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# Development and Optimization of Ice Cream by Incorporating the Leaves of Amaranthus Cruentus

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**ABSTRACT:**

Ice cream is one of the most popular desserts. Notwithstanding children, every age group of people has an appetite for ice cream. Though it is a highly consumable dessert, considering its nutritional value it does not meet the human nutritional requirement. To get the better out of it this project thought of coming up with value-added ice cream which is highly rich in proteins, fibers, and minerals. Amaranthus cruentus – red spinach is one of the notable spinaches for centuries. It is a good source of Vitamin C where milk is very much deficient in it. It is also a rich source of protein. In addition to that, it adds red color to the food product naturally. Therefore, this project aims at fortifying the leaves of Amaranthus cruentus to ice cream and developing it as a functional dessert. To begin with, the preparation of dried Amaranthus cruentus leaves powder. Approximately, 700g of leaves are shade dried and grinded efficiently, and sieved. It is followed by the preparation of ice cream at four different concentrations (0%, 5%, 10%, 15%). To prepare 250g of standard plain ice cream 164ml of milk, 25g of fresh cream, 37g of sugar, 22.5g of skim milk powder, 0.5g of gelatin, and 0.5g of CMC is added according to standard ice cream preparation. The processing steps start with the pasteurization of milk. Other ingredients such as granulated sugar, skim milk powder, gelatin and CMC are added to the boiling milk eventually. They are then added to pasteurized fresh cream and homogenized at two stages 500 psi (I stage) and 2500 psi (II stage), cooled at 4deg for 24 hrs, hardened at -22deg C and stored for further analysis. The spinach samples (5%, 10%, 15%) are prepared similar to plain ice cream with the difference of adding spinach powder at a different concentration to the boiling milk separately. Thus, the samples are analyzed for overrun, texture, color, and nutritional composition and optimized that sample 15% is standard.

KEYWORDS: AC-Amaranthus cruentus, homogenization, hardening, pasteurization.

## I. INTRODUCTION:

Ice cream, which is deemed as a decadent category of food, has evolved to the point that it is now widely and happily perceived as a snacking option by consumers. It has been steadily increasing at a pace of 10–15 percent. Manufacturers have been encouraged to strive for advancement through innovations in product offers and service delivery by expanding the consumer base, product acceptability, and competitiveness. Ice cream consumption reached 158 million kg in 2018 and is expected to expand at a rate of 16 percent per year through 2020, with a market value of Rp19.8 trillion. (Ciptadana Sekuritas Asia, 2018).

Milk, sugars, emulsifiers, stabilizers, and flavoring compounds are the components used to manufacture ice cream. It is an aerated fat and water suspension in a concentrated sugar solution containing stabilizers, casein micelles, and proteins. Ice cream is a complex colloidal frozen system made up of various components such as air cells, ice crystals, and a continuous aqueous phase including polysaccharides, proteins, lipid droplets, lactose, and minerals. Ice cream has a high calorie and milk fat content. Ice cream is a delectable, energy-giving, safe, and moderately priced treat. One serving of vanilla ice cream with a good average composition (116 qt) has 200 calories, 3.9 g of protein, 0.31 g of calcium, 0.104 g of phosphorus, 0.14 mg of iron, 548 mg of vitamin A, 0.038 mg of thiamine, and 0.236 mg of riboflavin. (W.SArbuckle,1986) . It is a desirable milk product due to its high tasty and caloric density. Ice cream is high in calories, but it is low in natural antioxidants, dietary fiber, and minerals. Consumers have recently driven toward functional foods that are higher in natural antioxidants, dietary

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fiber, minerals, vitamins, natural colorants, and are free of synthetic additives, among other things. As a result, the experiments aimed to raise the nutritional value of ice cream.

The objective of nutritional enrichment has shifted away from addressing nutrient deficiency and toward achieving optimal health and food intake. Consumers are increasingly interested in healthy diets and seek meals that contain beneficial elements such as antioxidants, phenolics, and phytosterols. As a result, food manufacturers must include functional ingredients in their products to appeal to health-conscious consumers. Foods or dietary ingredients that provide additional health advantages beyond their typical nutritional value are known as functional foods. Many fruits and plants are being studied for their functional qualities, particularly for their potential application as novel nutraceuticals in functional foods. The utilization of various substances with nutritional and physiological qualities has increased in recent years.

Amaranth species are domestic to Mexico and Central America. Amaranthus is highly wholesome. Both the grain and the leaves of amaranthus are rich in dietary fiber. Amaranth and its leaves are used for both human and animal consumption. (Tucker, 1986). There has been a lot of research done on amaranth species' nutritional value. It has been established that the leaves of the amaranth plant are high in protein during a blossoming phase. Amaranth leaves contain high amounts of minerals, especially calcium and magnesium (Betschart et al. 1981; Bodroža-Solarov 2001 )Out of many Amaranthus species, Amaranthus cruentus is distinctive in its nutritional aspects. Amino acids containing sulphur, such as methionine and cysteine, are abundant in Amaranthus cruentus. Their significant parts are boiled with honey for infants, its water extract is used to treat pains in the limbs, wound dressing, and tumors; has antioxidant properties; used lubricants in the industry, cosmetics, and health foods amaranthus cruentus is widely used. (Schippers, 2002; Oomen and Grubbens, 1978).
Considering the nutritive qualities of Amaranthus cruentus, its leaves are used as a fortifying component in the manufacturing of ice cream. It results as a functional food product and can be consumed effectively by consumers which is the objective of this project.

## II.MATERIALS AND METHODS:

The leaves of amaranthus cruentus are freshly harvested from the organic farm of BIT, Sathyamangalm. Cow's milk is obtained from a local market. Fresh cream is obtained from the brand of the silver mark. Other ingredients such as Carboxymethylcellulose, gelatin, powdered sugar, skim milk powder are purchased from the nearby supplier.

## III.EXPERIMENTATION:

Initially, the experiment process is split into two categories. Manufacturing of Amaranthus powder and manufacturing of ice cream.

### A.MANUFACTURING OF AMARANTH POWDER:

The leaves of amaranthus cruentus are freshly harvested from the organic farm of BIT, Sathyamangalam. The harvested leaves are cleaned and separated from twigs and other foreign particles manually. Sorting of leaves is done to remove unqualified leaves from the qualified ones. Then, their initial weight is taken which was approximately 687.4g. The weighed leaves are chopped off for efficient drying. Shade drying is the drying method used to dry the leaves. In this method, color retention and nutritional loss are minimized when compared to other thermal modes of drying. Leaves are dried for about 9 days to reach sufficient moisture content (0.63). The dried leaves weighed has been taken which was approximately 154.32g. They are followed by grinding into a fine powder and sieved under sieve mesh to get uniform particle size and packed in an air-tight container for further work.

Fig 2.0 Harvesting of Amaranth leaves

**Harvesting**

↓

**Cleaning and sorting**

↓

**Weighing the leaves**

↓

**Shade drying**

↓

**Grinding**

↓

**Sieving**

↓

**Storage**

Fig 1.0 Flow diagram of manufacturing of amaranth powder

Fig 3.0 Shade drying of leaves

B.PREPARATION OF ICE CREAM:

Ice cream samples are prepared in the laboratory of the Food Technology Department, BIT. Ingredients needed for the preparation of ice cream are measured according to FSSAI standards. To prepare 250g of plain ice cream mix: cow milk - 164 ml, Fresh cream - 25 g, Skim milk powder - 22.5 g, Granulated sugar- 37 g, Gelatin - 0.5 g, CMC powder – 0.5 g has been taken. Four samples (0%,5%,10%15%) including control sample has prepared in the laboratory. After weighing all the ingredients 4 times, milk is pasteurized at 72deg Celsius for 15 seconds. It is followed by the addition of skim milk powder, gelatin, and CMC eventually. According to the sample type amaranthus powder at 5%,10%, and 15% concentrations are added to the ice cream mixes. They are then mixed with the fresh cream at room temperature. The next step is homogenization which takes place at two stages ( 500 psi ) and( 2500 psi) for all four samples. In this processing step, fat globules are reduced to smaller fat globules, and the volume of air is increased to attain proper overrun efficiency. The ice cream samples are cooled at 4 degree Celsius for 24 hours, hardened at -22 degree Celsius for 1 day and stored at -18 degree Celsius for further analysis.

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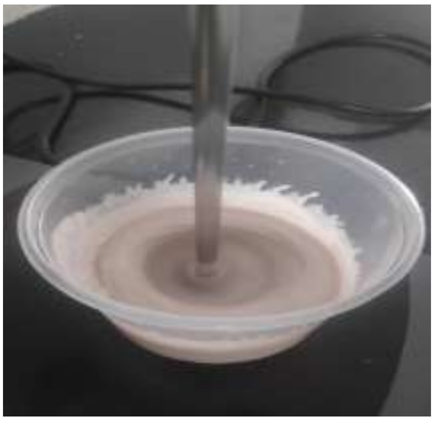

**Weighing**
↓
**Pasteurization**
↓
**Mixing**
↓
**Homogenization**
↓
**Cooling**
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**Hardening**
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**Storing**

Fig 4.0 Flow diagram of preparation of ice cream mix

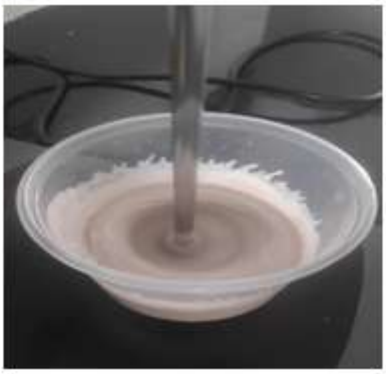

Fig 5.0 Homogenization

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Fig 6.0 Four ice cream samples- 0%,5%,10%,15%

| Sample | Protein | Total solids | Ash content |
|---|---|---|---|
| $AC_0$ | $5.30 \pm 0.08_a$ | $38.70 \pm 0.50_b$ | $1.00 \pm 0.10_c$ |
| $AC_5$ | $7.85 \pm 0.05_b$ | $40.32 \pm 0.30_a$ | $1.20 \pm 0.10_b$ |
| $AC_{10}$ | $9.25 \pm 0.13_b$ | $43.35 \pm 0.30_c$ | $1.60 \pm 0.10_c$ |
| $AC_{15}$ | $9.65 \pm 0.09_c$ | $45.50 \pm 0.50_b$ | $1.60 \pm 0.20_b$ |

$AC_0$ – control without AC, $AC_5$ – sample with 5% AC, $AC_{10}$ – sample with 10% AC, $AC_{15}$ – sample with15% AC. Values are mean ± standard deviation. Means followed by different letters in the same column are significantly different ($P < 0.05$).

| Sample | Viscosity(cP) |
|---|---|
| $AC_0$ | $1714 + 10^a$ |
| $AC_5$ | $2161 + 369^b$ |
| $AC_{10}$ | $3430 + 267^c$ |
| $AC_{15}$ | $4654 + 339^d$ |

| Sample | Overrun(%) |
|---|---|
| $AC_0$ | 48.02+5.62 |
| $AC_5$ | 44.87+3.84 |
| AC $I_{10}$ | 42.95+2.72 |
| $AC_{15}$ | 36.88+4.67 |

## IV.RESULTS:

Overrun was calculated as per the equation [(volume of ice cream)−(volume of mix)/volume of mix × 100]. Secondly, the viscosities of the ice creams were measured at 4 °C using a digital Brookfield Viscometer. The total solid and ash contents of ice cream samples were calculated using the gravimetric method, fat content by the Gerber method, and protein content using the Kjeldahl method.

## V.CONCLUSION:

From the results obtained, it is inferred that $AC_{15}$ has high overrun %, viscosity, total solids, ash content, and protein content than other samples. Without any colorimetric measurements, it is found that sample $AC_{15}$ has turned to reddish-green color compared to other samples. By analyzing the physico-chemical properties of all samples it is concluded that sample $AC_{15}$ is the optimum sample and can be developed for further research work. The results also showed that AC can be used as fortifying component to improve the value-added ice cream.

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