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2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM



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EDITORS

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
Ms. Nurul Nazwa Mohammad
Ms. Rozaina Saleh

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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
Ms. Nurul Nazwa Mohammad
Ms. Rozaina Saleh

ISETC 2025 Proceedings Editors

FORMULATIONS OF LIP BALM USING NATURAL COLOURS FROM PLANTS

Muhammad Syafiq Farhan Mohd Sabri @ Mohd Fardhir, Muhammad Danial Suhaimi, Rosmawati Abdul Aziz*

Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, 35400 Tapah Road, Perak, Malaysia

**Corresponding author: rosmawatiaa@uitm.edu.my*

Abstract: As the demand for natural and eco-friendly beauty products increases, a lip balm was formulated using safe, simple, and trustworthy natural ingredients. In this project, natural colourants were extracted from commonly available plant materials, including carrot, tomato, rose petals, orange peel, cinnamon, papaya, and jasmine green tea. A plain formulation without added colour served as the control. Each plant powder was infused in mineral oil using a gentle double-boil method to extract colourants, and the resulting-colored oils were incorporated into lip balm formulations along with beeswax, shea butter, and vitamin E. The finished lip balms were evaluated for several physicochemical properties, including pH, melting point, texture, colour stability, and moisturization. Additionally, a small group of evaluators was engaged to assess sensory attributes such as appearance, texture, and scent. The findings were promising. Carrot, tomato, and orange peel produced the most vibrant colours, ranging from yellow-orange to golden and reddish hues. Rose and jasmine contributed subtle colours and mild floral aromas, while cinnamon provided an earthy tone with a warm fragrance. All formulations melted smoothly within the range of 40–45°C, remained stable at room temperature, and exhibited pH values between 6.75 and 7.85. Moisturizing performance across all samples was primarily attributed to the base ingredients used, as the infused plant colourants were not intended to influence hydration or texture. Overall, the study demonstrated the feasibility of producing lip balms that are visually appealing, moisturizing, and pleasant to use, using only natural ingredients without synthetic dyes.

Keywords: *Lip balm, natural colourants, mineral oil infusion, beeswax, vitamin E, double boil method*

INTRODUCTION

As demand for natural cosmetics grows, this study aimed to formulate lip balms using plant-based colourants as alternatives to synthetic dyes. Colour was extracted from carrot, tomato, rose petals, orange peel, cinnamon, papaya, and jasmine green tea via oil infusion. The coloured oils were blended with beeswax, shea butter, and vitamin E. Formulations were evaluated for pH, melting point, texture, colour stability, and moisturization, with sensory feedback from a small panel. Results showed vibrant colours from carrot, tomato, and orange peel, with all samples exhibiting stable properties. This confirms the feasibility of natural, effective, and visually appealing lip balms.

LITERATURE REVIEW

In recent years, more people have chosen beauty products that are natural, safe, and eco-friendly. Many commercial lip balms still use synthetic dyes and chemicals that can irritate the skin over time. Vadje et al. (2024) conducted a comparative evaluation of herbal lip balms using different natural bases. This has led to growing interest in lip balms made with natural, plant-based colourants like carrot, tomato, rose, green tea, and cinnamon. These ingredients contain natural pigments such as carotenoids and lycopene, which provide vibrant colours and may offer added benefits like antioxidant and anti-inflammatory effects (Górecka et al., 2020). Making natural lip balm involves key ingredients like beeswax, shea butter, oils, and vitamin E for moisture, texture, and skin protection (Vadje et al., 2024). The colours are extracted using oil infusion with a double boiler to preserve pigment quality 9 (Vadje et al., 2024; Kour et al., 2024). To ensure safety and effectiveness, the lip balms must also be tested for pH, melting point, stability, and comfort on the lips. While some studies have explored herbal lip care, few compare different plant-based colourants (Lohar et al., 2024). This study fills that gap by testing various natural powders to create safe, colourful, and moisturizing homemade lip balms.

MATERIALS AND METHODS

This study used natural ingredients from plants orange peel, rose petals, papaya, tomato, cinnamon, jasmine green tea, and carrot to extract colours in lip balm formulation. Each plant powder was infused in mineral oil using a double boiler for two hours to preserve heat-sensitive compounds. The coloured-oil was filtered and mixed with melted beeswax, shea butter, and vitamin E to make the lip balms. A control sample without any plant extract was also prepared. All balms were poured into containers and left to set at room temperature. To test quality and performance, samples were evaluated over seven days for changes in appearance, texture, and scent. Stability was assessed under three temperatures (−14 °C, 25 °C, and 40 °C), and melting points were recorded at 40 °C and 45 °C. Volunteers also tested the balms for moisturization and comfort, while pH levels were measured to ensure they were safe for use on lips.

RESULTS

The colour evaluation of the lip balm samples revealed noticeable differences in pigment intensity and overall appearance across the various plant-based formulations as shown in Table 1. The original (ORI) lip balm, which served as the control, appeared white and pigment-free, as no extract was added. Among the coloured variants, the most vibrant shades were found in the Carrot, Orange Peel, and Tomato formulations. The Carrot lip balm showed a bright yellow-orange hue with moderate intensity, while Orange Peel presented a golden-yellow tone with slightly stronger intensity. The Tomato variant featured a yellow-orange base with a hint of red, also displaying moderate colour intensity. In comparison, the papaya lip balm had a softer, light yellow-orange tone with mild intensity. The rose-infused lip balm appeared light pink, while Jasmine Green Tea produced a pale greenish-beige colour, both with subtle pigment. The Cinnamon variant had a beige-brown or muted pinkish-brown shade, also with mild intensity. To evaluate the physical integrity of the lip balms, a series of stability tests were carried out.

Table 1. Lip Balm Colour Obtained

Lip Balm Sample	Observed Colour	Colour Intensity	Remarks
Original (ORI)	White	None	No added pigment, base-only colour
Jasmine Green Tea	Pale green	Very low	Nearly neutral with subtle herbal hue
Roses	Soft pink	Mild	Soft floral tint, light but visible
Papaya	Light yellow-orange	Mild	Fruity, slightly translucent
Carrot	Bright yellow-orange	Moderate	Warm and vibrant tone
Cinnamon	Pale cream	Mild	Earthy appearance, soft natural colour
Orange Peel	Rich yellow-orange	Moderate to strong	Bold citrus colour, consistent tone
Tomato	Bright yellow	Moderate	Slightly deeper than papaya, warm and fruity tone

The appearance stability and thermal stability tests were conducted over a one-week period, while the moisturization test was completed within a few hours. No noticeable changes in colour, scent, or shape were observed during the appearance stability Test. In the thermal stability test, freezing conditions had no visible effect on appearance, though some reduction in fragrance and slight textural changes were noted. The results show in Table 2. At room temperature, all samples remained stable. However, at 40°C, most lip balms melted completely, with the exception of the orange lip balm, which only partially melted. The melting point test further confirmed this: at 40°C, all variants (except orange) began melting within 5 minutes and were fully liquefied by the 10th minute (Patil et al., 2023). The orange lip balm only began melting at the 10-minute mark and did not melt entirely. At 45°C, it was fully melted by the 20th minute. Lastly, the pH analysis showed that all lip balm samples had values ranging between 6.75 and 7.85, which falls within the acceptable range for topical products (Kour et al., 2024).

Table 2. Lip Balm Test Results Table (Based on Plant Ingredients)

Plant-Based Ingredient	Appearance Stability	Thermal Stability	Melting Point	Moisturization	pH
Original	No colour, no texture change, no change in scent, and the shape remained unchanged.	Slightly dry at -14°C; no changes at room temp; fully melted at 40°C	Started melting at 5 min (40°C), fully melted at 10 min. (40°C)	Moderate, non-greasy, slightly short-lasting	7.26
Orange peel	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; not fully melted at 40°C	Started at 10 min (40°C), fully melted at 20 min (45°C).	Lips feel moisturized, not oily.	6.77
Papaya	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Good moisturization, quickly absorbed	7.5
Carrot	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Moderate, slightly smooth feel	6.95
Tomato	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Good, slightly sticky	6.85
Rose Petals	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Moderate, light floral scent	7
Cinnamon	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Lower moisturization, more protective	6.89
Jasmine Green Tea	Colour stable, no texture or scent change, shape unchanged	Slightly dry at -14°C; fully melted at 40°C	Started at 5 min (40°C), fully melted at 10 min (40°C)	Light moisturization, natural scent faded	6.97

DISCUSSION/ANALYSIS

This study highlights how natural pigments and formulation choices can greatly affect the look and performance of lip balm products. Each type of lip balm showed different colours depending on the ingredients used. For example, the carrot and orange lip balms stood out with bright, vibrant yellow-orange tones. This is likely due to the high beta-carotene content in these ingredients, which naturally reflects orange-yellow light (Ansari et al., 2022). Interestingly, the tomato lip balm turned out to be more yellow than red, which wasn't what we initially expected. This could mean that the lycopene (the red pigment in tomatoes) either existed in a lower concentration or degraded during the extraction or heating process. Since beta-carotene is more stable than lycopene, it may have become the dominant pigment, giving the balm its yellow appearance (Górecka et al., 2022). The rose lip balm had a soft pink colour which fits well with the presence of anthocyanins, natural pigments found in flower petals that can produce red, pink, or

purple tones depending on the pH (Yusra & Ginting, 2023). On the other hand, the jasmine green tea balm showed a pale green shade. It wasn't intense but still had a visible green tint, likely due to low chlorophyll content or partial breakdown during preparation. Chlorophyll is quite sensitive to heat and light, so it's possible that some of its colour was lost (Formula Botanica, 2024). The cinnamon and ORI (original base) lip balms did not show much colour at all, which makes sense, since they either had no pigments or were made purely from the base ingredients like oils and waxes. When it came to heat resistance, the orange lip balm showed the most stability under higher temperatures. This version contained 10 grams of both beeswax and shea butter, which are known for their solid structure and high melting points. These ingredients helped the balm stay firm even in warmer conditions. In contrast, lip balms with only 5 grams of those base materials were much softer and more likely to melt. This shows how important it is to get the right ratio of base to active ingredients, especially for products made for hot or tropical climates (Visht et al, 2024). The moisturization test results were also promising. All the lip balm samples helped improve lip texture, and every participant shared positive feedback. Every participant described their lips as feeling smoother, softer, and less dry after use. This shows how well the combination of emollient and occlusive ingredients like oils, shea butter, and beeswax worked to keep moisture in. These ingredients help by both softening the skin and forming a protective layer to reduce water loss (Chavan & Chikkodi, 2024). Lastly, all the lip balm formulations had pH levels between 6.75 and 7.85, which falls within the safe range for skin and lips. Since the lips are more sensitive than other areas of the skin, it's important that cosmetic products maintain a gentle pH. Too acidic or too alkaline can cause irritation, but a near-neutral pH helps keep the skin barrier healthy and reduces the risk of discomfort (Fischer, 2025). Overall, the results of this study show that using natural plant extracts can improve both the function and the feel of lip balm. The pigments enhance the product's appearance, while the base ingredients contribute to stability and moisture. When carefully balanced, these natural components make the product not only effective but also appealing and safe for daily use, something that consumers are increasingly looking for in today's cosmetic market.

CONCLUSIONS

In summary, this study effectively showed that eco-friendly lip balm formulations with desired aesthetic and functional qualities may be made using natural, plant-based ingredients. While rose, jasmine, and cinnamon offered delicate tints and pleasing scents, carrot, tomato, and orange peel were used to create vivid, eye-catching colors. All formulations demonstrated acceptable pH levels and stable physicochemical characteristics, indicating their suitability for routine usage. Positive user reactions regarding texture, smell, and appearance were validated by sensory assessments. These results provide credence to the expanding possibilities of natural cosmetics, which provide a sustainable and user-friendly substitute for traditional lip balms with artificial ingredients.

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