 2010**) whereas the acidity was determined by titrating known quantity of sample against 0.1 N sodium hydroxide solution using phenolphthalein indicator and expressed in per cent anhydrous citric acid. pH is determined by a digital pH meter using buffer solutions (4, 7 and 9.2) while, vitamin-C content was estimated by preparing sample in 3 % metaphosphoric acid solution and titrating against 2, 6 dichlorophenol indophenols dye solution till the appearance of light pink colour. The reducing, non-reducing and total sugars were analysed by using fehling's solution A and B and methylene blue used as an indicator. A panel of 9 semi trained judges including males and females evaluated RTS for its colour, flavour, taste, appearance and overall acceptability on 9-point hedonic scale.

2.6 Statistical Analysis

The experiments were conducted in 3 replications and the statistical analysis of the data was done by computer software "SPSS" on excel as the method described by **Panse and Sukhatme, 1985** for CRD experiment.

3. RESULTS AND DISCUSSION

3.1 Chemical Attributes of Papaya pulp, ginger juice and honey

The data pertaining to chemical attributes of fresh papaya pulp, ginger juice and honey is presented in **Table 1** which revealed that the papaya pulp used in RTS making contained 10.00 % TSS, 0.13 % acidity, 5.53 pH, 60.85 mg/100g vitamin-C, 4.91 % reducing sugars, 4.25 % non-reducing sugar and 9.16 % total sugars. Similarly, **Kumari et al. (2020)** showed 14.50% TSS, 0.18% acidity, 4.52% reducing sugar, 6.10% non-reducing sugar, 10.62% total sugars in papaya. Ginger juice contained 2.13 % TSS, 0.22 % acidity, 6.5 pH, 1.9 mg/100g vitamin-C, 0.61 % reducing sugars, 1.14 % non-reducing sugar and 1.75 % total sugars. Similarly, **Hedge et al. (2018)** reported 1.50 % TSS, 0.24 % acidity, 5.20 % pH, 2.70 mg/100g vitamin-C, 0.64 % reducing sugars and 1.60 % total sugars in ginger. Honey contained 80.00 % TSS, 0.70 % acidity, 4.23 pH , 0.5 mg/100g vitamin-C, 46.77 % reducing sugars, 32.23 % non-reducing sugar and 79.00 % total sugars. The subtle difference in chemical attributes of raw materials might be due to variety, season and lab facilities.

3.2 Standardization of blends for RTS

A quality blended RTS with 10 % blend comprising 80 % papaya pulp, 10 % ginger juice and 10 % honey with 13 % TSS and 0.20 % acidity and 70 ppm SO₂ was organoleptically found best for preparation of blend RTS (**Table 2**). Similarly, **Sindumathi et al. (2017)** reported that 10% of blended juices incorporated 50% papaya juice + 50% mango juice with 15% TSS and 0.3% acidity was reached the highest sensory scores for overall acceptability. which indicates that component of raw materials influenced the acceptability of the blend beverages.

3.3 Biochemical changes during storage

Data pertaining to biochemical changes during storage of RTS into polypet bottles is presented in **Table 3** which indicates that the TSS of RTS increased gradually after 4 months of storage from 13.00 % to 13.79 % . This change might be due to the conversion or hydrolysis of polysaccharides into simple sugars (monosaccharides and oligosaccharides). These results are also in conformity with the findings of **Sawant et al. (2018)** in papaya and aloe vera blended RTS, **Kumari et al. (2020)** in RTS prepared from papaya and aloe vera, **Harendra and Deen (2021)** in mango based RTS and **Deen and Harendra (2022)** in rangpur lime based RTS. The acidity of RTS increased gradually from 0.20 % at initial day to 1.05 % at final day of storage. This might be due to degradation of pectic substances and formation of organic acid have been reported to increase the acidity of fruit products (**Conn and Stumpf, 1976**). Similarly, an increasing trend in acidity during storage was observed by **Bornare and Khan (2015)** in papaya and banana blended RTS, **Hirdyani (2015)** in kinnow-basil-ginger blended RTS, **Hariharan and Mahendran (2016)** in ginger-lime blended RTS, **Sindumathi et al. (2017)** in papaya and mango based RTS and **Harendra and Deen (2021)** in mango based RTS. The pH decreases from 2.76 to 2.17 during 4 months of storage. This might be due to increase in titrable acidity, as acidity and pH are inversely proportional to each other. Similarly finding was observed by **Sindumathi and Premalatha (2015)** in the papaya and pineapple based RTS and **Sawant et al. (2018)** in the papaya and aloe vera based RTS. Vitamin-A content was continuously decreased from the first day (93.87 I.U.) to the end of storage (92.95 I.U.) throughout the storage period. Similar result observed by **Sindumathi and Premalatha (2013); Sindumathi et al. (2017) and Harendra and Deen (2022)**. Vitamin-C content was continuously decreased from the first day (8.35 mg/100ml) to the end of storage (7.77 mg/100ml) throughout the storage period. This decrease in vitamin-C content might be due to the oxidation of ascorbic acid into dehydro-ascorbic acid in the presence of oxygen. Similar observation was also observed by **Kumari et al. (2020) and Deen and Harendra (2022)**. The reducing sugars and total sugars of blended RTS increased and it was increased from 6.00 % to 6.76% and 9.93% to 10.15 %, respectively. This change might be due to the inversion of non-reducing sugar into reducing sugars. This was also shown by **Malav et al. (2014)** in orange based RTS beverages and **Sindumathi et al. (2017)** in papaya and mango based RTS. The non-reducing sugar of blended RTS was decreased during storage and it was decreased from 3.93 % to 3.39 %. This might be due to also inversion of reducing sugars. This finding was supported by **Singh et al. (2018)** in mango and aloe vera blended RTS and **Kumari et al. (2020)** in papaya and aloe Vera blended RTS.

The blended RTS organoleptic score gradually decreased with increasing the storage period at room temperature (23.1-28.7⁰C). RTS continued to be acceptable for four months. The score was significantly decreased from 8.31 to 7.06. This change might be due to the cause of temperature, because temperature plays an important role in biochemical changes that leads to development of off flavour as well as discolouration in the beverages. The reduction in organoleptic quality is also reported in previous studies performed by **Kumari *et al.* (2020)** in papaya and aloe vera blended RTS and **Harendra and Deen (2021)** in mango based RTS beverages.

Table 1. Chemical attributes of papaya pulp, ginger juice and honey

Chemical attributes	Papaya pulp	Ginger juice	Honey
TSS (%)	10	2.13	80.00
Acidity (%)	0.13	0.223	0.70
pH	5.53	6.50	4.23
Vitamin A (I.U.)	950	0.00	0.00
Vitamin C (mg/100g)	60.85	1.90	0.5
Reducing sugars (%)	4.91	0.61	46.77
Non-reducing sugar (%)	4.25	1.14	32.23
Total sugars (%)	9.16	1.75	79.00

Table 2. Organoleptic quality of syrup prepared from different blends of papaya pulp, ginger juice and honey.

Treatments	Different combination of blends			Organoleptic quality	
	Papaya pulp	Ginger juice	Honey	Score	Rating
T1	100	0	0	7.69	Like moderately
T2	0	100	0	7.00	Like moderately
T3	0	0	100	7.50	Like moderately
T4	33.33	33.33	33.33	7.90	Like moderately
T5	60	20	20	8.04	Like very much
T6	80	10	10	8.31	Like very much
T7	90	5	5	8.20	Like very much
SE (m)				0.23	
C.D. at 5%				0.70	

Table 3. Biochemical and organoleptic changes of RTS during storage into polypet bottles

Storage period in months	TSS (%)	Acidity (%)	pH	Vitamin-A (I.U.)	Vitamin-C (mg/100ml.)	Reducing sugars (%)	Non-reducing sugar (%)	Total sugars (%)	Organoleptic	
									Score	Rating
0	13.00	0.20	2.76	93.87	8.35	6.00	3.93	9.93	8.31	LVM
1	13.11	0.33	2.70	93.62	8.22	6.15	3.84	9.99	8.08	LVM
2	13.34	0.51	2.59	93.44	8.08	6.34	3.70	10.04	7.81	LM
3	13.50	0.79	2.40	93.17	7.92	6.57	3.52	10.09	7.44	LM
4	13.79	1.05	2.17	92.95	7.77	6.76	3.39	10.15	7.06	LM
SE (m)	0.01	0.04	0.10	0.03	0.02	0.02	0.04	0.03	0.05	
C.D. at 5%	0.04	0.11	0.32	0.09	0.07	0.06	0.11	0.08	0.17	

LVM: Like very much, LM: Like moderately

Conclusion

It may be concluded from above findings that RTS prepared from 10 % blend pulp comprising 80% papaya pulp, 10% ginger juice and 10% honey containing 13% TSS, 0.20% acidity and 70 ppm SO₂ (T6) was found best during organoleptic evaluation. The TSS, acidity, reducing sugars, total sugars were increased, whereas pH, vitamin-A, vitamin-C, non-reducing and organoleptic quality were decreased during storage into polypet bottles. The RTS can be stored up to 4 months at ambient storage temperature (23.1-28.7⁰C) into polypet bottles with acceptable quality.

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