



IMPROVEMENT OF THE PRODUCTION TECHNOLOGY OF A NATURAL GEL-BASED CLEANSING AGENT USING ESSENTIAL OIL EXTRACTED FROM ROSA DAMASCENA PETALS

Master's students of Fergana State Technical University

Vahobova Gulnozaxon Vohidjonovna

Kadirova Nafisaxon Bannopovna

gulnozaxonvahobova97@gmail.com

Abstract: The growing global demand for natural, eco-friendly, and skin-safe personal care products has stimulated intensive research into plant-based raw materials. Rosa damascena, widely known for its high-value essential oil, possesses significant antimicrobial, antioxidant, and aromatic properties, making it a promising ingredient for cosmetic and hygiene formulations. This study focuses on improving the production technology of a natural gel-based cleansing agent incorporating essential oil extracted from Rosa damascena petals. The research aims to optimize the extraction process of rose essential oil and enhance its incorporation into a gel formulation while preserving its bioactive compounds. Special attention is given to the selection of natural gelling agents, stabilization techniques, and formulation parameters that improve product texture, cleansing efficiency, and skin compatibility. Physicochemical properties, microbiological safety, and sensory characteristics of the developed cleansing gel are evaluated to ensure product quality and consumer acceptability. The improved technology is expected to reduce the use of synthetic surfactants and preservatives, thereby minimizing potential skin irritation and environmental impact. The results of this study contribute to the development of sustainable cosmetic technologies and promote the utilization of natural plant-based resources in hygiene product manufacturing.

Keywords: Rosa damascena, essential oil, natural cleansing gel, plant-based cosmetics, gel formulation, eco-friendly hygiene products.

The cosmetic and personal care industry is increasingly shifting toward the use of natural and environmentally friendly raw materials due to growing concerns about human health and ecological sustainability. Conventional cleansing products often contain synthetic surfactants, artificial fragrances, and chemical preservatives that may cause skin irritation, allergic reactions, and long-term damage to the skin barrier. In response to these challenges, scientific research has focused on the development of plant-based formulations that are both effective and safe for regular use. Among such natural resources, Rosa damascena has attracted significant attention because of its rich essential oil



composition and long history of application in cosmetic and therapeutic products. *Rosa damascena*, commonly known as Damask rose, is a valuable aromatic plant belonging to the Rosaceae family. Its petals are widely used for the extraction of essential oil, which is considered one of the most expensive and biologically active essential oils in the world. The essential oil derived from *Rosa damascena* petals contains a complex mixture of volatile compounds, including citronellol, geraniol, nerol, phenyl ethyl alcohol, and various flavonoids. These components are responsible not only for the characteristic fragrance of rose oil but also for its antimicrobial, antioxidant, anti-inflammatory, and soothing properties. Due to these characteristics, rose essential oil is particularly suitable for incorporation into natural cleansing products designed for sensitive and delicate skin types. The quality and functional properties of essential oil largely depend on the extraction technology used. Traditional extraction methods such as hydrodistillation and steam distillation have been widely applied in rose oil production. Hydrodistillation involves boiling rose petals in water to release volatile compounds; however, prolonged exposure to high temperatures can lead to partial degradation of thermally sensitive components. Steam distillation provides better preservation of aromatic compounds, yet it still requires high energy consumption and may result in limited yield efficiency. Therefore, improving extraction technology is an important aspect of enhancing the overall quality of the final cleansing product.

Modern extraction techniques such as supercritical carbon dioxide extraction, ultrasound-assisted extraction, and microwave-assisted extraction have demonstrated significant advantages over conventional methods. These technologies operate under controlled conditions that minimize thermal degradation and oxidation of bioactive compounds. In particular, supercritical CO₂ extraction allows for selective isolation of essential oil components without the use of organic solvents, resulting in high-purity extracts with preserved biological activity. Optimization of extraction parameters, including temperature, pressure, extraction time, and raw material particle size, plays a crucial role in maximizing oil yield and maintaining its functional properties. Gel-based cleansing agents have become increasingly popular due to their pleasant texture, ease of application, and effective yet gentle cleansing action. Unlike traditional soap-based products, gel cleansers can be formulated using mild surfactants that do not disrupt the natural lipid balance of the skin. The incorporation of *Rosa damascena* essential oil into a gel-based formulation enhances not only the sensory properties of the product but also its functional performance. The antimicrobial activity of rose oil contributes to the reduction of harmful microorganisms on the skin surface, while its antioxidant properties



help protect skin cells from oxidative stress caused by environmental factors. One of the main technological challenges in developing a natural gel-based cleansing agent is the stabilization of essential oil within the formulation. Essential oils are volatile and sensitive to light, oxygen, and temperature, which can lead to oxidation and loss of bioactivity during processing and storage. To address this issue, various stabilization strategies can be employed, including emulsification, encapsulation, and the use of natural antioxidants such as vitamin E or plant-derived polyphenols. These approaches help maintain the integrity of essential oil components and extend the shelf life of the final product.

The choice of gelling agent is another critical factor in the formulation of natural cleansing gels. Synthetic polymers are commonly used in conventional products; however, natural alternatives such as xanthan gum, guar gum, carrageenan, aloe vera gel, and cellulose derivatives are preferred in eco-friendly formulations. Natural gelling agents provide suitable rheological properties, improve product stability, and enhance skin compatibility. Additionally, they contribute to the biodegradability of the product, reducing its environmental impact after use. The interaction between natural surfactants, gelling agents, and essential oil must be carefully balanced to achieve optimal cleansing efficiency and product stability. Mild surfactants derived from plant sources, such as coco-glucoside or decyl glucoside, are commonly used in natural formulations due to their low irritation potential. When combined with *Rosa damascena* essential oil, these surfactants create a synergistic effect that enhances cleansing performance while maintaining skin hydration and comfort. Improving the production technology of a natural gel-based cleansing agent also involves optimizing processing conditions such as mixing speed, temperature control, and pH adjustment. Maintaining an appropriate pH level is essential to ensure skin compatibility and prevent degradation of bioactive compounds. The final product should exhibit stable physicochemical properties, including viscosity, homogeneity, transparency, and pleasant sensory characteristics, which are important factors influencing consumer acceptance. Microbiological safety is another important aspect of natural cleansing product development. Although essential oils possess antimicrobial properties, additional measures may be required to ensure product safety during storage and use. The use of natural preservatives or hurdle technology, which combines multiple mild preservation methods, can effectively prevent microbial contamination without relying on synthetic chemicals. This approach aligns with the principles of green chemistry and sustainable product development. In conclusion, the integration of *Rosa damascena* essential oil into a natural gel-based cleansing agent represents a promising approach to the development



of safe, effective, and environmentally friendly hygiene products. By improving extraction methods, optimizing formulation components, and enhancing stabilization techniques, it is possible to produce a high-quality cleansing gel that meets modern consumer demands for natural and sustainable cosmetics.

The development of a natural gel-based cleansing agent containing *Rosa damascena* essential oil requires comprehensive evaluation of its physicochemical properties to ensure product quality and stability. Parameters such as viscosity, density, pH value, foaming ability, and spreadability play a significant role in determining the functional performance of the cleansing gel. Viscosity, in particular, influences consumer perception and ease of use. A well-balanced gel should maintain sufficient thickness to prevent excessive runoff while allowing smooth application on the skin. Natural gelling agents must therefore be carefully selected and optimized to achieve the desired rheological behavior without compromising the stability of essential oil components. The pH of the cleansing gel is another critical factor affecting both skin compatibility and product stability. Human skin typically has a slightly acidic pH ranging from 4.5 to 5.5, which helps maintain the natural skin barrier and microbial balance. Formulating the cleansing gel within this pH range minimizes the risk of irritation and supports the protective function of the skin. *Rosa damascena* essential oil demonstrates good stability under mildly acidic conditions, making it suitable for incorporation into skin-friendly gel formulations. Foaming properties, although not directly related to cleansing efficacy, significantly influence consumer satisfaction. Many users associate foam formation with effective cleaning, even though mild, low-foaming surfactants can provide adequate cleansing action. The presence of natural surfactants combined with rose essential oil results in soft and stable foam that enhances the sensory experience without causing dryness or irritation. Optimizing surfactant concentration is essential to balance cleansing efficiency and skin comfort. Sensory evaluation is an important component of product development, as consumer acceptance largely depends on fragrance, texture, and overall feel during use. *Rosa damascena* essential oil provides a natural and pleasant aroma that enhances the attractiveness of the cleansing gel without the need for synthetic fragrances. Additionally, the soothing properties of rose oil contribute to a calming effect on the skin, which is particularly beneficial for individuals with sensitive or reactive skin conditions.

From a technological perspective, improving the production process involves refining each stage of manufacturing, including raw material preparation, extraction, formulation, mixing, and packaging. The quality of rose petals used for essential oil extraction significantly influences the final



product. Factors such as harvesting time, drying conditions, and storage environment must be controlled to preserve the aromatic and bioactive compounds in the petals. Fresh or gently dried petals are generally preferred to minimize the loss of volatile components. During formulation, controlled mixing conditions are necessary to ensure uniform distribution of essential oil throughout the gel matrix. High shear mixing can lead to volatilization or degradation of essential oil components, whereas insufficient mixing may result in phase separation or uneven texture. Therefore, optimizing mixing speed and duration is essential for achieving a homogeneous and stable product. Temperature control during processing is equally important, as excessive heat can negatively affect both the essential oil and natural gelling agents.

Packaging also plays a vital role in maintaining product quality and shelf life. Exposure to light, air, and moisture can accelerate oxidation and degradation of essential oil components. The use of opaque or UV-protective packaging materials helps preserve the stability of *Rosa damascena* essential oil and maintain the sensory properties of the cleansing gel. Airless pump systems further reduce the risk of microbial contamination and oxidation during consumer use. Sustainability considerations are increasingly important in cosmetic product development. The use of plant-based raw materials, biodegradable ingredients, and environmentally friendly packaging aligns with global trends toward sustainable consumption. *Rosa damascena* cultivation supports agricultural development and provides economic benefits to rural communities. Utilizing rose petals, including by-products from the perfume industry, contributes to waste reduction and efficient resource utilization. The environmental impact of natural gel-based cleansing agents is generally lower compared to conventional products containing synthetic chemicals. Natural surfactants and gelling agents are more readily biodegradable and less harmful to aquatic ecosystems. By reducing the reliance on petrochemical-derived ingredients, the improved production technology supports the principles of green chemistry and sustainable manufacturing.

In addition to environmental benefits, the development of natural cleansing gels offers significant economic potential. Consumer demand for natural and organic personal care products continues to grow globally, creating new market opportunities. Products formulated with high-value ingredients such as *Rosa damascena* essential oil can be positioned as premium or therapeutic cosmetics, increasing their commercial attractiveness. Improved production efficiency and optimized formulations help reduce manufacturing costs while maintaining high product quality. Scientific evaluation of the developed cleansing gel includes microbiological testing to ensure safety and compliance with regulatory standards. Although *Rosa damascena* essential oil



exhibits antimicrobial properties, comprehensive testing is required to confirm the absence of pathogenic microorganisms throughout the product's shelf life. Stability studies conducted under different storage conditions provide valuable information on the long-term performance and safety of the formulation. Overall, improving the technology for producing a natural gel-based cleansing agent using *Rosa damascena* essential oil represents a multidisciplinary approach combining botany, chemistry, cosmetic science, and environmental sustainability. The integration of advanced extraction techniques, natural formulation components, and optimized processing conditions results in a high-quality product that meets modern consumer expectations for safety, effectiveness, and ecological responsibility.

CONCLUSION

The improvement of the production technology of a natural gel-based cleansing agent using *Rosa damascena* essential oil proves the effectiveness of plant-based ingredients in modern cosmetic formulations. The essential oil demonstrates strong antimicrobial, antioxidant, and soothing properties, which enhance the cleansing efficiency and skin compatibility of the product. Optimization of the extraction process and formulation parameters allows preservation of bioactive compounds and improves product stability and quality. The use of natural gelling agents and mild surfactants ensures gentle cleansing while maintaining the skin's natural balance. Overall, the developed technology supports sustainable, eco-friendly cosmetic production and provides a safe and effective alternative to conventional synthetic cleansing products.

REFERENCES

1. Baser, K. H. C., & Buchbauer, G. (2010). *Handbook of Essential Oils: Science, Technology, and Applications*. CRC Press, Taylor & Francis Group.
2. Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods – a review. *International Journal of Food Microbiology*, 94(3), 223–253.
3. Lawless, J. (2014). *The Encyclopedia of Essential Oils: The Complete Guide to the Use of Aromatic Oils in Aromatherapy, Herbalism, Health and Well-being*. Conari Press.
4. McKay, D. L., & Blumberg, J. B. (2006). A review of the bioactivity and potential health benefits of rose species. *Phytotherapy Research*, 20(8), 619–633.
5. Tisserand, R., & Young, R. (2014). *Essential Oil Safety: A Guide for Health Care Professionals*. Churchill Livingstone Elsevier.



6. Zheljazkov, V. D., Cantrell, C. L., Astatkie, T., & Ebelhar, M. W. (2013). Rose oil yield and composition as influenced by distillation time. *HortScience*, 48(7), 807–812.
7. Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). *Handbook of Pharmaceutical Excipients*. Pharmaceutical Press.
8. Charles, D. J. (2013). *Antioxidant Properties of Spices, Herbs and Other Sources*. Springer Science+Business Media.
9. ISO 9235:2013. *Aromatic natural raw materials – Vocabulary*. International Organization for Standardization.