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SUSTAINABLE USE OF NEW SOURCES OF FOOD

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ABSTRACT
Algae are a rich source of nutrients - essential amino acids, essential fatty acids, carotenoids, minerals and vitamins. This determines the modern man's motivation for the use of new sustainable sources of nutrients. Ingredients and technology of a new healthy product (cream ice cream) with added freshwater spirulina and Chlorella with different concentrations are presented. This study focuses on the replacement of industrially produced freshwater algae stabilizers. The quality of the ice cream is determined by measuring the melting time. A trained tasting committee conducted a sensory analysis using sensory cards with scores of 0 to 10.

Key words: Ice Cream, Physical and Sensory Performance, Spirulina, Chlorella

INTRODUCTION

Food is part of our cultural identity and plays an important role in the economy. Consumers are aware that food is a factor affecting health, but less attention is paid to the impact of production and consumption on global resources. In order to reduce the negative impact of industry, we are focusing on the demand for a "sustainable" food system. Demand and application of "sustainable" resources is our primary goal. Nutrition and physicochemical properties are an important factor in choosing dairy products. Ice cream is considered a food for pleasure. Therefore, the enrichment of ice cream with bioactive substances should be supported. Dairy products use additives such as colorants, stabilizers and emulsifiers. In some cases, food safety is threatened by the addition of synthetic food supplements because they can prevent nutrient absorption. Dairy products enriched with minerals, proteins and essential fatty acids can be produced by adding freshwater algae. They also give a natural color when added to ice cream. The effect of replacement of artificial stabilizers with freshwater algae on the ice cream properties is investigated.

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Spirulina is a useful biosystem for the production of biologically active foods, has antioxidant and antimicrobial activity and is a natural source of pigments [3]. It is a rich source of phycocyanin [7]. Spirulina is included as a functional ingredient in food products [1].

Our goal is to create a new culinary product - ice cream with algae.

MATERIAL AND METHOD

Standard raw materials authorized by the Ministry of Health were used. The ingredients of ice cream are Bulgarian organic freshwater algae Spirulina and Chlorella produced by BIO LEED, skimmed milk powder, whole cream animal cream - 35%, whole cream milk - 3.2% - [BDS EN ISO 17678: 2010], [ISO 9363-1 : 1994], stabilizer [agar-agar - BDS EN ISO 9371: 2003] and sugar - [BDS 13634: 1976] in the control sample. A Gelato Chef 2200, 150 W, 1.5 l ice cream machine was used.

Preparation of algae solution for its use in ice cream.

Concentrations of 1% Spirulina and Chlorella and 0.5% of both are dissolved in 15 ml of distilled water at 25 °C and homogenized using a magnetic stirrer for 20 minutes. For hydration purposes, the solution is left under refrigeration conditions (0-4 °C) for 12 hours. Prior to preparation of the product, it was stirred for 15 minutes with a magnetic stirrer [6].

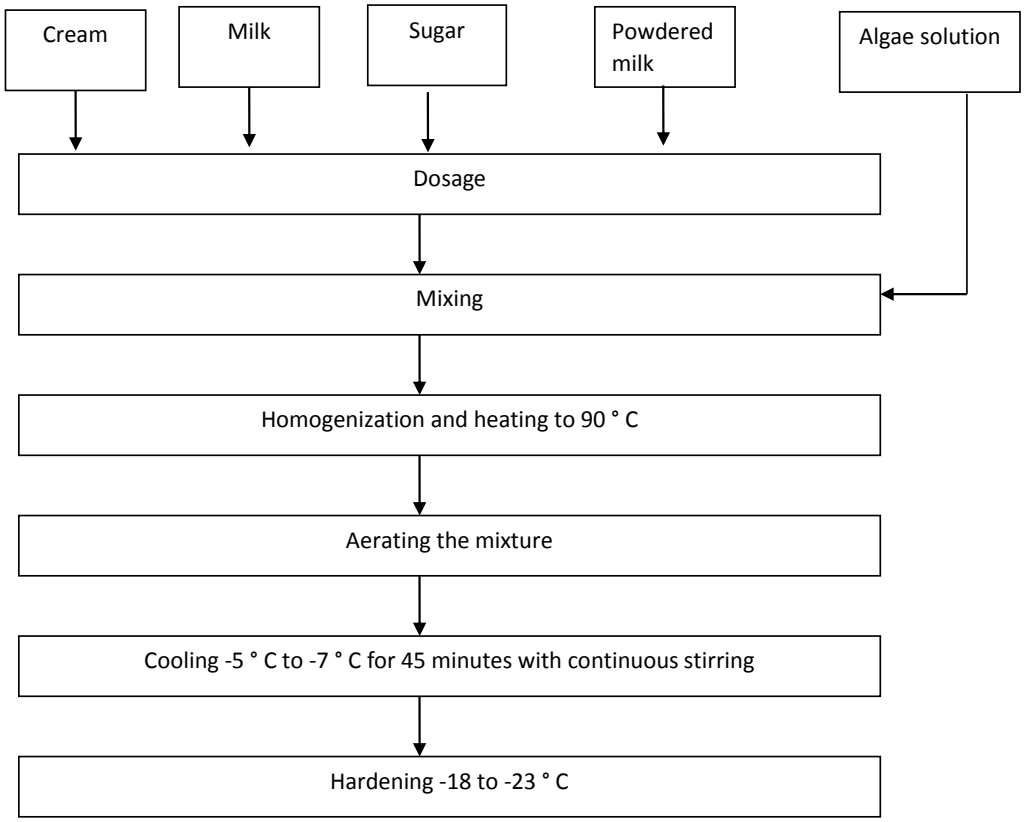

Figure 1. Ice cream production scheme

In **Figure 1.** is presented Ice Cream Making Technology. A classic technological scheme for the production of cream-milk ice cream [2] has been used, with traditional stabilizers being replaced with Spirulina Chlorella solutions. The melting properties of frozen ice cream are determined according to Goff and Hartel (2013), by careful preparation of the ice-cream samples (~ 70 g), we place a sample on a wire mesh through a glass funnel in a mounted conical flask, and the weight of the ice- in conical flasks at a temperature of 25 ± 2 °C is weighed every 10 minutes.

A quantitative descriptive sensing profiling test [ISO 13299: 2016] was used to determine sensory performance. The study was conducted by 10 trained tasters. Tasting cards have been developed. The intensity of each sensor indicator is recorded on a 10-point linear scale from 0 to 10. The evaluation was carried out after one-hour orientation sessions of sensory assessors, specifying the terminology and ball points on the scale. The coded samples are presented simultaneously and evaluated in random order between sensory assessors.

RESULTS AND DISCUSSION

Sensory characteristics of ice cream **(Figures 1, 2, 3, 4, 5)**.

Recipe composition:
-ice cream control saple
- ice cream 1% Spirulina
- ice cream 1% Chlorella
- ice cream с 0,5% Spirulina и 0,5% Chlorella.

The study shows that the ice cream score with Spirulina 1% is very close to the evaluation of the control sample at the Taste Sensor. Cream-milk ice cream with 1% Spirulina is very close to the sensory indicators taste, smell and consistency with the agar-agar control. Only for Color Sensor the differences in ball estimates are due to the specific blue-green color of Spirulina.

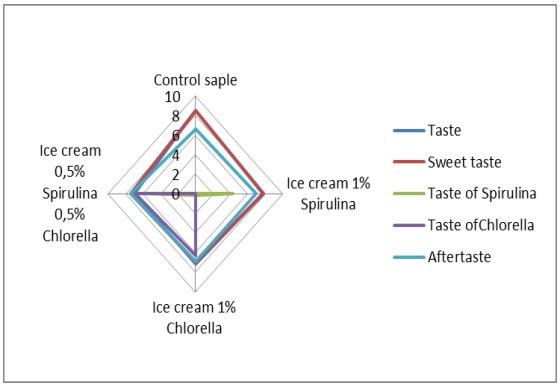

Figure 2. Taste profile

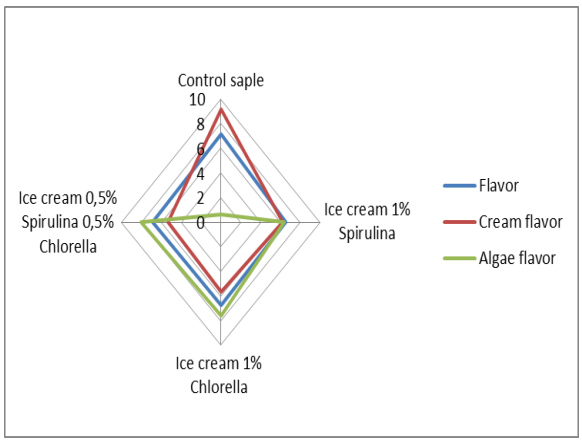

Figure 3. Flavor profile

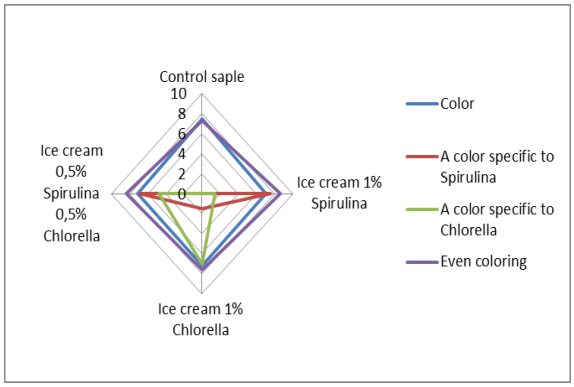

Figure 4. Color profile

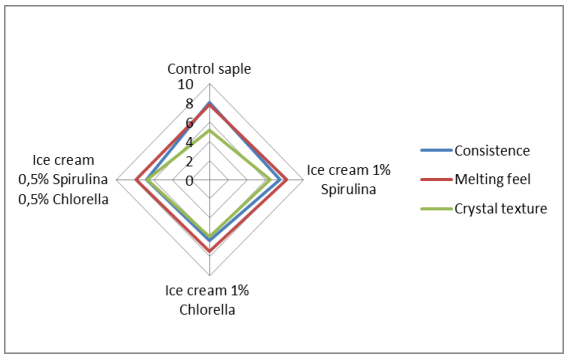

Figure 5. Consistence profile

The melting rate depends on the water holding capacity [9], which refers to the interaction between proteins in the product and water, resulting in some of the water remaining in the product. In **Figure 6** melting curves of the samples tested are presented. It is obvious that ice cream, prepared by replacing the stabilizer with Spirulina, has a higher melting resistance. It has been found that ice cream prepared by replacing the Spirulina stabilizer has an increased melt resistance compared to the control and relatively low in ice cream with Chlorella. The stabilizers have a water-holding capacity and absorb the oil spheres on the surface of the protein molecule, thus influencing the rheological properties of the products. This higher melting resistance can be attributed to the Spirulina water holding capacity of 1.1 g/g and the oil capacity of 1 g/g [8].

The high protein content in Spirulina [4] may be useful for stabilizing air globules, which is why higher melting resistance is achieved.

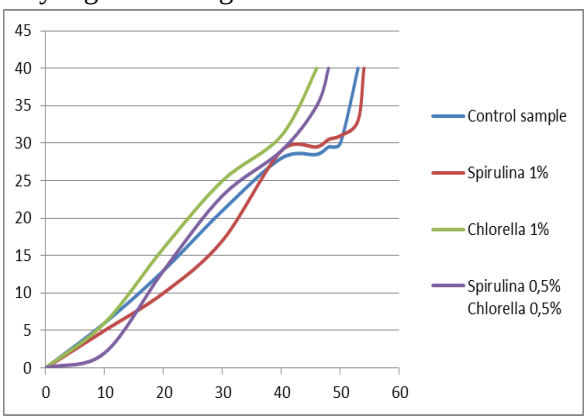

Figure 6. Ice melting rate

CONCLUSION

The present work focuses on enriching freshwater algae ice cream due to its rich chemical composition. The addition of Spirulina leads to the replacement of classical ice cream stabilizers, which contributes to its definition of a "sustainable" product. It was found that a concentration of 1% Spirulina can replace the stabilizer in the preparation of ice cream, the physical and sensory parameters being close to those of the control. The developed product has a pleasant blue-green Spirulina color. Based on the results, Spirulina freshwater algae has a sustainable use in the food and cooking industry as a substitute for synthetic additives (stabilizers, emulsifiers and colorants) for enrichment of dairy products and fruit drinks.

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