

Fortified Dairy Products with enhanced nutritional characteristics

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Abstract- Colour is a measure of quality and nutrient content of foods. The objective of including color to nourishments is to create them engaging, expand the misfortune of color amid processing, to move forward the quality conjointly to impact the customer. The creating nourishment industry had a tremendous cluster of engineered colors. This paper explores the utilization of natural colors extracted from beetroot and carrot in the context of dairy products. Beetroot extract, with its vibrant red pigments known as betalains, and carrot extract, rich in orange carotenoids, serve as potent and health-conscious alternatives to synthetic food colors. The study delves into the application of these natural hues in dairy products, assessing their stability, sensory impact, and consumer acceptance. Results indicate that beetroot and carrot-derived colors not only enhance the visual appeal of dairy items but also align with the increasing consumer demand for clean-label products. The incorporation of these natural colors offers a promising avenue for creating visually appealing and nutritionally wholesome dairy products.

Key words: Food biocolour, beetroot extract, carrot extract, betacyanin, beta carotene.

INTRODUCTION

Classification: Biocolours can be classified into three major classes (Sharma, 2014).

1. Normal colours: The vital characteristic colours utilized as added substances are the green color chlorophyll, the carotenoids which allow yellow to ruddy colours and the flavonoids with their foremost subclass the anthocyanins, which confer ruddy to blue colours to blooms and natural products.

2. Browning colours: These are delivered amid cooking and handling and in this way may not be of any coordinate significance in nourishments.

3. Additives: Nourishment added substance colours are based on anthocyanins determined from sources such as ruddy Beetroot extricate, sourced from ruddy beets, gives a profound ruddy tone, whereas turmeric imparts a golden-yellow grapes or beet but the primary added substance colour were engineered colors which were broadly utilized as nourishment colorants in nineteenth century and early 1900 s.

The ruddy color from the beetroot is caused by the nearness of the two bunches of betalains: betacyanins (red–violet colors) and betaxanthins (yellow–orange shades).

The purple or dark color of the dark carrot starts from its pigments called anthocyanins.

This alter in structure comes about in a move in shade from ruddy, purple to blue as the pH changes from acidic to fundamental.

Characteristic nourishment colors are inferred from different sources, advertising a dynamic palette without engineered added substances.

Moreover, anthocyanins extricated from natural products like berries surrender a range of reds, blues, and purples.

These common colors not as it were improve the visual request of nourishment but moreover appeal to health-conscious shoppers looking for choices to counterfeit added substances, adjusting with the developing request for clean and wholesome eating.

Properties of Carrot Juice:

- Its a potential antioxidant.
- and anti-cancer potential.
- Its have immunity-boosting potential.
- It have anti-diabetic potential.
- It potentially be cholesterol lowering and heart protective.
- and blood pressure lowering potential.
- also liver protective potential.

Carrot could be a great source of dietary fiber and of the follow mineral molybdenum, once in a while found in numerous vegetables. Molybdenum helps in digestion system of fats and carbohydrates and is important for assimilation of press. It is additionally a great source of magnesium and manganese. Magnesium is required for bone, protein, making unused cells, actuating B vitamins, unwinding nerves and muscles, clotting blood, and in vitality generation. Affront discharge and work too require magnesium. Manganese is accommodating in carbohydrate digestion system, in coordination with chemicals within the body. Manganese is utilized by the body as a co-factor for the antioxidant protein, superoxide dismutase. Potassium and magnesium in carrots help in working of muscles.

Like numerous other colored vegetables carrot could be a gold mine of cancer prevention agents. Carotenoids, polyphenols and vitamins show in carrot act as cancer prevention agents, anticarcinogens, and immunoenhancers. Carotenoids broadly conveyed in orange carrots are strong cancer prevention agents which can neutralize the impact of free radicals. They have been appeared to have hindrance mutagenesis movement contributing to diminish chance of a few cancers.

Properties of Beetroot extract

As a wealthy and nutritious source, it is accepted to hold wellbeing limited time characteristics, anti-oxidant and anti-inflammatory impacts, anti-carcinogenic and anti-diabetic exercises and hepato-protective, hypotensive and wound recuperating properties.

In this manner, beetroot is advertising it to their gods and utilizing it in ceremonies.

Whereas acid-resistant anthocyanins are for the most part utilized as normal shades, the color of betalains is moderately steady over a wide pH run (3–7), and they are a reasonable colorant for low-acid nourishments.

Their coloring control is exceptionally tall since betalains have the next molar termination coefficient than engineered colorants.

On the other hand, betalains have been demonstrated to be advantageous to human wellbeing due to their potential to have anti-inflammatory movement, repress lipid oxidation and peroxidation, increment resistance to the oxidation of low-density lipoproteins and give chemo-preventive impacts.

It is appeared that the diligent utilization of beetroot juice successfully puts off the postprandial glycemic reaction and diminishes the blood glucose peak.

LITERARY REVIEW

Dairy items, a orchestra of rich surfaces and different flavors, have been a foundation of human diets for centuries.

This audit dives into the wealthy history, complex dietary profile, and multifaceted world of dairy items, investigating both the challenges and openings forming its future.

The antiquated Egyptians respected drain as a divine drink, advertising it to their gods and utilizing it in ceremonies.

In India, the Rigveda, a sacrosanct content dating back to 1500 BCE, notices the utilization of drain and its subordinates like ghee and yogurt.

It's a wealthy source of calcium, fundamental for bone wellbeing, and gives protein, vitamins A and B12, and riboflavin. Choosing low-fat or fat-free alternatives, joining aged dairy items like yogurt for intestine wellbeing, and balancing dairy admissions with differing nourishment sources can offer assistance procure the benefits whereas mitigating potential dangers.

A Item Universe: Past Drain and Cheese: The world of dairy detonates with a astonishing cluster of items, each with its claim character and social noteworthiness.

Drain: The flexible establishment, delighted in plain, flavored, or matured into an cluster of delights like buttermilk, kefir, and yogurt.

From the sharp tang of Cheddar to the velvety liberality of Brie, cheese offers a flavor profile for each sense of taste.

Yogurt: A probiotic powerhouse, advancing intestine wellbeing and advertising a tart canvas for natural products, granola, and indeed savory plunges.

A Comprehensive Review of Curd: A Culinary Delicacy Curd, also known as dahi or yogurt, may be a fermented milk product with a wealthy and rich surface and a tart flavor.

It could be a staple nourishment in numerous societies around the world and is delighted in for its flexibility, wellbeing benefits, and culinary applications.

This comprehensive survey digs into the world of curd, investigating its history, generation handle, assortments, dietary profile, wellbeing benefits, and culinary employments.

Authentic Roots and Social Importance Curd's roots can be followed back to antiquated times, with prove of its generation dating back to 4500 BC in Mesopotamia.

The information of curd-making spread through exchange and social trade, and it before long got to be an indispensably portion of different territorial cuisines.

In numerous other societies, curd is moreover related with different customs and typical implications.

These microbes expend the lactose sugar in drain, creating lactic corrosive as a byproduct.

As the lactic corrosive concentration increments, the drain proteins, basically casein, thicken, giving curd its characteristic surface.

Assortments of Curd: A World of Flavors and Surfaces The world of curd is endless and assorted, with various assortments found over distinctive locales.

A few of the foremost well known sorts of curd incorporate: Characteristic curd: Plain curd, made from drain and lactic acid microbes, is the best and most flexible shape.

Wholesome Profile: A Treasure Trove of Supplement Curd may be a wholesome powerhouse, pressed with basic supplements that bolster by and large wellbeing and well-being.

It may be a wealthy source of: Protein: Curd may be a total protein, giving all nine basic amino acids required by the body.

Culinary Applications: A Culinary Canvas Curd's flexibility amplifies past its wholesome esteem, making it a culinary star.

It could be a key fixing in numerous cuisines, including flavor, surface, and tanginess to a wide run of dishes.

Preparing fixing: Curd can be utilized in cakes, biscuits, and hotcakes, improving flavor and dampness.

Sandesh

Sandesh It could be a conventional Indian sweetmeat that started within the eastern portion of the nation, especially in West Bengal and Odisha.

It is made by stewing drain until it thickens, at that point including sugar and mixing persistently until it comes to a smooth, fudge-like consistency.

Sandesh is regularly flavored with cardamom, saffron, or nuts, and can be molded into different shapes or served plain. Nowadays, sandesh is an necessarily portion of Indian culture and is regularly served amid celebrations and extraordinary events.

A few of the most popular sorts incorporate: Plain sandesh: Typically the best form of sandesh, made with as it were drain, sugar, and cardamom.

It contains a fragile sweetness and a soft, melt-in-your-mouth surface.

Dhoda sandesh: This sort of sandesh is made by adding roasted drain solids to the fundamental formula.

This gives it a wealthier, nuttier flavor and a brittle surface.

Kaju sandesh: This variety is flavored with cashews and encompasses a slightly chewy surface.

Nalen gurer sandesh: This extraordinary sort of sandesh is made with jaggery instep of sugar, giving it a dark brown color and a particular caramel flavor.

Once it comes to the required consistency, it is flavored and molded.

It may be a image of Indian culture and tradition, and its one of a kind flavors and surfaces proceed to enchant individuals all over the world.

AIM AND OBJECTIVE

- o Application of the color extracted from carrot and beetroot into Curd and Sandesh.
- o To comprehensively characterize the biocolour fortified dairy product, examining its visual attributes, nutritional composition, and overall quality.
- o Assess the nutritional changes induced by the incorporation of polyphenols.

The application of natural colors extracted from carrot and beetroot in curd and Sandesh, a popular Indian sweet, introduces a visually appealing and health-conscious dimension to these dairy products. Carrot extract, rich in vibrant orange carotenoids, imparts a warm and inviting hue to the curd, enhancing its aesthetic appeal. In Sandesh, the use of beetroot extract adds a subtle yet attractive pink or red tint, creating an appetizing visual contrast.

Beyond their visual impact, these natural colors contribute additional nutritional benefits, as both carrot and beetroot are rich in antioxidants and other health-promoting compounds. The incorporation of these natural colors aligns with consumer preferences for clean-label products, avoiding synthetic additives. This application not only enhances the sensory experience but also caters to the growing demand for visually appealing and health-conscious dairy offerings in the market.

We also check the polyphenol content of the biocolor fortified curd from both beetroot extract and carrot powder. We compare it with plain curd and use it as a control. For Sandesh, we check the moisture content and the ash content of it to know about the quality of the Sandesh.

METHODOLOGY

Preparation of carrot powder

First of all, carrot powder was prepared and then it was to be applied to the respective food product The preparation of Carrot powder is done in steps as mentioned:

Making carrot powder using a tray dryer involves a simple process of drying and grinding the carrots. Here's a step-by-step guide:

Ingredients/Equipment:

1. Fresh carrots
2. Tray dryer
3. Knife or vegetable peeler
4. Cutting board
5. Blender or food processor
6. Sieve or mesh strainer
7. Airtight container for storage

Procedure:

1. Preparation:

- Wash and peel the carrots to remove any dirt or contaminants.
- Slice the carrots into thin, uniform pieces to facilitate even drying.

2. Loading the Tray Dryer:

- Arrange the carrot slices in a single layer on the trays of the dryer. Ensure that there is free space b/w slices for proper air circulation.

3. Drying:

- Set the tray dryer to a low temperature (around 50-60°C) to gently dehydrate the carrots without cooking them.
- Dry the carrot slices until they are crisp and brittle. The drying time can vary depending on thickness of the slices and temperature and humidity. It taken few hours to a day or more.

4. Cooling:

- Allow the dried carrot slices to cool to room temperature before proceeding to the next step. This prevents condensation and helps maintain the powder's quality.

5. Grinding:

- Use a blender or food processor to grind the dried carrot slices into a fine powder. You may need to do this in batches, depending on the volume.

6. Sifting:

- For a finer texture, you can sift the carrot powder through a mesh strainer or sieve to remove any larger particles.

7. Storage:

- Transfer the carrot powder into an airtight container to protect it from moisture and light. Store it in a cool, dark place.
- 220 grams of carrot powder was added in 1litre of milk which gave an orange colour to the milk.



Carrot powder

Preparation of Beetroot extract

Extracting color from beetroot is a straightforward process. The deep red pigment in beetroot, known as betalain, is water-soluble, making it easy to extract. Here's a simple method for extracting color from beetroot:

Ingredients/Equipment:

1. Fresh beetroots
2. Knife or vegetable peeler
3. Grater or food processor
4. Cheesecloth or fine mesh strainer
5. Water
6. Saucepan

Procedure:

1. Preparation:

- Wash and peel the beetroots to remove any dirt or contaminants.
- Grate the beetroots using a grater or a food processor. Finely grated beetroots will release more color during the extraction process.

2. Boiling:

-Place the grated beetroots in a saucepan. Add enough water to cover the grated beetroots completely. Bring the water to proper boil over medium heat.

3. Simmering:

- Reduce the heat to low and let the grated beetroots simmer in the water for about 15-20 minutes. This allows the color to leach out into the water.

4. Straining:

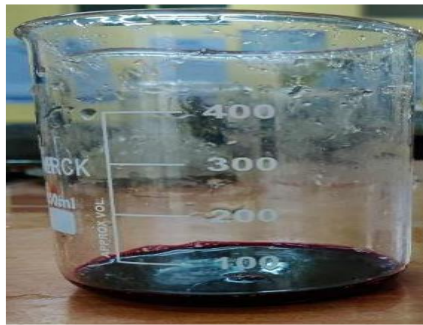
- After simmering, let the beetroot mixture cool slightly. - Strain the liquid through cheesecloth or a fine mesh strainer into another container to separate the beetroot pulp from the colored liquid.

5. Pressing:

- If you want to extract more color, you can press the grated beetroots in the cheesecloth to extract any remaining liquid.

6. Cooling: - Allow the extracted beetroot color to cool to room temperature.

7. Storage: - Store the beetroot color in a clean, airtight container in the refrigerator if not using immediately. Beetroot color can be stored for a few days, but its vibrancy may diminish over time. Out of the total beetroot extract, 60ml of the beetroot extract was taken and added to 1litre of milk.



Beetroot extract

Preparation of Biocolor Fortified Curd

Making curd, also known as yogurt, at home is a simple process that requires only a few ingredients. Here's a basic procedure:

Ingredients:

1. Milk (Here the biocolor fortified milk is used of both carrot and beetroot extract).
2. Yogurt starter culture (store-bought plain yogurt with live active cultures or a small amount of previously made curd)

Equipment:

1. Saucepan
2. Thermometer
3. Whisk
4. Clean cloth or towel
5. Insulated container with lid (for incubation)

Procedure:

1. Heat the Milk: - Pour the milk into a saucepan and heat it gradually over medium heat. Use a thermometer to monitor the temperature. Heat the milk until it reaches around 82°C.
2. Cool the Milk: - Allow the milk to cool down to a temperature of about 43°C. This is the ideal temperature for the yogurt culture to thrive.
3. Add the Starter Culture: - Take a few tablespoons of plain yogurt with live active cultures (either store-bought or from a previous batch) and whisk it into the cooled milk. Ensure that the yogurt is evenly distributed.
4. Prepare for Incubation: - Pour the milk and yogurt mixture into a clean, insulated container suitable for incubation. we can use a glass or plastic container with a lid.
5. Incubate the Yogurt: - Place the container in a warm environment to allow the yogurt to set. The container is placed in the BOD incubator. The incubation period is typically 4 to 8 hours, depending on the desired thickness and tanginess.
6. Check for Set: - After the incubation period, check the yogurt for a set. It should be thickened and have a creamy consistency. If it's not set, leave it for additional time.
7. Refrigerate: - Once the yogurt is set, refrigerate it to stop the fermentation process. This will also enhance the flavor, texture of the yogurt.



Biocolor Fortified Curd

Preparation of Sandesh

Ingredients:

1 liter of full-fat milk

1/2 cup powdered sugar (adjust to taste)

A pinch of cardamom powder

Chopped pistachios or almonds for garnish

Procedure:

Prepare Paneer (Chenna):

Heat the milk in a heavy-bottomed pan until it comes to a boil.

Reduce the heat and add lemon juice or white vinegar gradually while stirring. This will curdle the milk and separate the whey from the curds.

Once the milk has completely curdled, strain it through a muslin cloth or a fine sieve to separate the whey from the paneer. Rinse the paneer under cold water to remove any traces of lemon juice or vinegar.

Knead the Paneer:

Add the carrot and beetroot extract respectively to the chenna. The addition of the extracts gives the color orange and purple to the chenna. Gather the muslin cloth and twist it to remove excess water from the paneer. Place the paneer on a clean surface and knead it for about 8-10 minutes until it becomes smooth and pliable.

Cook the Paneer: Heat a non-stick pan on low heat and add the kneaded paneer. Cook it for about 5-7 minutes, stirring continuously. It helps to remove remaining moisture and gives a smooth texture to the Sandesh.

Add Sugar and Flavoring:

Transfer the cooked paneer to a mixing bowl. Allowing it to cool down for few minutes in ambient temperature.

Add powdered sugar to the paneer and mix well. we can also add a pinch of cardamom powder for flavor.

Shape the Sandesh:

Take small portions of the mixture and shape them into small, flat discs or any desired shape. You can also use molds for a decorative touch.

Garnish:

Garnish each Sandesh with chopped pistachios or almonds, pressing them gently into the surface.



Biocolor fortified Sandesh

Procedure of Calculating ash content of Sandesh:

Materials:

* Sandesh sample

- * Crucibles
- * Desiccator
- * Muffle furnace
- * Analytical balance

Procedure:

1. Weigh the crucibles: Preweigh three clean, dry crucibles and record their weights (W1).
2. Weigh the yogurt sample: Weigh approximately 5 grams of the sandesh sample into each crucible and record the weights (W2).
3. Incinerate the samples: Place the crucibles with the sandesh samples in a muffle furnace preheated to 550°C. Incinerate the samples for about 2 hours or until they turn white or grayish-white, indicating complete combustion of organic matter.
4. Cool the crucibles: Remove the crucibles from the muffle furnace and place them in a desiccator to cool.
5. Weigh the ash: Once the crucibles have cooled to room temperature, weigh them again and record the weights (W3).

Calculation:

Calculation of the ash content using the following formula:

$$\text{Ash content (\%)} = [(W3 - W1) / (W2 - W1)] \times 100$$

where:

- * W1 is the initial weight of crucible
- * W2 is the weight of the crucible with the sandesh sample before incineration
- * W3 is the weight of the crucible with the ash after incineration

Here,

$$W1 = 31.5\text{g}$$

$$W2 = 36.5\text{g}$$

$$W3 = 31.6\text{g}$$

Therefore,

$$\begin{aligned} \text{Ash Content} &= [(31.6 - 31.5) / (36.5 - 31.5)] \times 100 \\ &= 2.1\% \end{aligned}$$

The ash content of Sandesh is 2.1%.

Procedure of Calculating moisture content of Sandesh:

Oven drying method:

1. Weigh a clean, dry dish: Weigh a clean, dry dish and record its weight (W1).
2. Weigh the sandesh sample: Weigh approximately 5 grams of the sandesh sample into the dish and record the weight (W2).
3. Dry the sample: Place the dish and sandesh sample in an oven preheated to 105°C. Dry the sample for about 3 hours or until it reaches a constant weight.
4. Cool the sample: Remove the dish and sample from the oven and place them in a desiccator to cool.
5. Weigh the dried sample: Once the dish and sample have cooled to room temperature, weigh them again and record the weight (W3).

Calculation:

Calculation of the moisture content using the following formula:

$$\text{Moisture content (\%)} = [(W2 - W3) / (W2 - W1)] \times 100$$

where:

- * W1 is the initial weight of the dish
- * W2 is the weight of the dish with the sandesh sample before drying
- * W3 is the weight of the dish with the dried sample after drying

Here,

$$W1 = 20\text{g}$$

$$W2 = 25\text{g}$$

$$W3 = 24.1\text{g}$$

$$\begin{aligned} \text{Therefore, Moisture content (\%)} &= [(25 - 24.1) / (25 - 20)] \times 100 \\ &= 11.7\% \end{aligned}$$

The moisture content of Sandesh is 11.7%.

RESULTS AND DISCUSSION

For Sandesh,

	Ash Content	Moisture content
Plain Sandesh	1.65%	13%
Bicolor Fortified Sandesh	2.1%	11.7%

Column 1 represents Ash content and Column two represents Moisture content.

It is observed that the ash content of bicolor fortified Sandesh is 0.45 percent higher than the ash content of plain Sandesh. It is also observed that the moisture content of bicolour fortified Sandesh is 1.3% lesser than plain Sandesh.

CONCLUSION

As the demand for natural, health-conscious products continues to rise, the utilization of bio colors not only contributes to the aesthetic enhancement of these traditional dairy products but also brings forth a range of potential benefits, both in terms of market interest and nutritional value.

In the realm of curd, the incorporation of bio colors, derived from natural sources such as beetroot and carrot, can revolutionize the visual appeal of this staple dairy item.

The deep red tones from beetroot and the warm oranges from carrot not only infuse a visually appealing quality to the curd but also tap into the preferences of consumers seeking clean-label products free from synthetic additives.

The result is a visually striking, naturally colored curd that not only meets aesthetic expectations but also aligns with the contemporary emphasis on health-conscious eating.

Utilizing natural pigments from sources like beetroot not only imparts an inviting color but also reinforces the product's marketability as a visually distinctive and aesthetically pleasing sweet.

This infusion of bio colors caters to the evolving consumer preferences, where the demand for visually enticing, naturally colored sweets goes hand in hand with the desire for nutritional integrity.

By incorporating beetroot-derived bio colors, these nutritional benefits become seamlessly integrated into the final product.

By embracing natural hues derived from sources like beetroot and carrot, these dairy products can capture the attention of consumers seeking visually appealing, naturally vibrant options.

Simultaneously, the infusion of nutritional benefits from these bio colors aligns with the growing emphasis on health-conscious eating.

The potential market success of bio-colored curd and Sandesh lies not only in their aesthetic allure but also in their ability to meet the evolving expectations of consumers who seek a harmonious blend of taste, visual appeal, and nutritional integrity in their food choices.

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