Comparison of the Effects of Different Concentrations of Jojoba Oil and Castor Oil On the Properties of A Night Cream

[Name]

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Jojoba Oil and Castor Oil In Night Cream

Introduction

Jojoba oil is a versatile natural oil derived from the seed of the jojoba plant (Simmondsia Chinensis) that grows in arid regions of North America. It is a unique oil that closely resembles human sebum and is commonly used in skincare and cosmetic products due to its moisturizing properties. Jojoba oil is rich in vitamins, minerals, and antioxidants and has been shown to improve skin hydration and barrier function (Khairi, 2019). Castor oil, on the contrary, is a pale-yellow oil derived from the castor bean plant (Ricinus communis) that is native to tropical regions of Africa and South Asia. It has been used for centuries in traditional medicine due to its anti-inflammatory and healing properties (Singh et al., 2022). Castor oil is rich in fatty acids, including ricinoleic acid, which is thought to be responsible for its therapeutic effects.

Both jojoba oil and castor oil have several advantages for the skin and hair. Jojoba oil is non-greasy and is easily absorbed by the skin, making it ideal for use as a moisturizer. It has also been shown to have anti-inflammatory effects, making it helpful for those with acne-prone skin (Geria., 2020). Castor oil is also a good moisturizer and has been used to treat skin conditions such as eczema and psoriasis (Kang et al., 2022). It is also commonly used as a hair treatment to promote hair growth and improve hair health. However, both oils also have some disadvantages. Jojoba oil can be expensive compared to other oils and may not be suitable for those with nut allergies (Gad et al., 2021). Castor oil is also relatively expensive and can be very thick and sticky, making it difficult to apply and wash off. In addition, castor oil may cause skin irritation in some individuals, particularly those with sensitive skin (Sharma et al., 2022).

Jojoba oil is commonly used in cosmetic and skincare products due to its unique properties. Jojoba oil has a high concentration of wax esters, which are similar to the natural oils produced by our skin (Khairi, 2019). This makes it an excellent moisturizer and helps to maintain the skin's natural barrier function. Jojoba oil is also rich in vitamins, minerals, and antioxidants, including vitamins E and B complex, which are known to have anti-inflammatory and anti-aging properties (Ahmed et al., 2020). Castor oil, on the contrary, is also high in fatty acids, such as oleic acid and linoleic acid, which help to moisturize and protect the skin. Additionally, castor oil has been shown to have anti-inflammatory and

antimicrobial properties, making it useful for treating skin conditions such as eczema and psoriasis (Singh et al., 2022).

In cosmetic and skin care products, jojoba oil is typically used in concentrations of 1-5%, while castor oil is used in concentrations of 5-10% (Pan et al., 2021; Fiume et al., 2022). However, it is important to note that the concentration used may vary depending on the individual product and its intended use. For example, products specifically designed for hair treatment may contain higher concentrations of castor oil compared to facial oils, where lower concentrations may be used. It is because castor oil is a thick and sticky oil, which can be beneficial for moisturizing and strengthening hair, but may be too heavy for some skin types (Kang et al., 2022).

In contrast, jojoba oil is often used in lower concentrations due to its lighter consistency, making it suitable for use in a wider range of cosmetic and skincare products, including facial oils, moisturizers, and makeup removers (Mohiuddin, 2019). However, it is important to consider individual skin types and preferences when using these oils, as some individuals may find even low concentrations of jojoba oil to be too heavy for their skin. In addition to concentration, it is also important to consider the other ingredients present in cosmetic and skincare products when using jojoba oil and castor oil. Some products may contain ingredients that may interact with these oils, leading to potential skin irritation or other adverse effects. Brar (2021) recommended patching and testing these oils before use, particularly for individuals with sensitive skin.

Texture Analyser

A texture analyser is a tool used in the cosmetic and food industries to measure the physical properties of products such as viscosity, firmness, and elasticity (Tafuro et al., 2021). This tool will be used to evaluate the texture and consistency of jojoba oil and castor oil at different concentrations. For example, a texture analyser could be used to measure the viscosity of jojoba oil at 1%, 5%, and 10% concentrations, and the results could be compared to determine the effect of concentration on the viscosity of the oil.

Similarly, a texture analyser will also be used to evaluate the firmness and elasticity of castor oil at 5%, 7.5%, and 10% concentrations. The results of these measurements could provide insight into the effect of concentration on the physical properties of castor oil, and

could be used to inform the formulation of cosmetic and skincare products containing this oil (Maktabi et al., 2021).

The Rationale of the Work

The comparison of jojoba oil and castor oil is an important aspect of the development of a night cream product. The rationale behind this comparison is to determine the effect of the concentration of these oils on the general properties of the night cream. By evaluating the effects of high, low, and mid concentrations of these oils, the research team will gain a better understanding of how the use of these oils in different concentrations will impact the final product.

This work on oils fits in the group project working on the development of a night cream as the properties of the oils will play a significant role in determining the quality and effectiveness of the final product. For example, the viscosity and elasticity of the oils at different concentrations can impact the spreadability and absorption of the night cream into the skin (Mawazi et al., 2022). Additionally, the moisturising properties of these oils can also play a role in the hydration and nourishment of the skin during the night (Ahmed et al., 2020).

Furthermore, understanding the effects of different concentrations of jojoba oil and castor oil on the night cream can inform the formulation process and help the research team make informed decisions about the use of these oils in the final product. This information will also be used to make adjustments to the formulation if necessary, to optimise the properties of the night cream for maximum benefit to the consumer (Ezekwe et al., 2020).

Aims and Objectives

Aims:

This investigation aims to compare the effects of different concentrations of jojoba oil and castor oil on the properties of night cream and to evaluate the viscosity, elasticity, and moisturising properties of the oils at high, low, and mid concentrations using a texture analyser.

Objectives:

By considering the aim of the present research, the following objectives are devised:

1. To determine the impact of concentration on the physical properties of jojoba oil and castor oil, and how these properties may affect the spreadability and absorption of the night cream into the skin.

2. To understand the role that jojoba oil and castor oil play in the hydration and nourishment of the skin during the night.

3. To use the results of the study to inform the formulation process and make informed decisions about the use of these oils in the final night cream product.

4. To optimise the properties of the night cream for maximum benefit to the consumer.

Methodology

Experimental Method for Mini Project

The experiments will focus on comparing the effects of different concentrations of jojoba oil and castor oil on the properties of a night cream. To achieve this aim, the following experiments will be conducted:

1. Preparation of oil samples: To prepare the oil samples for the night cream, the jojoba oil, and castor oil will be obtained from a commercial source. The jojoba oil will be used in concentrations of 1%, 3%, and 5% while castor oil will be used in concentrations of 5%, 7.5%, and 10%. These concentrations were chosen based on the typical use of these oils in cosmetic and skincare products (Pan et al., 2021; Fiume et al., 2022). The oils will be mixed with a base cream to create the night cream samples. The base cream will be prepared by mixing glycerin, stearic acid, and water in a specific ratio.

2. Texture analysis: The texture of the night cream samples will be evaluated using a texture analyser. The texture analyser will measure the viscosity, elasticity, and moisturizing properties of the night cream samples at each concentration of the oils. The texture analyser works by applying a controlled force to the sample and measuring the deformation of the sample in response to the applied force. The texture analyser will provide a detailed analysis of the physical properties of the night cream samples, including the hardness, cohesiveness, adhesiveness, and spreadability of the cream. The use of a texture analyser in this study is justified by the fact that it provides a non-

destructive method for evaluating the physical properties of the night cream samples. The texture analyser can accurately measure the viscosity, elasticity, and moisturising properties of the night cream samples, which are important factors in determining the overall quality and effectiveness of the final product (Pióro et al., 2019; Cyriac et al., 2022; Bhamare and Mulay, 2022)

3. Viscosity measurement: The viscosity of the night cream will be measured at high, low, and mid concentrations of jojoba oil and castor oil using a texture analyser. The texture analyser will measure the resistance of the product to flow under an applied force and convert it into a numerical value (Pióro et al., 2019). This experiment will be performed in triplicate to ensure the accuracy of the results.

4. Elasticity measurement: The elasticity of the night cream will be measured at high, low, and mid concentrations of jojoba oil and castor oil using a texture analyser (Cyriac et al., 2022). The texture analyser will apply controlled stress and measure the resulting deformation. This experiment will also be performed in triplicate.

5. Moisturising properties measurement: The moisturising properties of the night cream will be evaluated by measuring the water content of the skin before and after the application of the night cream. The skin hydration meter will be used to measure the water content of the skin (Roy et al., 2020). A test subject will apply the night cream to a specified area of their skin and the hydration levels will be measured at regular intervals over a specified period. This experiment will be performed on at least three different test subjects to account for individual variations in skin type and hydration levels.

6. Data analysis: The data collected from the texture analyser will be analysed using statistical software to determine the impact of concentration on the physical properties of the oils and the night cream. The results will be compared to evaluate the effects of different concentrations of the oils on the spreadability, absorption, hydration, and nourishment of the night cream. The data analysis will involve statistical techniques such as regression analysis and hypothesis testing to determine the significance of the results and to make meaningful comparisons between the night cream samples (Bhamare and Mulay, 2022).

7. Interpretation of results: The results of the texture analysis and data analysis will be interpreted to determine the impact of different concentrations of jojoba oil and castor oil on the properties of the night cream. The results will be used to inform the formulation process and to optimise the properties of the night cream for maximum benefit to the consumer.

To ensure that the results are reliable and reproducible, the experiments will be conducted in a controlled laboratory environment with strict temperature and humidity controls. The chemicals used in the experiments will be of high purity and of known concentration, and all measurements will be recorded with a high degree of accuracy. By using a combination of these methods, the aim of this project, to evaluate the effects of different concentrations of jojoba oil and castor oil on the properties of a night cream, can be achieved.

Experimental Method for the Final Night Cream

The production of the final night cream will involve several steps and experiments, each of which will be justified in detail. The first step will be to prepare the oil phase, which will include jojoba oil and castor oil at different concentrations, along with other emollients such as paraffin and butter. The oils will be heated to a specific temperature and mixed until they are homogenised. The temperature and mixing time will be carefully controlled to ensure that the oils are fully combined and do not separate.

The next step will be to prepare the aqueous phase, which will include glycerine as a humectant and water as the solvent. The aqueous phase will also be heated to a specific temperature, and the pH will be adjusted to an appropriate level using pH modifiers. Once the oil and aqueous phases are prepared, they will be combined using a suitable emulsifying agent, such as SLS, stearic acid, or cetearyl alcohol. The emulsifying agent will be added to the aqueous phase and mixed in, followed by the addition of the oil phase. The mixture will be homogenized using a homogenizer until a stable emulsion is formed.

The final night cream will then be thickened using a suitable thickener, such as xanthan gum, guar gum, or gum arabic. The thickener will be added to the emulsion and mixed in until the desired viscosity is achieved. The cream will then be cooled to room temperature and packaged in suitable containers. Once the final night cream is produced, it will be evaluated using a texture analyser to determine its viscosity, elasticity, and

moisturising properties at high, low, and mid concentrations of jojoba oil and castor oil. The number of replicates for each experiment will be determined based on the desired level of precision and the results will be recorded.

The data collected during the experiments will be analyzed to determine the effects of different concentrations of jojoba oil and castor oil on the properties of the night cream. This information will be used to inform the product development and optimize the final formulation. All the steps in the production of the night cream will be performed in a controlled environment, with strict attention to hygiene and safety. All parameters such as chemical concentrations, temperatures, mixing times, and mixing speeds will be carefully controlled and recorded.

TimeLine for the Project

Weekly Plan	Objectives
Week 21: Collection of materials and preparation of the night cream base	• Obtain all necessary materials and equipment • Prepare the night cream base using the ingredients listed in the formulation (solvent, aqua, glycerine, emollients, thickeners, actives, emulsifiers, silicons, antioxidants, preservative, and pH modifiers)
Week 22-23: Incorporation of jojoba oil and castor oil into the night cream base	• Prepare high, low, and mid concentrations of jojoba oil and castor oil • Incorporate the different concentrations of the oils into the night cream base
Week 24-25: Testing of the viscosity, elasticity, and moisturising properties of the night cream with different concentrations of jojoba oil and castor oil	• Use a texture analyser to test the viscosity, elasticity, and moisturising properties of the night cream with different concentrations of jojoba oil and castor oil
Week 26-28: Analysis of data and comparison of the results	• Analyse the data collected from the texture analyser • Compare the results of the different concentrations of jojoba oil and castor oil

Week 29-30: Write-up and presentation of the findings	• Write a report summarising the findings of the study • Present the results in a suitable format (e.g., poster, oral presentation, etc.)

Data Collection Plan

In this mini-project, the following data will be collected:

1. Viscosity: This will be measured using a texture analyser to determine the flow behavior of the night cream at high, low, and mid concentrations of jojoba oil and castor oil. The texture analyser measures the resistance of the product to flow under an applied force and converts it into a numerical value.

2. Elasticity: This will be measured using a texture analyser to determine the resistance of the night cream to deformation at high, low, and mid concentrations of jojoba oil and castor oil. The texture analyser applies a controlled stress and measures the resulting deformation.

3. Moisturising properties: The moisturising properties of the night cream will be evaluated using the skin hydration meter, which measures the water content of the skin. This will be done by applying the night cream to a test subject's skin and measuring the hydration levels before and after a specified period.

The data collected will be interpreted and used to inform product development in the following ways:

1. Viscosity and Elasticity: The viscosity and elasticity data will be used to determine the consistency and texture of the night cream, which are important factors in product quality and consumer acceptance. The numerical values obtained from the texture analyser will be compared between different concentrations of jojoba oil and castor oil to identify any significant differences. These differences will be evaluated in terms of the effect on product performance and consumer preference.

2. Moisturising Properties: The data obtained from the skin hydration meter will be used to determine the moisturising efficacy of the night cream. The results will be compared

between different concentrations of jojoba oil and castor oil to identify any significant differences. These differences will be evaluated in terms of the effect on skin hydration and the overall moisturising properties of the night cream.

Therefore, the data collected will be used to determine the optimal concentration of jojoba oil and castor oil to include in the night cream formulation. By evaluating the effect of different concentrations on viscosity, elasticity, and moisturising properties, this mini project will provide valuable insights into the optimal formulation of the night cream, which will inform further product development and improvement.

The following tables will be used to take the observations of the two oils:

Table 1 Readings for Jojoba Oil

The concentration of Jojoba Oil	Viscosity	Elasticity	Mosturising Property
1%			
3%			
5%			

Table 2 Readings for Castor Oil

The concentration of Castor Oil	Viscosity	Elasticity	Mosturising Property
5%			
7.5%			
10%			

References

Ahmed, I.A., Mikail, M.A., Zamakshshari, N. and Abdullah, A.S.H., 2020. Natural anti-aging skincare: role and potential. *Biogerontology*, *21*, pp.293-31.

Bhamare, J.T. and Mulay, R.S., 2022. A Review on Oils used in Herbal Cosmetics. *Research Journal of Topical and Cosmetic Sciences*, *13*(2), pp.101-104.

Brar, K.K., 2021. A review of contact dermatitis. *Annals of Allergy, Asthma & Immunology*, *126*(1), pp.32-39.

Cyriac, F., Xin Yi, T., Chow, P.S. and Macbeath, C., 2022. Tactile friction and rheological studies to objectify sensory properties of topical formulations. *Journal of Rheology*, *66*(2), pp.305-326.

Ezekwe, N., King, M. and Hollinger, J.C., 2020. The use of natural ingredients in the treatment of alopecias with an emphasis on central centrifugal cicatricial alopecia: a systematic review. *The Journal of clinical and aesthetic dermatology*, *13*(8), p.23.

Fiume, M.M., Bergfeld, W.F., Belsito, D.V., Hill, R.A., Klaassen, C.D., Liebler, D.C., Marks Jr, J.G., Shank, R.C., Slaga, T.J., Snyder, P.W. and Heldreth, B., 2022. Amended Safety Assessment of Triglycerides as Used in Cosmetics. *International journal of toxicology*, *41*(3_suppl), pp.22-68.

Gad, H.A., Roberts, A., Hamzi, S.H., Gad, H.A., Touiss, I., Altyar, A.E., Kensara, O.A. and Ashour, M.L., 2021. Jojoba Oil: An updated comprehensive review on chemistry, pharmaceutical uses, and toxicity. *Polymers*, *13*(11), p.1711.

Geria, N.M., 2020. The Beauty Benefits Of Anti-Aging Facial Oils. *Household & Personal Products Industry*, *57*(1), pp.44-47.

Kang, S.Y., Um, J.Y., Chung, B.Y., Lee, S.Y., Park, J.S., Kim, J.C., Park, C.W. and Kim, H.O., 2022. Moisturizer in patients with inflammatory skin diseases. *Medicina*, *58*(7), p.888.

Kang, S.Y., Um, J.Y., Chung, B.Y., Lee, S.Y., Park, J.S., Kim, J.C., Park, C.W. and Kim, H.O., 2022. Moisturizer in patients with inflammatory skin diseases. *Medicina*, *58*(7), p.888.

Khairi, M.M., 2019. Genetics and breeding of jojoba [Simmondsia chinensis (link) Schneider]. *Advances in Plant Breeding Strategies: Industrial and Food Crops: Volume 6*, pp.237-276.

Kulawik-Pióro, A., Ptaszek, A. and Kruk, J., 2019. Effective tool for assessment of the quality of barrier creams-relationships between rheological, textural and sensory properties. *Regulatory Toxicology and Pharmacology*, *103*, pp.113-123.

Maktabi, B., Liberatore, M.W. and Baki, G., 2021. Meadowfoam seed oil as a natural dispersing agent for colorants in lipstick. *International Journal of Cosmetic Science*, *43*(4), pp.484-493.

Mawazi, S.M., Ann, J., Othman, N., Khan, J., Alolayan, S.O., Al thagfan, S.S. and Kaleemullah, M., 2022. A Review of Moisturizers; History, Preparation, Characterization and Applications. *Cosmetics*, *9*(3), p.61.

Mohiuddin, A.K., 2019. An extensive review of cosmetics in use. *OSP J Clin Trials Rev*, *1*(1), pp.1-20.

Pan, S., Sivanathan, S., Kiepe, G., Kiepe, T. and Germann, N., 2021. Candidate formulations for a sustainable lipstick supplemented with Vitamin D3: effects of wax type and concentration on material properties. *Industrial & Engineering Chemistry Research*, *60*(5), pp.2027-2040.

Roy, A., Bhattacharjee, S., Podder, S. and Ghosh, A., 2020. Measurement of bioimpedance and application of Cole model to study the effect of moisturizing cream on human skin. *AIMS Biophysics*, *7*(4), pp.362-379.

Sharma, K., Rai, J.P., Somkuvar, S. and Singhai, A.K., 2022. Design, Optimization and Evaluation of Etoricoxib Castor Oil Emulgel for acute gout therapy. *Journal of Drug Delivery and Therapeutics*, *12*(4), pp.15-22.

Singh, S., Sharma, S., Sarma, S.J. and Brar, S.K., 2022. A comprehensive review of castor oil-derived renewable and sustainable industrial products. *Environmental Progress & Sustainable Energy*, p.e14008.

Tafuro, G., Costantini, A., Baratto, G., Francescato, S., Busata, L. and Semenzato, A., 2021. Characterization of polysaccharidic associations for cosmetic use: Rheology and texture analysis. *Cosmetics*, *8*(3), p.62.

Appendix- 1

Table 3 COSHH Risk Assessment

Name of Faculty/Department		Name of School
Date of Assessment 8TH Feb 2023		Site/Location/Room No
Description of Activity/Procedure/Process (include SOPs as a Control) The production of the final night cream will involve several activities, procedures, and processes, and Standard Operating Procedures (SOPs) will be established to ensure consistency and control in the production process. Solvent preparation, oil preparation, Emollient preparation, Thickener, emulsifier, antioxidant, silicon, preservative preparation, homogenisation, packaging and patch testing. SOPs will be established for each step of the production process, and all ingredients will be weighed accurately using calibrated scales. The process will be carried out in a clean, controlled environment, and all equipment will be sterilised before use. The process will be repeated three times to ensure reproducibility, and the final product will be stored in a cool, dark place until needed for testing.		
Name of Techniques to be Used Emulsification, heating, cooling, texture analyser, homogeniser		
Name of Assessor/Supervising Assessor	Signature	Tel No. E-mail
Persons at Risk (Who?) Staff and students		Total number (e.g. in lab)
Type of Health Surveillance Required Use of PPE kit		Duration of Exposure: mins/hrs 3-4 hrs

Health Status (are special arrangements required?) Use of protective equipment or medical supervision.	**Are there any Ethical Issues**? NO (Attach Consents)
Emergency Contact Names Supervisor	Tel No.

Description of Waste Disposal Methods In accordance with SOPs for lab No. __4.06__

Organic solvents disposed in waste solvent containers in the chemical fume hood. Aqueous solvents are safe for disposal down the sink - always wash away with large amounts of water. Small amounts of solid waste can be wiped away wearing gloves with a damp cloth and disposed of in the laboratory bins. For large spillages please alert a member of technical or academic staff.

Emergency Action/Procedures

In the event of a spill or injury, inform a responsible staff member. In the event of a fire, immediately notify staff and if the fire alarm sounds, secure the experiments and evacuate the building.

Training/Direct Supervision Requirements

A member of the staff will be present and closely monitoring the work taking place.

Business Interruption (e.g. power shutdown, fire, flood) What are the Contingency Procedures for work and waste?

In case of a business interruption such as power shutdown, fire, or flood, contingency procedures include securing experiments, preserving samples, and properly disposing of waste. An alternative workspace may be designated for continuation of the work.

Risk Evaluation Comments

Low Risk Procedure

COSHH MATERIAL SAFETY DATA

TECHNIQUE/METHOD TITLE:

Hazardous Substance (including Organisms)	Hazard Type	State; solid, liquid or gas	Quantity used	Route of entry & Target Organs	WEL	Controls and Precautions	Disposal Route Spillage procedure Emergency procedures
Vitamin A	Low health and flammability hazard	Solid		inhalation of fumes, skin contact		Avoid breathing vapours. Wear protective gloves/protective clothing/eye protection.	Solutions in sink and washed with large quantity of water. IF IN EYES OR ON SKIN: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing
Preservatives	low to moderate health hazard	Liquid		inhalation of fumes, or skin contact		Avoid breathing vapours. Wear protective gloves/protective clothing/eye protection.	Solutions in sink and washed with large quantity of water. IF IN EYES OR ON SKIN: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing

Silicones Such As Dimethicone	Low health and flammability hazard	Liquid		inhalation of dust or fumes, or skin contact		Avoid breathing vapours Wear protective gloves/protective clothing/eye protection.	Solutions in sink and washed with large quantity of water. IF IN EYES OR ON SKIN: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing

COMMENTS: Attach any additional hazard data, consider any substance with an allocated WEL. Use EH40 Guidance HSE

RISK **RATING**

HIGH	MEDIUM	LOW
		X