Proximate Analysis of *Syzygium Samarangense*: A Comparative Study Between Raw Fruit and Candy Form

BY

Md. Mahadi Hassan Raju

ID: 201-34-1077

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Supervised By Ms. Effat Ara Jahan

Assistant Professor

Department of NFE

FACULTY OF ALLIED HEALTH SCIENCE (FAHS) DAFFODIL INTERNATIONAL UNIVERSITY

APPROVAL

This project title " **Proximate Analysis of *Syzygium Samarangense*: A comparative study between raw fruit and candy form**" submitted by Md. Mahadi Hassan Raju to the Department of Nutrition and Food Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirement for the degree of B.Sc. in Nutrition and Food Engineering and approved as to its style and content.

EXAMINING COMMITTEE

Member

Department of NFE

Faculty of Allied Health Science

Daffodil International University

Dr. Nizam Uddin Associate Professor & Head

Department of NFE

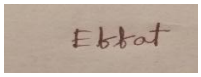
Faculty of Allied Health Science

Daffodil International University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **, Ms. Effat Ara Jahan Assistant Professor, Department of NFE,** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

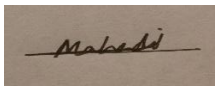


Ms. Effat Ara Jahan
Assistant Professor

Department of NFE

Daffodil International University

Submitted by:



Md. Mahadi Hassan Raju

ID:201-34-1077

Department of NFE

Daffodil International University

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ABSTRACT

The tropical fruit *Syzygium samarangense,* sometimes referred to as the water apple is distinguished by its unique bell-shaped form, crisp texture, and crisp flavor. The water apple is a great source of vital nutrients, such as dietary fiber and carbohydrate. According to the study,moisture content of raw water apple was more(84.39%) than the candy (3.35%) and Brix content was 4° in raw water apple but 37° in candy.The pH level in raw fruit was 5.13 and developed product had the 4.35pH content. It also contained smaller amount of other nutrients like protein,fat,ash,fiber and carbohydrate.The amount of ash (0.196%),fat (0.725%),protein (1.412%) and fiber (0.984%) in raw water apple. The water apple candy had (0.227%) ash,(1.133%) protein,(0.561%) fat and (0.843%) fiber and high amount of carbohydrate is (94.829%),raw water apple as high amount of moisture (84.39%).The big difference found in moisture ,brix and carbobohydrate after the proximate analysis about the fruit and candy.In fruit the moisture ,brix and carbohydrate was (84.39%) , (4°) and (13.277%).The moisture percentage was reduced in candy (84.39%) to (3.35%).The brix and carbohydrate content increased in candy from 4° to 37°(brix) ,carbohydrate turn (13.277%) to (94.829%).In the candy the moisture percentage was lower and brix and carbohydrate was higher than the fruit.

Key Words : Syzygium samarangense,Candy

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CHAPTER 1

Introduction

1.1 Introduction of (*Syzygium samarangense*)water apple candy.

The water apple, or *Syzygium samarangense*, has a long history, especially in Southeast Asia, where it is indigenous. This is a thorough examination of the cultural importance and history of this fruit.It is thought that the Andaman and Nicobar Islands, as well as the Malay Peninsula, are where *Syzygium samarangense* first appeared.The fruit moved from its natural areas to Thailand, Indonesia, and the Philippines, among other parts of Southeast Asia. Around the world, tropical and subtropical climates are also used for its cultivation.The fruit is a hydrating snack because it is high in water content and low in calories. It includes vital mineral and dietary fiber.

Candy is a type of confectionery that is typically manufactured using sugar and additional components such as flavorings, colorings, and occasionally even nuts and other fruits. available in a variety of forms, including chocolates, gummies, chewy sweets, and hard candies. Candy is a common snack or treat consumed by people of all ages worldwide (Hinkova, A., Bubnik, Z., & Kadlec, P. 2015). a fruit-based treat, like a fruit-flavored candy, jam, or preserve. These sweets might be hard candies with fruit centers or covered in sugar, or they can be mushy fruit-flavored candies like gumdrops or gummies. Additional fruit candies consist of either dehydrated or candied fruit and fruit pieces. If it's strawberry or orange or lemon of Coming Flavour they give the best of the fruit flavours that you wouldn't change even with their sweetness tangy of their own kind.There's a diverse range of candy to satiate the palate that ranges from the traditional favourites to more contemporary creations.Large shrubs or small-to-medium-sized trees, Water apple normally grow to a height of 3 to 15 meters (10 to 49 feet), with a propensity for low branching. It has glabrous leaves and twigs, and even though the bark is dark brown, it is generally smooth and without structure or relief. As they grow, the leaves are vivid red, but as they reach full size, they turn a dark, glossy green. The leaves are lanceolate, 2 to 4 centimeters (3⁄4 to 1+5⁄8 inches) broad, 10 to 20 cm (4 to 8 in) long, pointy, and base cuneate with almost no petiole. The compact terminal clusters of white or greenish-white blooms have a diameter of 5–8 cm (2–3+1⁄4 in) due to the long and many stamens. The tree flowers in the summer in temperate climates (Khandaker, M. M., & Boyce, A. N. (2016). The fruit is shaped like some varieties of guava; in fact, it resembles the guava so much that those who are not familiar with it could mistake it for one at first glance. Its scent, flavor, and texture are distinct, nevertheless, and unlike guavas, which have dozens of hard, tiny seeds enclosed in jelly-like tissue. When ripe, water apple often have one or two huge, naked seeds that are about a centimeter in diameter and lie loosely in a little fluffy cavity. A fruit's level of ripeness can be determined by shaking it to hear if the seeds rattle. It has thin, waxy skin. Some people claim that the blossoms smell fragrant, however this seems to be a subjective quality.This candy has numerous health benefit like good for weight loss,good for heart attack,lower lisk of diabetes,some times it prevent cancer.

1.1 Objective of the study:

General objective:

- To compare and evaluate the proximate composition of raw *Syzygium samarangense* fruit and candy.

Specific Objective:

- To determine the chemical composition of *Syzygium samarangense* raw fruit.
- To evaluate the chemical composition of *Syzygium samarangense* candy.
- To compare the proximate composition of raw fruit and candy of *Syzygium samarangense.*

CHAPTER 2

2.1 Literature Review

Water apple, also known as *Syzygium samarangense*, is a tropical fruit-bearing tree belonging to the Myrtaceae family. Native to Southeast Asia, it is cultivated widely in tropical and subtropical regions for its refreshing, juicy fruits. This review summarizes the nutritional content, health benefits of the water apple.

Fruit candies are well-liked confections that are available in a variety of shapes, tastes, and textures. Usually, fruit flavors are infused into sweet bases, frequently using genuine fruit juice, purees, or extracts. Here is a look at the various varieties, their origins, and how they are made. Candy has a lengthy and intriguing history that crosses centuries and cultural boundaries. This is a summary of the historical development of candies. (da Silva, L. B., Queiroz, M. B., Fadini, A. L., da Fonseca, R. C., Germer, S. P., & Efraim, P. 2016). The oldest candies were made with natural sweeteners like honey and fruits in ancient cultures. Honey-coated fruits and nuts were popular among the Greeks, Romans, and Egyptians.The first "candies" are said to have been made by the Egyptians, who preserved fruits and nuts in honey. The Greeks and Romans were among the other ancient cultures to adopt this custom.

Syzygium samarangense is a small to medium-sized tree that can reach heights of up to 12 meters. The tree has evergreen leaves, which are simple, opposite, and elliptic to obovate in shape. The flowers are white to pale green, with numerous stamens giving a feathery appearance. The fruit is bell-shaped, ranging from white to pink to red, and has a crisp, watery flesh. (Banadka, A., Wudali, N. S., Al-Khayri, J. M., & Nagella, P. 2022).

Water apple is a great vitamin supplement that works without the use of pharmaceuticals to thoroughly saturate the body with the essential nutrients and microelements. The high antioxidant content in water apples helps in neutralizing free radicals, thereby reducing oxidative stress and potentially lowering the risk of chronic diseases such as cancer and heart disease. Compounds found in water apples exhibit anti-inflammatory properties, which can help in managing conditions like arthritis and other inflammatory disorders. Due to its high water content and presence of essential electrolytes, water apple is an excellent fruit for hydration and maintaining electrolyte balance, especially in hot climates. The dietary fiber in water apples aids in digestion, helps prevent constipation, and promotes overall gut health. Preliminary studies suggest that water apple extracts may have a role in regulating blood sugar levels, making it a potential complementary food for managing diabetes. (Simirgiotis, M. J., Adachi, S., To, S., Yang, H., Reynertson, K. A., Basile, M. J., ... & Kennelly, E. J. 2008)

The southern and southeast portions of Bangladesh, including the Chittagong and Sylhet regions, are where water apples are mainly grown. The warm, humid weather in these places is ideal for the growth of fruit.The majority of the cultivation is carried out by small-scale farmers employing conventional farming techniques. There aren't any sizable industrial farms devoted just to growing water apples. Water apples are typically harvested during the monsoon season, from June to September. This seasonality affects the availability and price of the fruit in the market. (Mani, A., Alam, M., Mitra, S., & Bauri, K. M. 2020).

Water apples have a high water content, approximately 90%, making them an excellent fruit for hydration. Low in calories, with about 25-30 calories per 100 grams. Contain around 6 grams of carbohydrates per 100 grams, mainly in the form of natural sugars. Provide about 1 gram of dietary fiber per 100 grams, aiding in digestion and promoting gut health.Rich in vitamin C, which is essential for the immune system, skin health, and antioxidant protection.
Contains small amounts of vitamin A, which is important for vision, immune function, and skin health.

Though water apple flourishes in tropical or near-tropical climatic conditions where it is widely distributed, the tree proved hardy enough to be grown and establishes its populations in varied agro-climatic conditions. In natural conditions, *S.samarangense* spread was mainly through from seeds which were dispersed by tidal flood, rain, birds, fruit eating bates, pigs, monkeys, deer and other creatures. But the intercontinental spread of rose apple has been due to introduction by travellers and home gardeners in the tropical and subtropical regions of the world for its edible fruits, as an ornamental, fuel or shade tree and as wind-break. The spread of water apple to the tropical regions including Australia, Florida in Continental USA, Hawaii, Cook Islands, Fiji, French Polynesia, Pitcairn Islands, Galapagos, Seychelles and Chile's Rapa Nui islands; Reunion, Mayotte and Mauritius in the Indian Ocean is mainly through introduction by humans. It grows abundantly in Puerto Rico, the Virgin Islands, Guatemala, Honduras and Panama in wild and formed thick forest and solid stands. Rose apple exists in Ghana, Jamaica, Japan, Mexico, Myanmar, Papua New Guinea, Peru, Samoa, Solomon Islands, Sri Lanka, Bangladesh, Taiwan, Province of China, Thailand, Tonga, Zanzibar. (Nasution, F., & Hadiati, S. , 2019).

Fruit candies remain a beloved treat worldwide, with a rich history and a dynamic market. Advances in production techniques and changing consumer preferences continue to shape the industry. Understanding the balance between indulgence and health, as well as staying attuned to market trends, will be crucial for the future success of fruit candy manufacturers. (Fujiwara, S., Hori, K., Shitara, S., Okawa, J., Kodama, S., Murakami, K., & Ono, T. 2021)

This literature review highlights the multifaceted nature of fruit candies, from their historical roots to contemporary innovations. Continued research and development in this field will likely yield even more diverse and appealing products for consumers to enjoy.

CHAPTER 3

3. Materials and Methods

3.1 Method:

Laboratory for preparation: The study and formulation were carried out in the food processing and food analytical labs located at Daffodil International University's Department of Nutrition and Food Engineering in Ashulia, Savar, Dhaka.
Acquisition of Raw Materials: The components required to make this product were gathered from , super markets, and internet marketplaces an the main thing (*Syzygium samarangense*) collected from university tree.

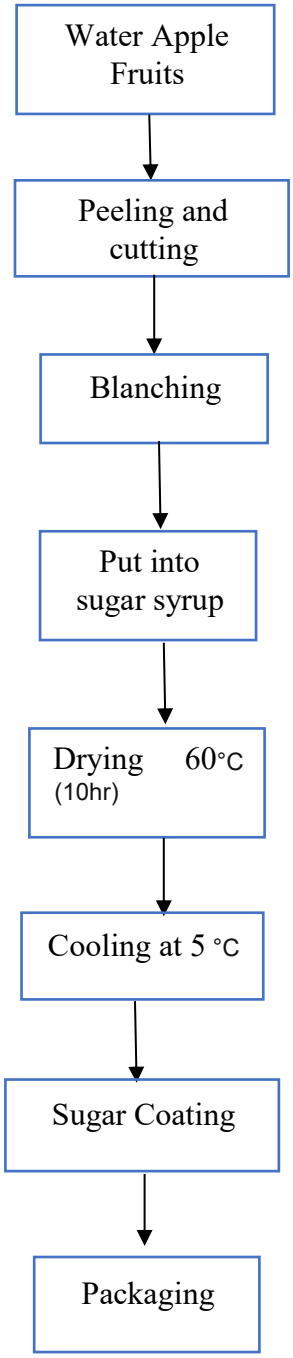
3.2 Materials

- Water apple
- Sugar
- Water
- Salt

Table 1: Ingredients & Amounts

Ingredients	Amounts	Percentage
Water apple	50gm	29%
Water	100ml	50%
Sugar	40gm	20%
Salt	0.5gm	1%

Preparation of (*Syzygium samarangense*) water apple candy



Procedure :

I. First we collect some fresh water apple .
II. Then wash the fruit in cold water and cut into tme same size.
III. Blanching the water apple for 4 to 5 minutes.
IV. After the blanching need to cold the water apple
V. Then put into a sugar syrup for 24hrs
VI. Remove all pf the moisture from water apple skin
VII. Drying the water apple into the dryer at 60 degree celcius for 8 to 10 hrs
VIII. After the drying cooling the candy at 5 °C
IX. Again the candy need coated with grinding sugar.Now its ready to eat and preserve.

3.2.1 Determination of Moisture

• Weigh 2gm of sample on moisture analyzer, power it up and wait for approximately 5 minutes.

• Next, the moisture analyzer shows the results on display (Digital moisture analyzer operational Process).

• Took the hint and examined the % Moisture value.

Figure-2: Moisture Analyzer

The Following Was the Formula:

Moisture content (%) = [Final weight (in gram)/ Raw sample weight (in gram)] x 100.

Final weight = (Crucible + dried sample) - (Crucible + Raw sample)

3.2.2 Determination of ºBrix

- First, take a dropper and take sample into the dropper.
- Then take brix analyzer (refractometer) and wash the refractometer prism by distilled water.
- Place a drop of sample on refractometer prism.
- Take the readings.
- Between samples, rinse the prism with distilled water, and then dry it with a soft, lint-free tissue.

Figure-3: Refractometer (nscbd.com)

3.2.3 Determination of pH

Read more about water apple candy pH measured, turn on the light Grab an aliquot, throw it into a beaker Ensure that both the temperature sensor and pH electrode are dry.collection and PH in Beaker Place the measuring cup with pH meter inside. Read after correcting digits in meters.

Figure 4: PH meter

3.2.4 Determination of Ash content

Apart from food chemistry, the determination of ash content is also an important quantitative analysis for confectionery products (e.g., fruit candies). This gives us a complete fingerprint of the mineral content or is used in regulatory (quality control and nutritional evaluation) applications.

- This sample is dried in order to remove moisture and have accurate results.
- In the case of fruit candies, stirring is done to homogenise the sample.
- Weighed a specific amount of the sample (after preperation).
- The sample is put in a crucible that is then placed in a muffle furnace and heated to high temperature (usually at 500°C-600°C).
- The sample is heated until completely combusted with only inorganic ash remaining.
- The crucible is cooled in a desiccator before the dry-weight bottle, to avoid moisture build-up.
- The crucible with the ash is cooled and weighed.

Calculation : The ash content is calculated as a percentage of the original sample weight using the formula.

$$\text{Ash content}(\%) = (\text{Weight of original sample}/\text{Weight of ash}) \times 100$$

3.2.5 Determination of Fat

In food science, including the confectionery sector, determining the fat content of a product is crucial for maintaining product quality, uniformity, and adherence to nutritional labeling laws. For this, the Soxhlet extraction process is frequently employed.The term "fat content" describes how much lipids are included in a dietary item. Triglycerides, phospholipids, and other compounds soluble in fat are included.

Steps in Soxhlet Extraction Method

- The candy sample is homogenized to ensure uniformity.
- A representative sample size (usually 2-10 grams) is taken.
- The sample is dried to remove moisture, which can interfere with the extraction process.
- This is often done in an oven at 100-105°C for a specified time.
- The dried sample is weighed accurately and placed in a porous extraction thimble.
- The thimble containing the sample is placed in the extraction chamber of the Soxhlet apparatus.
- The extraction chamber is connected to a flask containing the solvent and a condenser.
- The solvent is heated, evaporates, and condenses in the condenser, dripping into the extraction chamber.
- The solvent extracts the fat from the sample as it siphons back into the boiling flask.
- This process is repeated for several cycles (typically 4-8 hours) until the fat is completely extracted.
- The flask containing the fat residue is cooled in a desiccator and then weighed.
- The weight of the fat is calculated by subtracting the initial weight of the empty flask from the final weight.

Calculation : The fat content is expressed as a percentage of the original sample weight using the formula

$$\text{Fat content}(\%) = (\text{Weight of original sample}/\text{Weight of extracted fat}) \times 100$$

The Soxhlet extraction method is a dependable and precise way to find out how much fat is in candies. Manufacturers can guarantee the nutritional value and quality of their confectionery items by adhering to the correct procedures and keeping accuracy.

Determination of Protein Test

Determining the protein composition of food, including confectionery goods, is an essential analytical task in food science. The most widely used method for determining the amount of protein in food is the Kjeldhal method.The term "protein content" describes the total amount of amino acids, peptides, and proteins that are present in a food product.
A popular approach for figuring out the total nitrogen concentration is the Kjeldahl method, which may be used to estimate the protein amount.

Sample Preparation:

- Weigh accurately 0.5 to 2 grams of the sample (depending on the nitrogen content).

Digestion:

- Place the sample in a Kjeldahl flask.
- Add 10-20 mL of concentrated sulfuric acid.
- Add a catalyst mixture (usually 1 g of a mixture of potassium sulfate and copper sulfate, or other catalyst).
- Heat the flask gently until frothing ceases, then increase the heat and boil until the solution becomes clear (this typically takes 1-2 hours).

Neutralization:

- Allow the digestion mixture to cool.
- Carefully add distilled water to the flask to dilute the acid solution.
- Add 40% sodium hydroxide solution (equal to the volume of sulfuric acid used) to the flask to make the solution strongly alkaline.

Distillation:

- Connect the Kjeldahl flask to the distillation apparatus.
- Distill the ammonia liberated by the alkaline reaction into a receiver containing a known volume of boric acid solution (with indicator).

Titration:

- Titrate the boric acid solution containing the absorbed ammonia with the standard acid solution (HCl or H_2SO_4) until the endpoint is reached (color change of the indicator).
- Record the volume of acid used.

Calculation : Nitrogen Content(%)=W/(Vb −Va)×N×1.4007

· Vb = volume of base used in titration (mL)

· VaV_aVa = volume of acid used to capture ammonia (mL)

· NNN = normality of the acid/base

· WWW = weight of the sample (g)

· 1.40071 = factor converting milliequivalents of nitrogen to grams of nitrogen

Protein Content

To convert nitrogen content to protein content, use a conversion factor based on the specific protein being analyzed. For most proteins, the general conversion factor is 6.25 (since protein is approximately 16% nitrogen by weight).

$$\text{Protein Content}(\%) = \text{Nitrogen Content}(\%) \times 6.25$$

Determination of FiberTest

The determination of dietary fiber in food samples is crucial for nutritional labeling and health research. The most commonly used methods for fiber analysis are:

Procedure for Total Dietary Fiber (AOAC 985.29)

Heat the sample at 95-100°C with heat-stable α-amylase to gelatinize and hydrolyze the starch.

~ Cool the mixture to 60°C, and add protease for digest proteins. •

• Lower the pH to 4.5 and add amyloglucosidase, then let it hydrolyze any remaining starch

• Adjust pH to 7.5 and precipitate the fibre using ethanol Leave the mixture to allow full precipitation.

• Collect the precipitate through filtration using a crucible containing a filter paper or conjoined with fritted glass filters.

• Residue washes with 78 % ethanol and then acetone are conducted to remove sugars, proteins, and other non-fiber materials.

• Making constant the dry weight in an oven at 105°C.

• Simple determination of the fiber fraction; weigh dried residue.

• Correct the ash content: Burn in a muffle furnace at 525°C dried residue.

• Ash weight is subtracted from the general residue wieght for estimation of amount of fiber

Calculation

$$\text{Total Dietary Fiber}(\%) = (\text{Weight of dried residue} - \text{Weight of ash})/\text{Weight of sample} \times 100$$

Determination of Carbohydrate

Carbohydrates are body's main source of energy. They are present in various types of food and have different structures.

The conventional method for determination of carbohydrates in foods is by subtraction - that the measured moisture, ash, protein (estimated from total nitrogen), and fat are added together and then subtracted from the total weight.

Calculations :

Total carbohydrate % = 100-(Protein%+Fat%+Ash%+Moisture%)

CHAPTER 4

4. Results and Discussion

4.1

Table 2 : Proximate analysis of *Syzygium samarangense* raw fruit

Sample Name	Parameter	Nutrient content %
Syzygium Samarangense	**Moisture**	84.39%
	Brix	4 ◦
	pH	5.23
	Ash	0.196%
	Protein	1.412%
	Fat	0.725%
	Fiber	0.984%
	Carbohydrate	13.277%

Table 2 shown that the nutrient percentage about *Syzygium samarangense* raw fruit. Here we see the high amount of moisture content(84.39%) and 4° brix ,5.23pH ,0.196%ash, 1.412% protein,0.725% fat,0.984% fiber and 13.277% carbohydrate found in the raw water apple**.**

4.2

Table 3 : Proximate analysis of *Syzygium samarangense* candy

Sample Name	Parameter	Nutrient content %
Syzygium Samarangense Candy	**Moisture**	3.25%
	Brix	37 ◦
	pH	4.35
	Ash	0.227%
	Protein	0.561%
	Fat	0.561%
	Fiber	0.843%
	Carbohydrate	94.829%

The proximate analysis *Syzygium samarangense* candy sample shown the presence of moisture (3.25%),Brix (37°),pH (4.35),Ash (0.227%),Protein (0.561%),Fat (0.561%),Fiber (0.843%) and the high amount of carbohydrate (94.829%).

Discussion : The comparison between water apple *(Syzygium samarangense)* and water apple candy.Table 2 (*Syzygium Samarangense*) water apple fruit higest level of moisture content 84.39% and the low amount of carbohydrate 13.277%. On the other table,Table 3 *Syzygium Samarangense* fruits candy has minimum amount of moisture 3.25% and the carbohydrate was very high amount 94.829%. After developed the product the study found this the amount of protein,fat,ash and fiber was in the developed product.In raw fruit we got 1.412% protein, 0.725% fat and 0.984% fiber.On the other table developed candy 1.33% protein, 0.561% fat and 0.843% fiber.In raw fruit and candy we found the big difference in moisture ,brix and carbohydrate percentage.The amount was 84.39% moisture , 4° brix and 13.277% carbohydrate in raw fruit.After developed the product the moisture content reduced 84.39% to 3.25% ,brix increased 4° to 37° and the carbohydrate also increased to 13.277% to 94.829%.(Lim, A. S. L., & Rabeta, M. S. 2013).

CHAPTER 5

5. Conclusion

The investigation examined the physical properties and the approximate content. The raw fruit moisture level of 84.39% and an ash content of 0.196% according to the proximate analysis.Fruit candy moisture level 3.25% and ash content is 0.227%.We see the higest amount of carbohydrate in candy was 94.829% respectively raw fruit carbohydrate was 13.277% It was the major big change in nutrient content. Additionally, it provided 5.23 pH of raw fruit and 4.35pH in fruit candy. The raw fruit's content was 84.39% moisture, 4° brix, and 13.277% carbohydrates.The developed products water content decreased from 84.39% to 3.25%, its brix increased from 4° to 37°, and its carbohydrate content also increased from 13.277% to 94.829%.

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