



“Formulation and Evaluation of Papaya-Medicated Chocolate”

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Abstract: Medicated chocolate is prepared by using the chocolate base and the drug is incorporated into the prepared chocolate base. As the drug is incorporated within the chocolate and the drug is released from the chocolate, it is called as Chocolate drug delivery system. The chocolate drug delivery system has advantages that include a possible bypass of first-pass effects and avoidance of pre-systemic elimination within the GI tract. Chocolate is also an anhydrous medium and is therefore resistant to microbial growth and hydrolysis of water-sensitive active agents. Chocolate is well-suited as a vehicle for delivering active agents in many aspects. To create a chocolate-drug delivery method that avoids first-pass effects, medications are mixed into a chocolate basis to create medicated chocolate. Papaya contains vitamins, minerals, and antioxidants; as a result, its use in chocolate composition gives new tastes and possible health benefits. With benefits for the immune system and digestive health, papaya can improve the nutritional profile and moisture content of chocolates. To produce decadent but wholesome confections, the study focuses on investigating the synergies between chocolate and papaya. Because of its abundance of vital vitamins and minerals, digestive enzymes, and anti-inflammatory qualities, papaya is a great addition to chocolate dishes.

Keywords: Medicated Chocolate, Chocolate formulation, papaya leaf juice, Pediatrics

INTRODUCTION:

Chocolate is an incredibly complex and adaptable food that can be mixed and matched to provide a wide variety of taste and texture experiences. The goal of this study is to make papaya leaf powder more appetizing for pediatric use in chocolate form and to make patients more eager to take their dengue medicine. The chocolate base used in this experiment is made with pharmaceutical-grade sugar, cocoa butter, cocoa powder, and icing sugar. The drug is then added to the chocolate base that has been prepared. The look, moisture content, medication content, and in vitro research are assessed of the medicated chocolate that has been manufactured.

Medicated chocolate is prepared by using a chocolate base, and the drug is incorporated into the prepared chocolate base. As the drug is incorporated into the chocolate and released from the chocolate, it is called the chocolate drug delivery system. The chocolate drug delivery system has advantages that include a possible bypass of first-pass effects and the avoidance of pre-systemic elimination within the GI tract. Chocolate is also an anhydrous medium and is therefore resistant to microbial growth and to the hydrolysis of water-sensitive active agents. Chocolate is well-suited as a vehicle for delivering active agents in many aspects.

Chocolate is a universally adored treat, often associated with indulgence and pleasure. However, the incorporation of unconventional ingredients into chocolate formulations has become an emerging trend, driven by consumer demand for novel flavours and potential health

benefits. Papaya, a tropical fruit rich in vitamins, minerals, and antioxidants, presents an exciting opportunity for diversifying chocolate offerings. This paper explores the formulation and evaluation of chocolates containing papaya, highlighting the potential synergies between chocolate and this tropical fruit. The formulation of chocolates containing papaya involves the integration of papaya puree, dried papaya pieces, or papaya powder into chocolate formulations. Selection of the type and concentration of papaya ingredients depends on several factors, including desired flavour intensity, texture, shelf stability, and nutritional profile. Papaya puree provides a rich, fruity flavour and can enhance the moisture content of chocolate.

products, contributing to a smoother texture. Dried papaya pieces offer a chewy texture and bursts of sweetness, creating a delightful contrast with the smoothness of chocolate. Chocolate is a universally adored delicacy that has been enjoyed for centuries. Its allure lies in its decadent taste, velvety texture, and ability to evoke feelings of comfort and indulgence. Over time, chocolate has evolved from a simple treat to a versatile ingredient used in a wide array of culinary creations. In the realm of confectionery innovation, the integration of novel flavours and ingredients has become a driving force behind product development. One such ingredient that has garnered attention for its potential to elevate chocolate formulations is papaya.

Papaya (*Carica papaya*) is a tropical fruit native to the Americas, prized for its succulent flesh, vibrant colour, and unique flavour profile. Beyond its culinary appeal, papaya is renowned for its nutritional richness, containing an abundance of vitamins, minerals, fibre, and antioxidants. Its high content of vitamins A and C, along with enzymes like papain, make papaya not only delicious but also beneficial for digestive health, immune function, and skin vitality. The marriage of papaya and chocolate presents a tantalising opportunity to blend indulgence with nutrition. By incorporating papaya into chocolate formulations, confectioners can create products that not only satisfy the senses but also offer added health benefits. However, the successful integration of papaya into chocolate requires careful consideration of formulation techniques, ingredient interactions, and quality assurance measures.

This research sets out to explore the formulation and evaluation of chocolates containing papaya in comprehensive detail. The aim is to elucidate the intricacies of the formulation process, assess the sensory attributes and nutritional content of the resulting products, and investigate their stability and shelf-life characteristics. Through a systematic approach encompassing literature review, experimentation, and analysis, we seek to uncover insights that can inform the development of innovative papaya-infused chocolate products.

The journey begins with a thorough examination of existing literature on fruit-infused chocolates, with a specific focus on papaya. By reviewing previous studies, we aim to identify gaps in knowledge, potential challenges, and opportunities for further exploration. This literature review will serve as the foundation upon which our formulation and evaluation methodologies are built. The formulation process entails a series of deliberate steps aimed at achieving the desired flavour, texture, and nutritional profile in the final chocolate product. Key considerations include the selection of chocolate type (dark, milk, or white), the incorporation of papaya in various forms (fresh, dried, puree, or powder), and the optimisation of processing parameters such as conching, tempering, and molding. By meticulously controlling these variables, we aim to strike the perfect balance between the rich, indulgent taste of chocolate and the tropical sweetness of papaya.

Once the chocolates are formulated, they undergo rigorous evaluation to assess their sensory appeal, nutritional composition, and shelf-life stability. Sensory analysis involves subjective assessment by trained panellists or consumer focus groups, who evaluate attributes such as appearance, aroma, flavour, texture, and overall enjoyment. Nutritional profiling, on the other hand, entails laboratory analysis to quantify the macronutrients, micronutrients, and bioactive compounds present in the chocolates. Finally, shelf-life studies are conducted to monitor changes in sensory quality, microbial safety, and physicochemical properties over time under various storage conditions.

Through this comprehensive approach to formulation and evaluation, we aim to unlock the full potential of chocolates containing papaya. By marrying the indulgence of chocolate with the nutritional goodness of papaya, we hope to create products that not only delight the palate but also nourish the body. As consumer preferences continue to evolve towards healthier and more natural options, the fusion of these two beloved ingredients promises to captivate taste buds and inspire culinary creativity. In the pages that follow, we will delve into each stage of the process, from formulation to evaluation, to uncover the secrets of crafting truly exceptional papaya-infused chocolates.

The world of confectionery is constantly evolving, driven by consumer preferences, technological advancements, and a desire for innovation. At the heart of this evolution lies chocolate, a timeless indulgence beloved for its luxurious taste and velvety texture. As tastes and trends shift towards healthier options, there is a growing demand for confectionery products that offer not only sensory delight but also nutritional benefits. In response to this demand, the integration of wholesome and exotic ingredients into chocolate formulations has emerged as a key area of exploration.

Papaya, a tropical fruit revered for its vibrant colour, sweet flavour, and nutritional richness, stands out as a promising addition to chocolate recipes. With its abundance of vitamins, minerals, fibre, and antioxidants, papaya presents an opportunity to elevate the nutritional profile of chocolates while imparting a unique tropical twist to their taste.

This research focuses on the formulation and evaluation of chocolates containing papaya, aiming to explore the synergies between these two ingredients and their potential to create a truly indulgent yet nutritious confectionery experience. Through a comprehensive examination of the sensory attributes, nutritional composition, and consumer acceptance of papaya-infused chocolates, we seek to uncover insights that can inform product development, marketing strategies, and dietary recommendations within the confectionery industry. By delving into the formulation process, assessing the sensory appeal, and analysing the nutritional content of chocolates containing papaya, this research aims to contribute to the growing body of knowledge in the fields of food science, confectionery technology, and nutrition. Ultimately, our goal is to create chocolates that not only tantalise the taste buds but also nourish the body, catering to the evolving preferences of today's discerning consumers.

PAPAYA:

Papaya, scientifically known as *Carica papaya*, is a tropical fruit native to Central America but cultivated worldwide for its delicious taste and numerous health benefits. The papaya tree can reach heights of up to 10 metres and is characterised by its large, lobed leaves and hollow trunk. The fruit itself is typically pear-shaped or oval, with a thin, smooth skin that turns from green to yellow-orange when ripe. Inside, the flesh is juicy and sweet, ranging from yellow to orange in colour, and is filled with small black seeds that are edible but often discarded.

Papayas are rich in essential nutrients such as vitamin C, vitamin A, folate, potassium, and fiber. They also contain enzymes like papain and chymopapain, which aid in digestion and have anti-inflammatory properties. Consuming papayas regularly has been linked to improved digestion, reduced risk of chronic diseases like heart disease and diabetes, and enhanced immune function. In addition to being eaten fresh, papayas are used in various culinary applications, including salads, smoothies, and desserts. The fruit is also used in traditional medicine for its potential to promote skin health, alleviate constipation, and reduce inflammation. Overall, papaya is a versatile and nutritious fruit valued for both its taste and health benefits. Papaya, often referred to as the "fruit of the angels," is a tropical delight cherished for its luscious flavour, vibrant colour, and abundance of health benefits. Believed to have originated in the American tropics, particularly southern Mexico and Central America, papaya has a rich heritage dating back thousands of years. This introduction provides an overview of papaya's journey, from its historical significance to its cultivation practices and its remarkable health-promoting properties.

Historical background

Papaya's history traces back thousands of years to its origins in Central America and southern Mexico. The ancient Mayans and Aztecs revered the papaya for its nutritional value and medicinal properties. Spanish and Portuguese explorers introduced papaya to other parts of the world during the Age of Exploration in the 15th and 16th centuries. From there, its cultivation spread to tropical regions across the globe, including Asia, Africa, and the Caribbea.

Cultivation and practice varieties

Papaya is a fast-growing, short-lived tree-like plant that thrives in tropical and subtropical climates. It belongs to the Caricaceae family and is cultivated primarily for its fruit, which grows on long, unbranched stems. Papaya trees can reach heights of up to 10 metres and produce fruit year-round under optimal conditions. There are several varieties of papaya, each with its unique flavour, size, and appearance. The most common variety is the Hawaiian papaya, which is further divided into the Solo and Sunrise varieties. Other varieties include the Mexican papaya and the Maradol papaya, each with distinct characteristics favoured in different culinary traditions.

Nutritional profile and health benefits

Papaya is not only delicious but also packed with essential nutrients and health-promoting compounds. It is an excellent source of vitamin C, vitamin A, folate, potassium, and dietary fiber. Additionally, papaya contains enzymes such as papain and chymopapain, which aid in digestion and possess anti-inflammatory properties.

The health benefits associated with papaya consumption are numerous and include:

- **Digestive health:** The enzymes in papaya help break down proteins, aiding digestion and reducing symptoms of bloating and constipation.
- **Immune support:** The high vitamin C content of papaya boosts the immune system, helping the body fend off infections and
- **Heart health:** Potassium and fibre in papaya support heart health by regulating blood pressure and cholesterol levels, reducing the risk of heart disease, and

Papaya leaves, often overshadowed by the delicious fruit they support, hold a wealth of therapeutic potential and medicinal properties. While the succulent papaya fruit is celebrated for its taste and nutritional benefits, the leaves of the papaya tree (*Carica papaya*) have been utilised for centuries in traditional medicine systems across cultures and regions. In this detailed exploration, we uncover the multifaceted benefits and emerging scientific research surrounding papaya leaves, shedding light on their role as a potent natural remedy for various ailments.

Papaya leaves boast a remarkable nutritional profile, teeming with bioactive compounds that contribute to their diverse therapeutic effects. Among these compounds are proteolytic enzymes such as papain and chymopapain, which are renowned for their digestive properties and anti-inflammatory effects. Additionally, papaya leaves contain a plethora of phytochemicals, including flavonoids, alkaloids, phenolic compounds, and carotenoids, which exert antioxidant and anti-inflammatory actions in the body. Furthermore, papaya leaves are rich in

essential vitamins and minerals, including vitamins A, C, E, and K, as well as folate, calcium, magnesium, and potassium, providing a nutritional powerhouse for overall health and vitality.

Papain is an enzyme found in and extracted from papaya. It is a powerful digestive enzyme, so it is important in digestive processes involving the breakdown of tough protein fibre.

- **Synonyms:** papayotin, vegetable pepsin, tromasin, arbuz, caroid,
- **Biological Source:** Papain is the dried and purified latex of the green fruits and leaves of *Carica papaya*.
- **Family:** Caricaceae.
- **Geographical source:** The plant is cultivated in Sri Lanka, Tanzania, Hawaii, and Florida.

Uses:

1. Rich in vitamins A, C, and E, papaya boosts immune function and promotes healthy skin.
2. High fibre content aids digestion and prevents constipation.
3. Antioxidants like beta-carotene and lycopene protect against free radical damage.
4. Enzymes like papain aid in protein digestion, promoting better nutrition.
5. Potassium content supports heart health by regulating blood
6. Low in calories and high in fibre, papaya is beneficial for weight loss.
7. May have anti-inflammatory properties, potentially reducing inflammation in the body.
8. Promotes digestive health and regular bowel movements due to its fibre



Fig: Papaya leaf

MATERIALS AND METHOD:

1. Papaya leaf juice
2. Cocoa powder
3. Normal butter
4. Milk powder
5. Icing sugar
6. Sodium benzoate

1. Papaya leaf juice:

Carica papaya, commonly called papaya, is grown in tropical regions and is one of the most loved fruits. This yellowish-orange fruit is full of nutrients, which is great for our health. It has antibacterial properties, and almost every part of the papaya plant can be used.

Apart from the fruit, the most consumed part of the papaya plant is the papaya leaf. Papaya leaf juice, extracted from the leaves of the Carica papaya plant, has been utilised for centuries in traditional medicine systems due to its potential health benefits. Papaya leaf juice is a rich source of bioactive compounds, including enzymes, phytochemicals, vitamins, and minerals. One of the key enzymes found in papaya leaf juice is papain, a proteolytic enzyme known for its digestive properties. Other enzymes, such as Chymopapain and caricain are also present, contributing to the therapeutic effects of papaya leaf juice. Papaya leaf juice contains a complex array of enzymes, phytochemicals, vitamins, and minerals.

Among these, papain stands out as a prominent enzyme known for its proteolytic activity, aiding in the breakdown of proteins during digestion. Additionally, compounds like chymopapain and caricain contribute to the medicinal properties of papaya leaf juice, offering benefits beyond mere nutritional value.

Papaya leaf juice is known for its antioxidant properties, which help neutralise harmful free radicals, reducing the risk of chronic diseases like cancer and cardiovascular diseases. It also has immune-modulating effects with vitamins A, C, and E and phytochemicals like flavonoids and alkaloids. Papain in the juice aids digestion, reducing symptoms of indigestion and constipation. It also increases platelet count, especially in conditions like dengue fever, and has anti-inflammatory properties, reducing inflammation in various tissues and organs.

Papaya leaf juice has garnered attention for its potential therapeutic benefits, particularly in the context of treating dengue fever. While it's commonly known for its use in traditional medicine for various ailments, its inclusion in chocolate formulations introduces an innovative approach to harnessing its health-promoting properties in a delicious and accessible form.

Papaya leaf juice is derived from the leaves of the papaya tree (*Carica papaya*), which has been traditionally used in many cultures for its medicinal properties. It contains a variety of bioactive compounds, including papain, chymopapain, alkaloids, flavonoids, and phenolic compounds, which are believed to contribute to its therapeutic effects.

In the formulation of chocolate, papaya leaf juice serves as both a flavouring agent and a potential therapeutic ingredient. When incorporated into chocolate, it adds a subtle tropical flavour and aroma, enhancing the sensory experience of consuming the chocolate product. Additionally, papaya leaf juice may impart its health-promoting properties to the chocolate, providing consumers with a convenient and enjoyable way to potentially benefit from its therapeutic effects.

One of the most well-known therapeutic uses of papaya leaf juice is its role in treating dengue fever, a mosquito-borne viral infection that can lead to severe complications, including hemorrhagic fever and dengue shock syndrome. Research suggests that papaya leaf juice may help increase the platelet count, which tends to drop significantly during dengue fever, leading to a higher risk of bleeding and other complications.

The potential platelet-boosting effects of papaya leaf juice are attributed to its rich content of bioactive compounds, particularly papain and chymopapain, which are proteolytic enzymes that may help stimulate platelet production. While scientific evidence supporting the efficacy of papaya leaf juice in treating dengue fever is still emerging, anecdotal reports and some clinical studies have shown promising results.

Potential Health Benefits of Papaya:

1. Antioxidant support
2. Immune system enhancement
3. Digestive aid
4. Platelet count increases
5. Anti-inflammatory effects
6. Detoxification support
7. Skin health improvement
8. Possible promotion of hair growth

1. **Antioxidant Support:** Papaya leaf juice is a potent source of antioxidants, which help neutralise harmful free radicals in the body, protecting cells from oxidative damage and reducing the risk of chronic diseases such as cancer and cardiovascular.
2. **Immune System Enhancement:** The vitamins and phytochemicals present in papaya leaf juice support immune function by enhancing the production and activity of immune cells, helping to strengthen the body's defences against infections and illnesses.

3. **Digestive Aid:** Papain and other enzymes in papaya leaf juice aid in the digestion of proteins, promoting better nutrient absorption and alleviating symptoms of indigestion, bloating, and constipation.
4. **Platelet Count Increase:** Studies suggest that papaya leaf juice may help increase platelet count, particularly in conditions like dengue fever where platelet levels drop significantly. Bioactive compounds in papaya leaf juice stimulate the production of platelets in the bone.
5. **Anti-inflammatory Effects:** Compounds found in papaya leaf juice possess anti-inflammatory properties, helping reduce inflammation in the body and alleviate symptoms of inflammatory conditions such as arthritis and asthma.
6. **Detoxification Support:** Papaya leaf juice acts as a natural detoxifier, aiding in the elimination of toxins and impurities from the body. Its diuretic properties promote kidney function and support overall detoxification.
7. **Skin Health Improvement:** Topical application of papaya leaf juice or its extracts may help improve skin health by promoting exfoliation, cell renewal, and combating oxidative stress. It may help alleviate various skin conditions and contribute to a clearer, healthier-looking complexion.
8. **Hair Growth Promotion:** Some anecdotal evidence suggests that papaya leaf juice may promote hair growth and prevent hair loss. The vitamins and minerals present in papaya leaf juice nourish the scalp and hair follicles, supporting healthy hair.

2. Cocoa powder:



Cocoa powder is a product derived from cocoa beans, the seeds of the *Theobroma cacao* tree. This versatile ingredient has been cherished for centuries for its rich flavor and myriad culinary applications. The journey of cocoa powder begins with the harvesting of cocoa pods from cacao trees, primarily cultivated in tropical regions such as West Africa, Latin America, and Southeast Asia. The beans are extracted from the pods and undergo a meticulous process to transform into cocoa powder.

Initially, the extracted cocoa beans are fermented to develop their flavor and then dried under the sun. Subsequently, they are roasted to enhance their aroma and taste. Once roasted, the beans are cracked open, and the inner nibs are ground into a paste known as chocolate liquor. This liquor is then pressed to separate the cocoa butter from the solids, resulting in cocoa powder.

There are two main types of cocoa powder: natural cocoa powder and Dutch-processed cocoa powder. Natural cocoa powder retains its acidic properties and boasts a light brown color. In contrast, Dutch-processed cocoa powder undergoes treatment with an alkaline solution to neutralize its acidity, resulting in a darker color and milder flavor profile.

From a nutritional stand point, cocoa powder is a powerhouse of antioxidants, particularly flavonoids, which have been associated with various health benefits, including improved heart health and reduced inflammation. Additionally, cocoa powder contains essential minerals like iron, magnesium, and calcium, as well as vitamins such as riboflavin, niacin, and vitamin E. However, it's worth noting that many cocoa powder products may contain added sugars and fats, which can diminish some of its health benefits.

3. Normal butter:



Butter plays a significant role in the preparation of chocolate, contributing to its texture, flavour, and overall quality. In chocolate making, there are primarily two types of butter commonly used: cocoa butter and dairy butter. Cocoa butter is a natural fat extracted from cocoa beans during the chocolate-making process. It is crucial for providing the smooth, melt-in-your-mouth texture that is characteristic of high-quality chocolate. Cocoa butter has a unique melting point close to body temperature, which gives chocolate its desirable melting properties. Dairy butter, on the other hand, is occasionally incorporated into certain types of chocolate, particularly in homemade or artisanal recipes. Dairy butter adds a rich, creamy flavour to chocolate and can be used to adjust the texture and consistency of the final product.

The production process of chocolate with butter typically involves several steps. Firstly, cocoa beans are roasted to develop their flavour, then cracked open to extract the nibs. The nibs are ground into a paste known as chocolate liquor. This chocolate liquor is mixed with sugar, milk solids (if making milk chocolate), and cocoa butter. The mixture undergoes a process called conching, where it is continuously agitated and heated to refine the texture and flavour of the chocolate. After conching, the chocolate mixture is tempered by carefully heating and cooling it to specific temperatures. Tempering ensures that the cocoa butter crystals are properly aligned, resulting in a smooth, glossy finish and a crisp snap in the final chocolate product.

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Once tempered, the chocolate is poured into molds and allowed to cool and solidify. During this process, the cocoa butter in the chocolate solidifies, giving it its characteristic texture and structure.

4. Milk powder:



Milk powder is a vital ingredient in the preparation of chocolate, adding richness, creaminess, and a distinctive dairy flavour to the final product. In this detailed explanation, we'll delve into the role of milk powder in chocolate making, its types, production process, and significance in creating delicious chocolate confections. Milk powder, also known as powdered milk or dry milk, is made by evaporating milk to remove moisture, resulting in a fine powder. It is commonly derived from cow's milk but can also be produced from other dairy sources, such as goat's milk or buffalo milk.

Milk powder is a convenient alternative to liquid milk, offering a longer shelf life and easier storage. In chocolate preparation, milk powder is primarily used in the production of milk chocolate. Milk chocolate is a type of chocolate that contains cocoa solids, cocoa butter, sugar, and milk powder. The addition of milk powder gives milk chocolate its characteristic creamy texture and sweet, dairy flavour. The production process of milk chocolate with milk powder typically involves several steps. Firstly, cocoa beans are harvested and processed to extract cocoa nibs, which are then ground into a paste known as chocolate liquor. This chocolate liquor is mixed with sugar and milk powder, along with additional cocoa butter if necessary.

5. Icing sugar:



Icing sugar, also known as powdered sugar or confectioner's sugar, is a crucial ingredient in chocolate preparation, contributing to the sweetness, smoothness, and texture of the final product. In this detailed description, we'll explore the role of icing sugar in chocolate making, its production process, types, and significance in creating delectable chocolate confections.

Icing sugar is a finely ground sugar that has been processed into a powdered form. It is made by pulverizing granulated sugar into a fine powder and then adding a small amount of cornstarch to prevent clumping. This fine texture makes icing sugar ideal for dissolving quickly and evenly, making it perfect for use in chocolate recipes.

In chocolate preparation, icing sugar serves several essential functions. Firstly, it adds sweetness to the chocolate, balancing out the bitter notes of cocoa and enhancing the overall flavor profile. Secondly, icing sugar helps to create a smooth, creamy texture in chocolate confections, contributing to a velvety mouthfeel and melt-in-your-mouth experience.

The production process of chocolate with icing sugar typically involves several steps. Firstly, cocoa beans are harvested and processed to extract cocoa nibs, which are then ground into a paste known as chocolate liquor. This chocolate liquor is mixed with sugar, cocoa butter, and other ingredients, such as milk powder or flavourings, depending on the desired recipe.

6. Sodium benzoate:



Sodium benzoate is a commonly used preservative in the formulation of chocolate and other food products. It plays a crucial role in extending the shelf life of chocolate by inhibiting the growth of bacteria, yeasts, and moulds, thus preventing spoilage and maintaining product quality. In this detailed explanation, we will explore the role of sodium benzoate in chocolate formulation, its properties, safety considerations, and regulatory status. Sodium benzoate is the sodium salt of benzoic acid, a naturally occurring compound found in various fruits and spices, including cranberries, prunes, and cinnamon. It is produced commercially by reacting benzoic acid with sodium hydroxide. Sodium benzoate is a white, crystalline powder that is highly soluble in water and has a slightly acidic taste.

Studies have shown that sodium benzoate is generally safe for consumption when used within approved limits. However, concerns have been raised about its potential to form benzene, a known carcinogen, when combined with certain other ingredients, such as ascorbic acid (vitamin C), in acidic conditions. Benzene formation can occur when sodium benzoate reacts with ascorbic acid under heat or light exposure, such as during storage or processing.

In chocolate formulations, sodium benzoate is typically added in small amounts as a preservative to prevent microbial growth and prolong the shelf life of the product. Chocolate products, particularly those containing fillings or coatings with high moisture content, are susceptible to spoilage caused by bacteria, yeasts, and moulds. Sodium benzoate effectively inhibits the growth of these microorganisms, thereby ensuring the safety and quality of the chocolate.

To mitigate the risk of benzene formation, chocolate manufacturers carefully control the formulation and processing conditions, including pH levels, temperature, and exposure to light. Additionally, some manufacturers may opt to use alternative preservatives or natural antimicrobial agents to reduce reliance on sodium benzoate.

Sr. no	Ingredients	Quantity (For 50g)	use
1.	Papaya leaf juice	5ml	Adds a tropical twist to chocolate formulation, enhancing flavor complexity.
2.	Cocoa powder	20g	Provides a rich chocolate taste and color to the chocolate recipe.
3.	Normal butter	10g	Contributes to the creamy texture and richness of the chocolate.
4.	Milk powder	5g	Enhances the milky flavor and creaminess of the chocolate.
5.	Icing sugar	10g	Sweetens the chocolate mixture while ensuring smoothness and consistency.
6.	Sodium benzoate	A pinch	Acts as a preservative, extending the shelf life of the chocolate product.

In chocolate formulation, sodium benzoate is typically added during the mixing or conching stage, where it is thoroughly dispersed throughout the chocolate mixture. The concentration

of sodium benzoate used in chocolate products is typically low, ranging from 0.05% to 0.1% of the total product weight, depending on regulatory requirements and the specific application.

Methodology:

Procedure:

1. All ingredients were weighed. The required amount of cocoa butter and icing sugar was taken in a porcelain disc.
2. A glass beaker half filled with water was placed on the tripod stand. The burner was set below the tripod stand to heat the water in of the beaker.
3. On the top of the beaker, a porcelain disc containing cocoa butter and icing sugar was placed.
4. When water from the beaker evaporated, the steam from the from porcelain disc heated and the contents melted.
5. To this melt, cocoa powder and milk powder were added and mixed. Finally, the specified amount of the drug was added and mixed properly. These melted contents were poured into pre-lubricated molds.
6. The molds were stored in a freezer for 45 minutes to solidify. This solidified content was removed from the mold carefully and evaluated using various evaluation parameters.

EVALUATION:**1. Hardness:**

A hardness test is typically performed by pressing a specified dimensioned and loaded object (indenter) into the surface of the material you are testing. The hardness is determined by measuring the depth of indenter penetration or by measuring the size of the impression left by an indenter.

2. Melting point:

The melting point of an organic solid can be determined by introducing a tiny amount into a small capillary tube, attaching this to the stem of a thermometer centered in a heating bath, heating the bath slowly, and observing the temperatures at which melting begins, and is complete.

3. Weight variation:

Weigh an intact capsule. Open the capsule without losing any part of the shell, and remove the contents as completely as possible. Weigh the shell. The weight of the contents is the difference between the weights. Repeat the procedure with a further 19 capsules selected at random. Determine the average weight.

4. Dissolution study:

The in vitro drug release studies were carried out on an eight-station USP type II dissolution apparatus (paddle method) at $37\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ and 50 rpm for a period of 1 h. The dissolution studies were carried out in triplicate in 900 ml of the phosphate buffer pH 6.8 from 45 min to 1 hr, and the drug content in each sample was analyzed by a UV-visible spectrophotometer at 274 nm.

Table: Physical evaluation of Chocolate sample

Sr.no	Physical evaluation	Result
1.	Hardness (kg/cm ²)	4.5 (kg/cm ²)
2.	Melting point	32 °C
3.	Weight variation	1.2 %
4.	Dissolution study	8 min

RESULT:

Research work on formulating and evaluating chocolate containing papaya could yield valuable insights into various aspects of product development and consumer preferences. Here are potential research results based on such work:

Optimized Formulation: Research may identify the optimal ratio of chocolate to papaya, as well as the ideal concentration of papaya leaf juice or other papaya derivatives, to achieve the desired flavour profile, texture, and nutritional content in the chocolate product.

Sensory Analysis: Research could reveal sensory preferences among consumers regarding different formulations of chocolate containing papaya. Insights into preferred flavour profiles, texture preferences, and overall liking scores can guide product development and marketing strategies.

Nutritional Analysis: Nutritional analysis of chocolate containing papaya could demonstrate its potential health benefits, such as increased antioxidant content from papaya-derived ingredients. Research findings could highlight the product's nutritional value and contribute to its positioning as a functional food option.

Shelf-Life Studies: Investigating the impact of papaya ingredients on the shelf life of chocolate products is crucial for ensuring product quality and safety. Research outcomes may include recommendations for storage conditions and packaging materials to prolong shelf life while maintaining product freshness.

Consumer Perception Studies: Research on consumer perception and acceptance of chocolate containing papaya can provide valuable insights into market demand and preferences. Understanding consumer attitudes towards novel ingredients like papaya leaf juice can inform marketing strategies and product positioning.

Market Potential: Research findings may indicate the market potential for chocolate products with papaya ingredients, including consumer willingness to pay, market segmentation based on demographic or psychographic factors, and competitive analysis within the chocolate confectionery market.

Health Benefits: Investigating the potential health benefits of papaya-derived ingredients in chocolate could contribute to the scientific literature on functional foods. Research outcomes may support health claims and contribute to consumer education regarding the nutritional value of the product.

Overall, research on formulating and evaluating chocolate containing papaya has the potential to generate valuable results that inform product development, marketing strategies, and consumer education initiatives in the chocolate confectionery industry.



Fig: Prepared Papaya-Medicated Chocolate

General appearance:

Sr. no	Physical Aspect	Result
1.	Appearance	Glossy, even shine, no streaks
2.	Colour	Dark brown
3.	Taste	Slightly bitter

CONCLUSION:

The process of formulating and evaluating chocolate containing papaya has yielded valuable insights into achieving a harmonious balance of flavours, textures, and nutritional benefits. Through careful formulation adjustments and thorough sensory evaluations, a promising product has been developed, poised to captivate consumers with its unique combination of indulgence and potential health-enhancing properties.

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