2025年臺灣國際科學展覽會
優勝作品專輯

作品編號　080018

參展科別　生物化學

作品名稱　Tlaolli Onilli

得獎獎項　四等獎

就讀學校　Highschool UPAEP Huamantla

指導教師　Monica Rivera Diaz
Juana Mexicano Ortega

作者姓名　Sofia Elena Flores Rivera
Arantza Ximena Aguilar Mexicano

關鍵詞　nutraceutical, purple corn, pineapple, hibiscus

作者照片

Taiwán International Science Fair 2025

Tlaolli Onili

Arantza Ximena Aguilar Mexicano, Sofía Elena Flores Rivera

Biochemistry
High School
Upaep Huamantla
Tlaxcala

Taiwán, January 18th to 25th of 2025

Flores, S., Aguilar, A.

Summary

Mexican society is characterized by high levels of obesity and diabetes, the main cause is the diet that these people follow, in which soda appears as part of everyday life. For this reason, in the present project a nutritious drink was made from pineapple, hibiscus and purple corn, ingredients that provide vitamins and antioxidants, which have a positive effect on people with chronic degenerative diseases. Through an experimental methodology, it was possible to elaborate a beverage with these characteristics, which also has a pleasant flavor, aroma and texture, making it a viable option for consumption by people with or without chronic degenerative diseases.

Keywords: nutraceutical, purple corn, pineapple, hibiscus

LIST OF ACRONYMS

INSP – Instituto Nacional de Salud Pública

OMS – Organización Mundial de la Salud

PROFECO – Procuraduría Federal del Consumidor

UNAM – Universidad Nacional Autónoma de México

INDEX

1. Introduction

Most people in the country tend to consume soda as part of their daily lives, without thinking about the health consequences that this entails.

And the fact is that Mexico is considered the main consumer of soda in the world (Universidad Nacional Autónoma de México [UNAM], 2019), and not only that, it also tops the lists of obesity and diabetes (Procuraduría Federal del Consumidor [PROFECO], 2018).

A bad diet is one of the main causes of these medical conditions, so it is necessary to rethink the foods of daily consumption. In this project, the development of a carbonated beverage with three main ingredients: purple corn, hibiscus, and pineapple, which contain diverse nutritional properties in addition to having significant amounts of antioxidants (Secretaría de Cultura, 2020;

Sumaya et al., 2014; Kongsuwan et al., 2009), is established as an objective. In addition, antioxidants act as regulators of cellular aging and prevent chronic diseases (Vilaplana, 2007).

For this reason, the elaboration of a beverage with these characteristics is considered harmless and a good option for people with a chronic disease or who are prone to it, as well as a healthy alternative to the consumption of soft drinks.

In this project, an experimental methodology was followed to prepare the nutritional beverage, which had nutritional properties, such as vitamin and antioxidant content, in addition to having a pleasant taste and texture.

1.1 Justification

Mexico is one of the main consumers of soft drinks (UNAM, 2019), which contain high levels of sugar, artificial sweeteners, and preservatives that harm the health of consumers. In addition, Mexico has very high rates of overweight, diabetes, and diseases such as hypertension, making soft drinks a poor hydration option (National Institute of Public Health [INSP], 2013).

Therefore, this research project proposes the development of a carbonated beverage made from corn, pineapple, and hibiscus, sweetened

with natural agave syrup. These ingredients are nutritionally rich and provide an excellent option as a healthy beverage without negative health effects, particularly for people at high risk for chronic-degenerative diseases. Ingredients like purple corn and hibiscus, rich in antioxidants, are a natural source of oxidative stress inhibitors in the body, offering potential prevention against chronic diseases such as hypertension, diabetes, and even cancer (Aguilera et al., 2011).

1.2 Problem Statement

One of the main health issues in Mexico is the high percentage of people who are overweight or obese, with estimates indicating that over 75% of adults are affected by one of these conditions (PROFECO, 2018). This health condition, combined with a poor diet where soft drink consumption is prominent, leads to various degenerative diseases, such as diabetes (PROFECO, 2023). In this regard, Mexico ranked second in Latin America for diabetes cases in 2019, with more than 12.8 million people affected by the disease, which is also the third leading cause of mortality in the country (National Autonomous University of Mexico [UNAM], 2022).

Soft drink consumption figures in Mexico are concerning, as UNAM (2019) reports that Mexico ranks first globally in soft drink consumption.

Thus, developing a beverage with health benefits, such as antioxidant value, provides a positive nutritional option for frequent soft drink consumers and the general public.

1.3 Hypothesis

The hypothesis is that it is possible to develop a carbonated beverage that is nutritious and has a high antioxidant value, without harmful sugars, using natural ingredients such as purple corn, hibiscus calyxes, and pineapple.

1.4 Objectives

1.4.1 General Objective

To develop a carbonated beverage based on purple corn, hibiscus, and pineapple.

1.4.2 Specific Objectives

- Create a beverage that incorporates purple corn hulls, pineapple juice, hibiscus extract, and agave syrup as a sweetener.

- Carbonate, package, and refrigerate the beverage.

2. Theoretical Framework

2.1 Antioxidants

"Antioxidants are chemical compounds that interact with free radicals and neutralize them, preventing them from causing harm" (National Cancer Institute, 2023, para. 4). Free radicals, in turn, are responsible for cell deterioration and are linked to various diseases, including cardiovascular and degenerative diseases, and even cancer (Vilaplana, 2007).

Among antioxidants are flavonoids, a group of compounds characterized by high antioxidant levels (Vilaplana, 2007). This group includes flavones and anthocyanins (Vilaplana, 2007).

2.1.1 Anthocyanins

Anthocyanins are responsible for providing color to plants, with a spectrum ranging from red to blue. They are found in berries and flowers such as hibiscus. The color varies depending on increases in hydroxylation or methoxylation, with the former resulting in blue hues and the latter in red tones (Cartaya & Reynaldo, 2001). These red tones are characteristic of blue and purple corn.

Concerns about the toxicity levels of certain artificial colorants, such as Red 40, have led the agriculture, cosmetics, and pharmaceutical industries to seek natural alternatives. The food industry, for instance, uses anthocyanins to add vibrant colors to foods (Garzón, 2008). In addition to their aesthetic appeal, anthocyanins are beneficial to health, as various studies have shown that their properties improve visual clarity and help combat chronic degenerative diseases like diabetes due to their antidiabetic qualities (Aguilera et al., 2011).

2.2 Purple Corn

Most corn varieties are typically starchy. The endosperm, or the grain's outer layer, is soft-textured. The blue-purple color is found in a cell layer called the aleurone, where a higher concentration of anthocyanin pigments makes the grains appear black (Betrán et al., 2001).

Below is a table with the main characteristics of purple corn.

Table 1. Characteristics of Purple Corn

Characteristics of purple corn

Kingdom	Plantae
Class	Angiosperm
Family	Grasses
Fiber	It is found in the pencarp and cell walls of the endosperm.
Vitamins	Vitamin A (2.5 mg/kg) Vitamin E (35 mg/kg) In a lower proportion vitamin B1, pyridoxine, niacin and vitamin C
Minerals	Phosphorus (0.1% of grain) Calcium (0.01% to 0.1% of grain dry weight) It also contains potassium and magnesium

Source: Created based on Dickerson (2008).

****2.2.1 Properties of Purple Corn****

Purple corn "has an antioxidant effect that promotes tissue regeneration, encourages blood flow, improves circulation, reduces cholesterol, and slows down aging" (Secretariat of Culture, 2020, p. 2).

Furthermore, its consumption is associated with health benefits, as purple corn contains antioxidant compounds that help delay the damage caused by free radicals, possessing anticancer, antineurodegenerative, and anti-inflammatory activity (Kraft, 2008). The antioxidant pigment in purple corn regulates genes associated with cancer and lowers cholesterol levels (El Poder del Consumidor, 2021). Some studies have also shown that patients with atherosclerosis have lower antioxidant levels compared to healthy individuals (Durak et al., 2001). Ching et al. (2002) found that increasing blood antioxidant levels reduces breast cancer risk.

****2.3 Hibiscus****

Hibiscus is a plant that can grow up to 2 meters tall, with red coloring and upper and lower leaves—the former are wavy and pointed, while the latter are curved. The flowers, located at the junction of the leaf and stem, consist of a calyx and an epicalyx with 8 to 12 red bracts (Castañeda & Cáceres, 2014).

****2.3.1 Properties of Hibiscus****

Hibiscus provides various nutrients, including proteins, minerals, vitamins, and a high level of antioxidants such as flavonoids, polyphenolic acids, and anthocyanins (Cid & Guerrero, 2012). Notably, hibiscus flowers contain a high level of antioxidants, which are concentrated in the flower calyxes, where they are more abundant than in the leaves and seeds (Sumaya et al., 2014).

****Table 2. Nutritional Information of Hibiscus****

Hibiscus nutritional information

Proteins	High level of 6.4 g per 100 g
Lipids	Minimum levels, 0.3 per 10 g
Fiber	High levels for every 100 g of dried Jamaican calyx, 2.7 g are obtained
Vitamins	Large number of vitamins. For every 100 g of hibiscus flower you obtain: Vitamin B1 (0.02 mg), vitamin B2 or riboflavin (0.4 mg), Vitamin B3 (1.4 mg), Vitamin C (2.3 mg) and Vitamin A (1000 I.E)
Minerals	Important concentrations, for every 100 g of the flower you obtain 240 mg of calcium and 5 mg of iron

Source: Created based on Lara et al. (2013) and Singh et al. (2017).

In addition to the characteristics shown in the table above, hibiscus flowers contain high levels of anthocyanins, which give them their distinctive color (Lara et al., 2013). Anthocyanins act as inhibitors by suppressing the oxidative activity of oxygen free radicals, protecting cells from oxidative damage and slowing down the cellular aging process (Singh et al., 2017).

Furthermore, hibiscus extract protects lipoproteins from oxidation caused by free radicals. It also aids in cardiovascular health by thinning the blood, making it less viscous (Sumaya et al., 2014). Other health benefits attributed to hibiscus include diuretic and anti-inflammatory properties, as well as medicinal properties for treating conditions like cancer and cardiovascular issues (Singh et al., 2017).

****2.4 Pineapple****

Pineapple is a sweet, juicy, and somewhat acidic fruit, highly valued for its taste and nutritional content, including a variety of vitamins and minerals, as shown in the table below.

Table 3. Characteristics of Pineapple
*Source:

Pineapple characteristics

Scientific name	Ananas comosus
Family	Bromeliaceae
Characteristics	Perennial herb, of small size and hard, lanceolate leaves up to 1 m long, which bears fruit once every three years, producing a single fruit. fragrant and sweet It is a compound fruit (formed by the union of the fruits of several flowers around a campus axis), large in size, with a thick and hard shell, with brown scales and that has at one end a very showy green leaves. Its pulp is yellowish, aromatic and sweet with acidic notes.
Minerals	Potassium, magnesium, calcium, iron, sodium, vitamin A, vitamin C, folic acid

Created based on Agricultural and Fisheries Information Service [SIAP] (2018) and Ministry of Agriculture, Fisheries, and Food (2023).*

It is generally consumed fresh, sliced or diced, and is also commonly found in various food products like jams, juices, cakes, main dishes, and desserts (SIAP, 2018).

2.4.1 Properties of Pineapple

According to Kongsuwan et al. (2009), pineapple contains not only vitamin C but also several antioxidants, such as carotenoids and phenolic compounds. One of the main characteristics of this fruit is that it contains bromelain, an enzyme capable of breaking down proteins (SIAP, 2018). Bromelain also helps treat asthma, as it reduces inflammation of T cells in people with this condition (Sharma & Brajbhushan, 2015).

Due to this enzyme's properties, it is also used to treat stomach-related diseases, helping to prevent the formation of molecules known as nitrosamines, which can cause cancer (World Health Organization [WHO], 2019). "In addition, bromelain has a positive immunomodulatory effect against tumor development" (Ministry of Agriculture, Fisheries, and Food, 2023, para. 9).

---

3. Methodology of Project Development

3.1 Methodology

An experimental methodology was used for this project, developing a carbonated drink based on purple corn, hibiscus, and pineapple.

3.2 Materials

- Plant material: Purple corn, fresh pineapple, dried hibiscus calyces
- Purified water
- Common grinder or blender
- Strainer
- Drink carbonator
- Corning pH meter 3 D
- Portable refractometer OPTi Model Brix 95+

3.3 Resources Used

- Laboratory
- Glassware

3.4 Procedure

1. Plant material was purchased from a local market in Huamantla.
2. The corn kernels were removed, and each kernel's skin was peeled to

preserve the antioxidant-rich part, then ground into a fine powder.

3. Fifty grams of hibiscus were ground into a fine powder and macerated in 100 mL of water for four hours.

4. The pineapple was peeled, and its juice was extracted and strained to remove any solids.

5. 200 mL of pineapple juice, 50 mL of hibiscus water, and 10 g of purple corn were added, and the mixture was diluted to 500 mL with purified water.

6. Ten mL of agave syrup was added for sweetness, and 3 g of citric acid was used as a preservative.

7. The drink was carbonated with an ALIMOTA brand carbonator.

8. The beverage was stored and refrigerated for later consumption.

9. The nutritional information of the drink was determined using Food Data Central.

10. Finally, sensory tests were conducted, and the sample's pH and degrees °Brix were measured over a week.

****3.5 Evaluation Factors****

****3.5.1 Sensory Evaluation****

Product satisfaction was measured by a panel of 50 untrained participants.

1. A brief survey about the drink was conducted among potential untrained consumers.

2. Three criteria were measured using a 5-point hedonic scale.

3. The following criteria were measured along with the measurement scale.

Table 4. Sensory Test Criteria

measurement scale	1. I like it a lot 2. I like it moderately 3. I neither like it nor dislikes 4. I dislike him moderately. 5. I really dislike him.
Criteria to evaluate	- Smell - Flavor - Appearance

Measurement Scale

1. I like it very much.
2. I like it moderately.
3. I neither like nor dislike it.
4. I dislike it moderately.
5. I dislike it very much.

Criteria to Evaluate

- Smell
- Taste

- Appearance

Source: Created based on Molero-Méndez et al. (2017).

3.5.2 Dissolved Solids in the Drink or Brix Degrees

The dissolved solid content in the drink, specifically the dissolved sugar, was measured with a portable OPTi Model Brix 95+ refractometer following these steps:

1. One to two drops of the drink were placed on the refractometer.
2. The °Brix value was observed and recorded.

3.5.3 pH Measurement of the Drink

1. The pH of the drink was measured with a Corning pH meter 3 D.
2. The pH meter was turned on, and the electrode tip was cleaned with distilled water and dried with a soft cloth.
3. The potentiometer was calibrated with a known pH substance or a buffer solution.
4. An adequate amount of the drink was poured into a beaker to cover the electrode tip.
5. The potentiometer was turned on and immersed in the beaker until stabilized to record the pH results.

---

4. Results

The resulting beverage had a pleasant consistency, taste, and aroma, and its nutritional information can be found in the following table.

Table 5. Nutritional Information*

Nutritional information

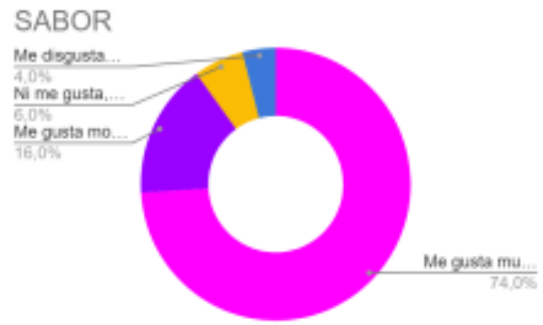
Food	200 ml pineapple juice	50 g hibiscus calyxes	10 g purple corn
Kilocalories	112	24.5	35
Fat	0.26 g	0.32 g	0.34 g
Carbohydrates	27.16 g	5.65 g	7.62 g
Proteins	0.76 g	0.48 g	0.73 g

Source: Created based on Food Data Central (2023).

4.1 Sensory Analysis of the Drink

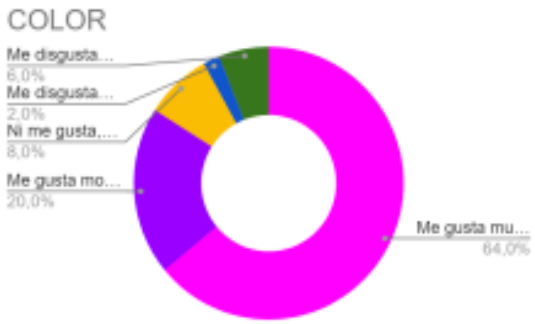
According to the opinions of untrained judges, the majority liked the drink regarding all three evaluated aspects (smell, taste, appearance), with the highest acceptance in taste: 74% rated it as "I like it very much," followed by 16% for "I like it moderately." The lowest values were 4% for "I dislike it moderately," as shown in Graph 1.

Graph 1. Sensory Test: "Drink Taste"



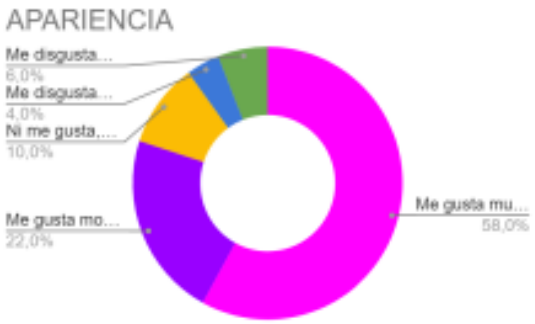
The color of the drink also received positive ratings, with a 64% acceptance rate for "I like it very much," followed by 20% for "I like it moderately." However, 6% reported "I dislike it moderately," as shown in Graph 2.

Graph 2. Sensory Test: "Drink Color"



Regarding the drink's appearance, most respondents liked it a lot (58%), although this criterion received the lowest scores, with 6% moderately disliking it. This was due to sediment present in the drink due to its natural characteristics, prompting suggestions to improve the appearance (see Graph 3).

Graph 3. Sensory Test: "Drink Appearance"



****4.2 pH of the Drink****

The pH was measured over seven days. The highest values were reported in the first three days, ranging from 2.5 to 3.5, with the drink becoming less acidic in the following days. This change can be attributed to malolactic fermentation, during which bacteria convert malic acid to lactic acid, shifting the pH from acidic to more basic (Romero, 2018). This trend is shown in Graph 4.

Graph 4. pH of the Drink

4.3 Total Soluble Solids in the Drink

The °Brix levels were measured over seven days, showing an increase in total solids from 2.8 to 7.7 °Bx, indicating 2.8 to 7.7 g of total soluble solids per 100 g of beverage. This increase is due to beverage fermentation, causing solids and liquids to separate continuously. This trend is shown in Graph 5.

Graph 5. °Brix of the Drink

5. Conclusions

The experimental design facilitated the development of a beverage that preserved the nutrients and antioxidants of the ingredients used. Purple corn and hibiscus, both with antioxidant properties, were incorporated in their natural forms. Only the pericarp or skin of the purple corn kernel was used, as this part is known to contain concentrated antioxidants. Likewise, the hibiscus calyces were ground and macerated in water without heat to maintain their antioxidant capacity, which can be reduced by high temperatures. The selected quantities of each ingredient resulted in a drink with a pleasant texture and viscosity, good flavor, and added benefits of vitamins, fiber, and antioxidants.

This beverage aligns with the United Nations' Sustainable Development Goal of "Responsible Consumption and Production," which promotes sustainable production and consumption practices (United Nations, 2015). By creating a drink made primarily from flowers, plants, and fruits, the project highlights sustainable practices in food production and consumption.

6. Future Research Directions

Future research could explore other fruits and flowers rich in nutraceuticals and antioxidants, such as dahlia, capulín, blue corn, pomegranate, and berries (blueberries, blackberries, raspberries). The aim would be to

develop a range of beverages with diverse flavors and high nutrient levels for consumers. Additionally, testing alternative natural sweeteners, like stevia, could enhance the drink's appeal. Methods like centrifugation may improve the appearance of the beverage by reducing sediment. Finally, microbial growth control using plate count methods could help determine the drink's shelf life.

Bibliografías

Aguilera, M., Reza, M., Chew, R. y Meza, J. (2011). Propiedades funcionales de las antocianinas. *Revista Biotecnia, 13*(2), 16-22.

12

Betrán, F., Bockholt, A. y Rooney, L. (2011). Blue corn in specialty corns. *Food Hydrocolloids. 5*, 455-467.

Cartaya, O. y Reynaldo, I. (2001). Flavonoides: características químicas y aplicaciones. *Cultivos Tropicales, 22*(2), 5-14

Castañeda, R. y Cáceres, A. (2014). Compuestos bioactivos y propiedades terapéuticas de los cálices de rosa de jamaica (Hibiscus sabdariffa L.). *Revista Científica Universidad de San Carlos de Guatemala, 24*(1), 7-24.

Ching, S., Ingram, D., Hahnel, R. y Rossi, E. (2002). Serum levels of micronutrients, antioxidants and total antioxidant status predict risk of breast cancer in a case control study. *Journal of Nutrition, 132*, 303-306

Cid, S. y Guerrero, J. (2012). Propiedades funcionales de la jamaica (Hibiscus Sabdariffa L.). *Temas Selectos de Ingeniería de Alimentos, 6*(2), 47-63.

Dickerson, G. (2008). Nutritional analysis of New Mexico blue corn and dent corn kernels. *Cooperative Extension of Agriculture*, *20*, 7-8

Durak, I., Kacmaz, M., Cimen, M., Buyukkock, U. y Ozturk, H. (2001). Blood oxidant/antioxidant status of arteroesclerotic patients. *Journal of Cardiology, 77*, 293-297

El poder del consumidor (2021). El poder de… El maíz azul. https://elpoderdelconsumidor.org/2021/10/ el-poder-de-el-maiz-azul/

Food Data Central. (2023). Food Search. *U.S. Department of Agriculture.* https://fdc.nal.usda.gov/

Garzón, G. (2008). Las antocianinas como colorantes naturales y compuestos bioactivos. *Acta Biológica Colombiana, 13*(3), 27-36.

Instituto Nacional del Cáncer. (2023). Antioxidantes y prevención del cáncer. *National Institutes of Health (NIH).*

https://www.cancer.gov/espanol/cancer/ca

usas-prevencion/riesgo/dieta/hoja-inf

orma tiva-antioxidantes#top

Instituto Nacional de Salud Pública [INSP]. (22 de febrero de 2012). ¿Los refrescos son una opción de hidratación saludable? *Gobierno de México.*

13

https://www.insp.mx/epppo/blog/2720-refr

escos-opcion-hidratacion-saludable.html

Kraft, T. (2008). Phytochemical composition and metabolic performance enhacing activity of dietary berries. *Journal of Agriculture and Food Chemestry, 26*, 654-660

Kongsuwan, A., Suthiluk, P., Theppakorn, T., Srilaong, V., & Setha, S. (2009). Bioactive compounds and antioxidant capacities of phulae and nanglae pineapple. *Asian Journal of Food and Agro-Industry, 2*(Special Issue), 44-54.

Lara, E., Osorio, P., Jiménez, A. y Bautista, S. (2013). Contenido nutricional, propiedades funcionales de flores comestibles. *Archivos Latinoamericanos de Nutrición, 63*(3), 197-208.

Ministerio de Agricultura, Pesca y Alimentación. (2023). Piña. *mapa.gob.*

https://www.mapa.gob.es/es/ministerio/ser

vicios/informacion/pi%C3%B1a_tcm30-10 3044.pdf

Molero-Méndez, M., Flores-Rondón, C., Leal-Ramírez, M., & Briñes-Zambrano, W. (2017). Evaluación sensorial de bebidas probióticas fermentadas a base de lactosuero. *Revista científica, 27*(2), 70-77.

Naciones Unidas. (2015). Objetivo 12: Garantizar modalidades de consumo y producción sostenibles. *UN.*

https://www.un.org/sustainabledevelopme

nt/es/sustainable-consumption-production/

Organización Mundial de la Salud [OMS]. (20 de noviembre de 2019). Actualización sobre las impurezas de nitrosaminas. *OMS.*

https://www.who.int/es/news/item/20-11-2

019-information-note-nitrosamine-impuritie

s#:~:text=%C2%BFQu%C3%A9%20son%

20las%20nitrosaminas%3F,cancer%C3%

ADgenas%20para%20el%20ser%20huma no.

Procuraduría Federal del Consumidor [PROFECO]. (18 de mayo de 2021). Obesidad y sobrepeso. Menos kilos, más vida. *Gobierno de México.*

https://www.gob.mx/profeco/documentos/obesidad-y-sobrepeso-menos-kilos-mas-vida#:~:text=De%20acuerdo%20la%20Encuesta%20Nacional,a%C3%B1os%2035.6%25%20muestran%20esta%20condici%C3 %B3n.

14

Procuraduría Federal del Consumidor [PROFECO]. (16 de marzo del 2023). Consumo de refresco. A propósito del Día mundial contra la obesidad. *Gobierno de México.* https://www.gob.mx/profeco/documentos/consumo-de-refresco-a-proposito-del-dia-mundial-contra-la-obesidad?state=published

Romero, L. (2018). La fermentación maloláctica. *Notas de Cata.* https://www.vinissimus.com/blog/fermentacion-malolactica/#:~:text=La%20llamada%20fermentaci%C3%B3n%20malol%C3%A1ctica%20no,la%20m%C3%A1s%20suave%20acidez%20l%C3%A1ctica

Secretaría de Cultura. (2020). Cartografía de sabores: maíz morado. *Gobierno de México.* https://metro.cdmx.gob.mx/storage/app/media/cultura/eventos/2020/Junio/Maiz%20 morado%20firma.pdf

Servicio de Información Agroalimentaria y Pesquera [SIAP]. (26 de junio de 2018). Piña, reina de las frutas tropicales. *Gobierno de México.* https://www.gob.mx/siap/articulos/pina-reina-de-las-frutas-tropicales?idiom=es

Sharma, S. P., & Brajbhushan, B. (2015). A study on nutritional efficacy of pineapple juice in the treatment of bronchial asthma. International *Journal of Scientific and Research Publication, 5*(1), 1-4.

Singh, P., Khan, M. y Hailemariam, H. (2017). Nutritional and health importance of Hibiscus sabdariffa: A review and indications for research needs. *Journal of Nutritional Health and & Food Engineering, 6*(5), 125-128

Sumaya, M., Medina, R., Machuca, M., Jiménez, E., Balois, R. y Sánchez, L. (2014). Potencial de la jamaica (Hibiscus sabdariffa L.) en la elaboración de alimentos funcionales con actividad antioxidante. *Revista Mexicana de Agronegocios, 35*, 1082-1088.

Universidad Nacional Autónoma de

México [UNAM]. (2019). México, primer consumidor de refresco en el mundo. *Boletín UNAM.* https://www.dgcs.unam.mx/boletin/bdbolet in/2019_757.html

UNAM. (2022). En aumento, los casos de diabetes en México. DGCS. 15 https://www.dgcs.unam.mx/boletin/bdbole tin/2021_966.html

Vilaplana, M. (2007). Antioxidantes presentes en los alimentos. Vitaminas, minerales y suplementos. *Offarm, 26*(10), 79-86.

Annexes:

Annex 1. Dried/powdered hibiscus and blue corn husk.

Annex 2. Peeled pineapple pulp.

Appendix 3. Grinding the pineapple.

Appendix 4. Juice filtration.

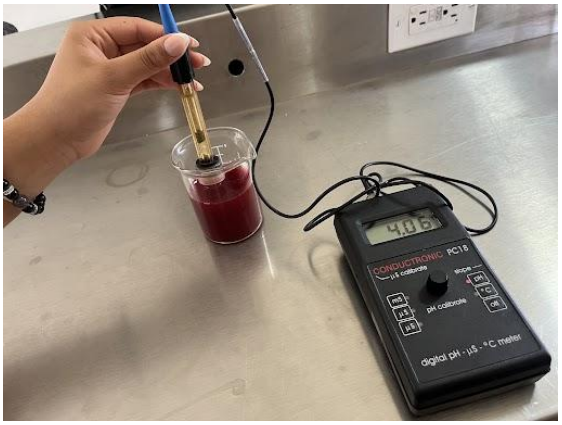
Annex 5. Weighing hibiscus for maceration.

Annex 6. Measurement of active ingredients.

Annex 7. CO2 gasification cartridge.

Annex 8. Obtaining and packaging carbonated beverages.

Annex 9. pH measurement on day 7.



【評語】080018

Advantages:

Through an experimental methodology, it was possible to elaborate a beverage with these characteristics, which also has a pleasant flavor, aroma and texture, making it a viable option for consumption by people with or without chronic degenerative diseases.

Comments and suggestions:

1. For further applications, it is suggested to conduct quantitative analysis of each ingredient.
2. For improving the quality of product, it is suggested to establish standard operation process (SOP) for production.
3. The nutrient value of each ingredient has been previously known. They just mixed them together.
4. The taste, aroma, and consistency preferred by people were quite subjective, via the senses.