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Physical Stability Test of Liquid Soap Preparation from Avocado Seed Oil (Persea americana Mill.)

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ABSTRAK

Minyak biji alpukat memiliki banyak manfaat dan mengandung senyawa metabolit sekunder seperti alkaloid, flavonoid, tanin, saponin, terpenoid atau steroid dan fenolik yang berperan sebagai antioksidan alami serta vitamin E yang dapat dijadikan sebagai bahan untuk melembabkan kulit. Kandungan flavonoid sebagai antioksidan dan vitamin E untuk melembabkan kulit dapat dijadikan sebagai sediaan sabun mandi cair. Penelitian ini bertujuan untuk mengetahui Uji Stabilitas Fisik Sediaan Sabun Mandi Cair Dari Minyak Biji Alpukat (Persea americana Mill.). Penelitian ini merupakan penelitian eksperimental laboratorium dengan menggunakan Minyak Biji Alpukat dan HPMC sebagai basis gel dengan konsentrasi 2%. Sediaan sabun mandi cair yang dihasilkan diuji stabilitas fisik meliputi organoleptik, homogenitas, pH, viskositas, daya sebar, iritasi, tinggi busa, hedonik dan cycling test. Hasil penelitian menunjukkan bahwa sediaan sabun mandi cair berwarna bening, bau khas alpukat, bertekstur semi solid, homogenitas serta stabil pada penyimpanan suhu ruang selama 21 hari dan stabil pada penyimpanan suhu 4°C dan 40°C selama 6 siklus.

Kata Kunci: *HPMC; Minyak Biji Alpukat; Sabun mandi cair*

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ABSTRACT

Avocado seed oil has numerous benefits and contains secondary metabolites such as alkaloids, flavonoids, tannis, saponins, terpenoids or steroids, and phenolics, which act as natural antioxidants, as well as vitamin E, wich can be used as a skin moisturizer. The flavonoid content as an antioxidant and vitamin E moisturizing the skin can be used to produce liquid soap formulations. This study aims to determine the Physical Stability Test of Liquid Soap Made from Avocado (Persea americana Mill.) Seed Oil. This research was an experimental laboratory study using Avocado Seed Oil and HPMC as a gel base with consentration of 2%. The outcome of liquid soap formulation was tested for physical stability, including organoleptic properties, homogeneity, pH, viscosity, spreadability, irritation, foam height, hedonic properties, and cycling tests. The results showed that the liquid soap formulation was clear, had characteristic avocado smell, a semi-solid texture, homogeneity, and stability at room temperature storage for 21 days, and stability at 4°C and 40°C storage for six cycles.

Keywords: *HPMC; Avocado Seed Oil; Liquid Soap*

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1. Pendahuluan

The skin covers the entire external surface of the human body and is the first site of interaction with the external environment. It serves as a barrier against ultraviolet radiation, temperature extremes, toxins, and bacteria. Other essential roles include sensory perception, immunological surveillance, thermoregulation, and regulation of transepidermal water loss. The skin consists of three principal layers: the epidermis, dermis, and subcutis. It should be maintained and cared for so that it remains clean, firm, soft, and fresh [1,2].

Soap is a cosmetic preparation that removes dirt and acts as a cleansing agent produced by reacting sodium or potassium bases with fatty acids derived from vegetable or animal oils. Soap molecules are surfactants with a hydrophobic (non-polar) moiety and a hydrophilic (polar, water-loving) moiety. By reducing water's surface tension, surfactants facilitate the removal of contaminants from the skin. Impurities such as sweat, lipid particles, and dust adhering to the skin's surface are captured by the hydrophobic groups and are carried away during rinsing with water, which becomes more effective as surface tension decreases [3,4].

There are various types of soaps, including bar and liquid bath soaps. Liquid bath soap is commonly used to cleanse and remove impurities and is therefore suitable for dry skin. Cleansing removes cutaneous metabolites such as sebum, desquamated corneocytes, sweat residues, dirt, dust, and microorganisms. Modern soaps are formulated not only to cleanse the body but also to soften and brighten the skin and to protect it against free-radical damage by incorporating antioxidants. The soap developed in this study contains both an antioxidant and a moisturizer. Antioxidants are compounds that can donate an electron to free radicals, thereby quenching them. Moisturizers are intended to increase skin hydration. Many traditional medicinal plants remain under-investigated despite their potential to moisturize dry skin; much of their use is based on everyday empirical experience. In this study, avocado seed oil serves as both the antioxidant and moisturizing agent[4,5].

Avocado seeds contain nutrients such as vitamin E that can act as moisturizers and are considered safe for topical use at normal skin pH. They are rich in phytochemicals: analyses of different extracts have revealed constituents such as flavonoids, anthocyanins, condensed tannins, alkaloids, sterols, and triterpenes. Because avocado seeds are often discarded as waste, they can be valorized by processing them into useful preparations such as liquid bath soap. Based on this rationale, we aim to formulate and evaluate the physical stability of a liquid bath soap containing avocado seed oil (Persea americana Mill.)[6–8].

The cleansing action of soap arises from surfactants that remove soil from the skin via micelle formation, a concentration-dependent process known as micellization. At low concentrations, surfactant monomers adsorb at interfaces until the surface becomes saturated. With further addition, the monomer concentration in solution increases and micelles begin to form. The concentration at which micelles first appear is termed the critical micelle concentration (CMC) and micelles form only when the surfactant concentration exceeds this value. Because the skin is naturally lipophilic, the hydrophobic tails of surfactant molecules associate with oily soils; once micelles form, the hydrophilic head groups interact with water and are rinsed away, carrying the entrapped soil [9,10].

Soap functions primarily as a cleansing agent. By lowering the surface tension of water, it allows water to wet substrates more effectively; it also acts as an emulsifier to disperse oils and can adsorb onto particulate soils. Contaminants adhering to the skin are typically oils, fats, and sweat, which are not water-soluble due to their non-polar nature. Soap solubilizes these soils: its non-polar hydrocarbon (–R) groups bind the dirt, while the polar carboxylate headgroups ($-COO^-Na^+$) interact with water. Because the soil is bound to the soap and the soap is bound to water, the soil is removed during rinsing[11,12].

Soap formation—saponification—is the reaction of fats or triglycerides with alkali, typically NaOH or KOH. The reaction initially proceeds slowly because oils and alkaline solutions are immiscible. Once some soap forms, the reaction rate increases and later decreases again as the amount of unreacted oil diminishes. Saponification is exothermic, so the addition of oils and alkali must be carefully controlled to avoid excessive heat. In practice, the alkaline solution is added gradually with stirring and heating to produce soap. Efficient, uniform mixing improves the process. Several factors influence the course of saponification[13,14].

Hydroxypropyl methylcellulose (HPMC) is widely used as an excipient in topical and oral formulations. It is a granular or fibrous, off-white material that is odorless and tasteless. HPMC dissolves in cold water to form colloidal solutions; it is practically insoluble in ethanol, chloroform, and ether, but soluble in certain alcohol–dichloromethane mixtures. It yields neutral, clear gels that are stable over pH 3–11, exhibits good microbial resistance, and forms films with good strength upon drying on the skin. It is non-irritating and maintains stable viscosity during long-term storage. HPMC dissolves in water below about 40 °C, whereas in hot water it does not dissolve but swells to form a gel. It is used as an emulsifier, suspending agent, and stabilizer in gel preparations. Being non-ionic, HPMC does not form complexes with metal salts or organic ions, does not precipitate as insoluble salts, and can prevent sediment formation. As a gelling agent, it is typically used at concentrations below 20% [15,16].

2. Methods

Research Design

This study is a laboratory-based experimental investigation. In this work, we formulated a liquid bath soap using avocado seed oil. The study was conducted at the Pharmaceutical Technology Laboratory, Department of Pharmacy, Faculty of Sports and Health, Universitas Negeri Gorontalo.

Equipment

The liquid bath soap formulation comprises avocado seed oil (10%), HPMC (2%), methyl paraben (0.2%), sodium lauryl sulfate (3%), propylene glycol (15%), triethanolamine (1.6%), fragrance q.s., and purified water to 100%, by weight, mixed thoroughly.

Liquid Bath Soap Formulation of Avocado Seed Oil Extract

HPMC was gradually dispersed into warm water (80°C) with continuous stirring in a mortar until fully hydrated, then the vessel was covered with aluminum foil. In Beaker A, propylene glycol and methyl paraben were dissolved. In Beaker B, sodium lauryl sulfate was dissolved in warm water. The contents of Beakers A and B were then added to the mortar containing the HPMC solution and mixed until uniform. The active ingredient was subsequently incorporated into the mixture. Finally, the batch was homogenized using a Thinky planetary mixer until a homogeneous liquid soap was obtained.

Organoleptic test

This evaluation examined the product's appearance, color, odor, and any phase separation during 21 days of storage. Thirty panelists assessed overall quality and sensory attributes, providing structured observations and ratings. Outcomes characterize visual and olfactory stability, detect potential instability, and inform formulation optimization and acceptability for a liquid bath soap [17–22].

Homogenity test

A 0.1-g portion of the preparation was accurately weighed, placed on a clean glass slide, and gently spread into a thin, even film. The slide was examined against a transmitted light source, inspection across fields. The sample was considered homogeneous when the film appeared continuous and smooth, showing no visible coarse particles, crystals, bubbles, or agglomerates. Any observable granularity, streaking, or phase separation indicated inadequate mixing and required reprocessing of the batch before further testing[17–26]

pH test

pH testing was performed to verify that the preparation fell within the normal skin range (pH 4.6–6.5). The pH meter was first calibrated with distilled water and dried with tissue. The electrode was then immersed in the sample. Readings were recorded once the display stabilized, and the value indicated by the pH meter was taken as the preparation's pH [17–26]

Viscosity test

Viscosity influences consumer use—e.g., ease of pouring and resistance to accidental spillage—and depends on the fluid's internal friction under shear. For liquid bath soap, the Indonesian SNI standard specifies a viscosity range of 400–4000 cP. Accordingly, a liquid soap sample measuring 600 cP is considered acceptable and complies with the SNI requirement for product viscosity [17–26].

Spreadability test

A 0.5-g aliquot of liquid soap was placed at the center of a round glass plate (15 cm diameter). A second plate was carefully set on top and left for 1 minute. The spread diameter was then recorded with successive incremental loads until the value became constant. Acceptable spreadability for the product was defined as 3–5 cm [17–26].

Iritation test

An irritation test was conducted to determine whether the formulation induces cutaneous adverse effects. A preventive patch procedure was used: a measured amount of the cosmetic was applied to the retroauricular region (behind the ear) or the volar forearm of ten healthy volunteers. Application sites were occluded for a standardized period, then unoccluded and inspected at set intervals over the observation period. Trained evaluators documented erythema, edema, pruritus, burning, or pain using a semiquantitative scoring scale. Absence of relevant reactions across subjects indicated the product is well tolerated and unlikely to provoke primary irritation under intended conditions of safe use [27,28].

Foam height and stability test

One gram of liquid soap was introduced into a graduated cylinder containing 10 mL of distilled water and capped. The cylinder was shaken for 20 seconds, and the resulting foam height was recorded. Foam stability was assessed by noting foam height immediately after shaking and at defined intervals. According to the Indonesian SNI standard, an acceptable foam height for liquid soap ranges from 13 to 220 mm [29,30]

Hedonic test

Hedonic evaluation used to determine the magnitude of quality differences among similar products by assigning ratings or scores to specific attributes of a product and to determine consumer liking or preference for that product. In a hedonic test, trained panelists or naive consumers assess characteristics such as appearance, color, fragrance, texture, foaming, spreadability, and after-feel using structured scales, typically nine-point hedonic scales ranging from “dislike extremely” to “like extremely.” Data are analyzed to compare formulations, identify statistically significant differences, and generate preference maps. Results guide optimization of product design, labeling, and positioning, ensuring target users perceive superior quality[31,32].

Cycling test

The cycling test evaluates whether phase separation occurs during storage. Stability was assessed using a freeze–thaw method. An aliquot of 2 mL was dispensed into eight vials and tightly sealed. Four vials served as controls and were stored at 25 °C. The remaining four underwent freeze–thaw cycles: each vial was stored at 4 °C for 24 h, then at 40 °C for 24 h (one cycle). Organoleptic changes (appearance, color, odor, and phase behavior) were recorded after each temperature step. A total of six cycles were performed, with organoleptic characteristics evaluated at the end of every cycle. Absence of visible change indicated satisfactory physical stability [33,34].

3. Results and Discussion

Throughout the study, the organoleptic properties of the liquid soap remained unchanged. Visual inspection revealed no phase separation or sediment; the product retained its original, uniform appearance and characteristic color. Olfactory assessment showed a consistent odor profile with no evidence of off-notes or rancidity. These results were maintained across all time points, storage temperatures, and freeze–thaw cycles. The stability observed is consistent with the intrinsic attributes of the active ingredient and the selected excipients, which together form a physically compatible and well-balanced system. Overall, the formulation demonstrated robust organoleptic stability, supporting its suitability for consumer use and subsequent scale-up manufacturing.

Table 1. Homogenity test

Day	Result
0	Homogenity
7	
14	
21	

The homogeneity evaluation revealed no visible granules in any formulation, both immediately after preparation and following storage at ambient temperature as well as cycling at 4 °C/40 °C for six cycles. The absence of particulate matter or phase irregularities indicates that all constituents were uniformly dispersed within the liquid soap matrix. These findings suggest adequate mixing, appropriate selection of excipients, and sufficient compatibility between the active ingredient and the base. Overall, the formulations exhibited stable, visually homogeneous systems under both static and stress conditions, supporting their suitability for subsequent performance testing and potential scale-up.

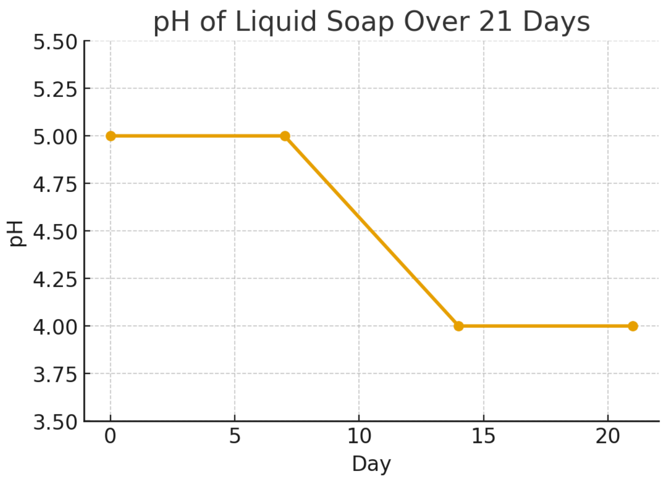

Figure 1. Graph Stability pH test

Table 2. Stability pH test

Day	pH
0	5
7	5
14	4
21	4

Following evaluation under ambient storage and cycling conditions, the formulations exhibited pH values that varied over time but consistently remained within the specified acceptable range. The observed decreases or shifts in pH are attributable to environmental factors particularly storage conditions and temperature fluctuations. By design, the cycling test imposes alternating low and high temperatures, which can accelerate hydrolysis, alter ionization equilibria, and change the solubility of formulation components, thereby lowering measured pH. Despite these stressors, all samples maintained pH within the target window, indicating adequate buffering capacity and overall chemical stability during the study period. Detailed results are shown in Table 2 and Figure 1.

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Table 3. Viscosity test

Day	Cps
0	2960
7	2913
14	2900
21	2853

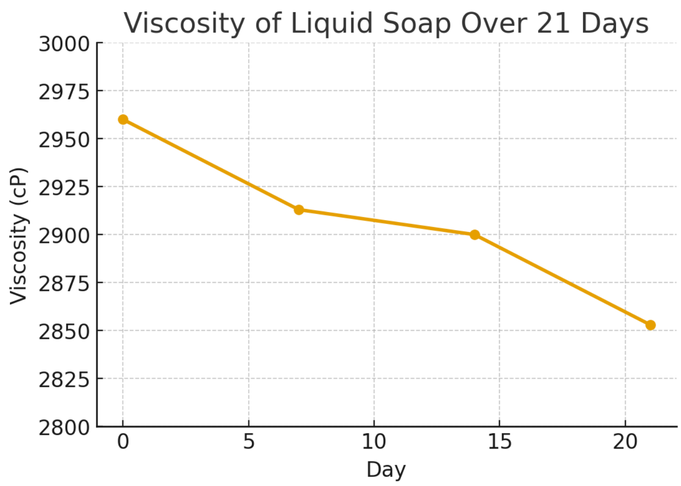

Figure 2. Graph Viscosity test

Under both ambient storage and cycling conditions, the formulation exhibited a gradual decline in viscosity; however, all values remained within the accepted range for topical liquid soaps. The decrease is attributable to temperature-dependent rheology: higher temperatures typically reduce intermolecular interactions and lower viscosity, whereas lower temperatures may increase it. Consequently, shifts in viscosity can alter functional performance particularly spreadability where lower viscosity generally increases spread diameter and higher viscosity reduces it. Despite these fluctuations, the observed changes were modest and did not compromise handling or product acceptability over the study period. Detailed results are shown in Table 3 and Figure 2.

Table 4. Spreadability test

Day	cm
0	3.5
7	3.7
14	4.1
21	4.5

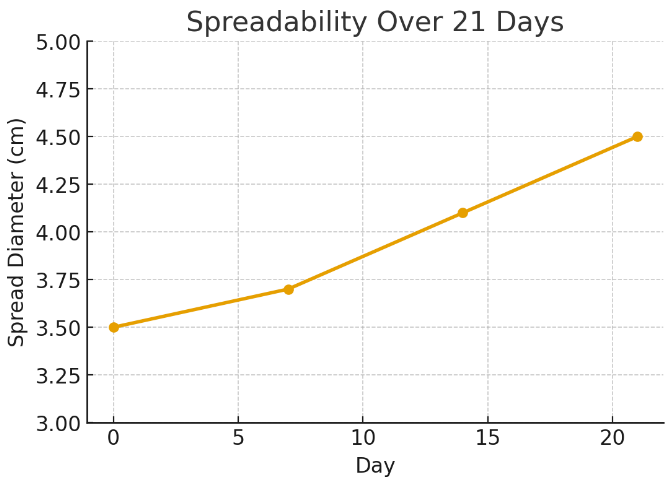

Figure 3. Graph Spreadability test

The evaluated formulation showed spreadability values within the acceptable range for liquid bath soap both immediately after manufacture, during room-temperature storage, and under cycling conditions. The gradual increase in spread diameter remained compliant with product specifications and did not indicate instability. These findings confirm suitable rheological behavior for consumer use, as shown in Table 4 and Figure 3.

Across the 21-day observation period, no signs of primary irritation were detected in any participant following application of the liquid soap formulation. Retroauricular and volar-forearm sites remained free of erythema, edema, pruritus, burning, or pain at all scheduled assessments. Panelists reported no discomfort during or after use, and no delayed reactions were observed during subsequent checks. Skin condition at test sites appeared comparable to adjacent untreated areas, indicating excellent local tolerance. These findings suggest the product is unlikely to provoke irritation under intended conditions of use and support its suitability for routine cleansing applications and further development toward consumer deployment.

Table 5. Hedonic scale

Day	Hedonic scale					Total
	Very Like	Like	Quite like	Dislike	Very Dislike	
0	2	5	8	0	0	15
7	5	1	9	0	0	15
14	6	9	0	0	0	15
21	14	1	0	0	0	15

Table 5 summarizes hedonic ratings from 15 panelists at four time points. On Day 0, most responses clustered around “Quite like” (8 of 15), with fewer “Like” (5) and “Very Like” (2); no negative ratings were recorded. By Day 7, early preference already shifted upward: “Very Like” increased to five while “Quite like” remained high (nine), suggesting good initial acceptance. A marked improvement occurred by Day 14, when no panelist selected “Quite like,” and positive responses split between “Very Like” (six) and “Like” (nine). On Day 21, acceptance peaked: fourteen panelists chose “Very

Like” and one chose “Like,” with zero “Dislike” or “Very Dislike” throughout. The progressive shift from “Quite like” toward “Very Like” indicates that the product’s sensory attributesappearance, fragrance, texture, foaming, and after-feel were stable and increasingly preferred during storage. These results align with viscosity and spreadability profiles and support the formulation’s organoleptic quality and consumer appeal over time.

4. Conclusion

Avocado seed oil can be formulated as a liquid body wash that delivers antioxidant and moisturizing functions. A gel type dosage form using HPMC as the base was developed with appropriate excipients preservative, humectant, surfactant, thickener, fragrance, and solvent. Physical stability assessments demonstrated that the avocado seed oil liquid soap remained stable throughout the study. The evaluation panel included organoleptic inspection, homogeneity, pH, viscosity, spreadability, irritation, foam height, hedonic acceptance, and freeze thaw cycling. Across these tests, the formulation met relevant acceptance criteria, showed no evidence of phase separation or irritation, and maintained desirable sensory and rheological properties, supporting its suitability for consumer use and further scale-up.

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Reference :

[1] de Szalay S, Wertz PW. Protective Barriers Provided by the Epidermis. Int J Mol Sci 2023;24:1–13. https://doi.org/10.3390/ijms24043145.

[2] Lee SH, Jeong SK, Ahn SK. An update of the defensive barrier function of skin. Yonsei Med J 2006;47:293–306. https://doi.org/10.3349/ymj.2006.47.3.293.

[3] Arasaretnam S, Venujah K. Preparation of Soaps by Using Different Oil and Analyze their Properties Natural Products Chemistry & Preparation of Soaps by U sing Different Oil and Analyze their Properties 2019;7:1–4. https://doi.org/10.4172/2329-6836.1000357.

[4] Dalibor. Mijaljica, Spada. Fabrizio HIP. Skin Cleansing without or with Compromise : Molecules 2022;27.

[5] Fajar IRF. Formulation Of Liquid Soap Based on Sea Grass (Eucheuma Cottonii) Used Olive Oil as An Oil Phase. SANITAS J Teknol Dan Seni Kesehat 2022;13:210–25. https://doi.org/10.36525/sanitas.2022.18.

[6] Bahru TB, Tadele ZH, Ajebe EG. A Review on Avocado Seed: Functionality, Composition, Antioxidant and Antimicrobial Properties. Chem Sci Int J 2019;27:1–10. https://doi.org/10.9734/csji/2019/v27i230112.

[7] Iskandar B, Sidabutar SEB, Leny L. Formulasi dan Evaluasi Lotion Ekstrak Alpukat (Persea Americana) sebagai Pelembab Kulit. J Islam Pharm 2021;6:14–21. https://doi.org/10.18860/jip.v6i1.11822.

[8] N.M I, U.P I, P.C Uo. Anti-Microbial and Phytochemical Screening of the Seed Extracts of Persea Americana (AVOCADO PEAR). IOSR J Pharm Biol Sci 2014;9:23–5. https://doi.org/10.9790/3008-09262325.

[9] Hadgiivanova R, Diamant H, Andelman D. Kinetics of surfactant micellization: A free energy approach. J Phys Chem B 2011;115:7268–80. https://doi.org/10.1021/jp1073335.

[10] Shimizu S, Matubayasi N. Cooperativity in micellar solubilization. Phys Chem Chem Phys 2021;23:8705–16. https://doi.org/10.1039/d0cp06479c.

[11] Li Z. Modern Mild Skin Cleansing. J Cosmet Dermatological Sci Appl 2020;10:85–98. https://doi.org/10.4236/jcdsa.2020.102009.

[12] Gotoh K. Experimental analysis of detergency phenomena and investigation of a next-generation detergency system. J Oleo Sci 2017;66:1–11. https://doi.org/10.5650/jos.ess16163.

[13] Rosdanelli Hasibuan, Fransiska Adventi, Rahmad Parsaulian Rtg. Pengaruh Suhu Reaksi, Kecepatan Pengadukan Dan Waktu Reaksi Pada Pembuatan Sabun Padat Dari Minyak Kelapa (Cocos nucifera L.). J Tek Kim USU 2019;8:11–7. https://doi.org/10.32734/jtk.v8i1.1601.

[14] Aprianti N, Nurhayati S, Moeksin R. Liquid Soap Production from Catfish (Pangasius hypophthalmus) Fat Waste. Indones J Fundam Appl Chem 2019;4:77–81. https://doi.org/10.24845/ijfac.v4.i2.77.

[15] Akbar Mh, Harmita, Suryadi H. Preparation and Characterization of Hydroxypropyl Methylcellulose Produced From A-Cellulose Betung Bamboo (Dendrocalamus Asper) and It'S Evaluation on Gel Formulation. Int J Pharm Pharm Sci 2020:156–65. https://doi.org/10.22159/ijpps.2020v12i8.38066.

[16] Schmitt C, Jacques MC, Andrighetti TT, Antunes AS, Barros CF de, Freitas CMD de, et al. Hydroxypropyl methylcellulose-based films incorporated with Ocimum basilicum L. extract for skin wound healing. Concilium 2022;22:583–97. https://doi.org/10.53660/clm-722-768.

[17] Aprianto Paneo M, Sy Pakaya M, Ain Thomas N, Ratu Cindana Moo F, Efriani Puluhulawa L, Thamrin R, et al. Formulasi Ekstrak Kulit Jeruk Nipis (Citrus Aurantifolia) Dalam Masker Gel Peel-Off Anti Aging Dengan Metode DPPH (2,2-diphenyl-1-picrylhydrazyl). J Farm Teknol Sediaan Dan Kosmet 2024;1:11–20.

[18] Mustapa MA, Paneo MA, Puluhulawa LE, Latif MS, Nani I. Formulasi Dan Evaluasi Sediaan Exfoliating Gel Sari Buah Anggur (Vitis vinifera L .). J Farm Teknol Sediaan Dan Kosmet 2025;2:35–44.

[19] Herlina Jusuf, Hartono Hadjarati, Mohamad Adam Mustapa, Widy Susanti Abdulkadir, Ahmad M. Andy Suryadi, Muhammad Taupik, et al. Characterization and Formulation of Anti-Aging Cream Using Collagen Derived

from Sardine (Sardinella spp.) Fish Scales. Trop J Nat Prod Res 2025;7:3013–20. https://doi.org/10.26538/tjnpr/v9i7.8.

[20] Thomas N, Paneo MA, Mo'o FRC, Puluhulawa LE, Latif MS. Formulation of natural hydrogel from bromelain enzym and alginate-chitosan and the effectiveness test by in vivo in healing burns. J Med Pharm Chem Res 2025;7:944–59. https://doi.org/10.48309/jmpcr.2025.472155.1374.

[21] Mu A, Suryadi A, Paneo MA, Djuwarno EN, Balikan VA. Formulasi Dan Evaluasi Sediaan Emulgel Sabun Cuci Tangan dari Ekstrak Tomat (Solanum Lycopersicum L .). J Farm Teknol Sediaan Dan Kosmet 2025;2:45–54.

[22] Mu A, Suryadi A, Paneo MA, Thomas N, Manno MR, Sabrina PF. Formulasi Dan Evaluasi Sedian Gel Sabun Cuci Tangan Ekstrak Jeruk Kalamansi (Citrus Microcarpa). J Farm Teknol Sediaan Dan Kosmet 2025;2:1–15.

[23] Pomalango ZB, Paneo MA, Pakaya N, Aman LO, Hutuba AH. Cholesterol-Lowering Effects of Turmeric Effervescent Dosage in Preventing Atherosclerosis 2025;10.

[24] Tungadi R, Paneo MA, Nurkamiden FS. Pengembangan Teknik Matriks Patch Alpha Arbutin Berbasis Nanoemulsi Dan Uji Permeasi Secara In Vitro 2024;1:53–63.

[25] Tuloli TS, Pomalango ZB, Paneo MA. Pemanfaatan Rempah Tradisional Kunyit Kawasan Teluk Tomini Sebagai Vitamin Herbal dalam Pencegahan Jantung Pada Masyarakat Pentadu Barat, Kabupaten Boalemo, Provinsi Gorontalo. J Pengabdi Masy Farm Pharmacare Soc 2023;2:140–7. https://doi.org/10.37905/phar.soc.v2i3.21597.

[26] Tungadi R, Thomas NA, Paneo MA, Latif MS, Voenna CD. Formulasi Dan Evaluasi Sediaan Perona Pipi Dalam Bentuk Compact Powder Menggunakan Zar Pewarna Alami Ekstrak Kulit Buah Manggis (Garcinia Mangostana L .). Indones J Pharm Educ 2024;4:10–7. https://doi.org/10.37311/ijpe.v4i1.18039.

[27] Mulyanti YS, Y, Kasemchainan B, Mitra PP, Evans P, Hartono H. Evaluation of the Skin Irritation and Sensitization Potential of the Cussons Baby Sensicare Skin Range of Products in Healthy Volunteers. J Cosmet Dermatological Sci Appl 2019;09:207–15. https://doi.org/10.4236/jcdsa.2019.93017.

[28] Ali A. In vivo skin irritation potential of a cream containing Moringa oleifera leaf extract. African J Pharm Pharmacol 2013;7:289–93. https://doi.org/10.5897/ajpp12.890.

[29] Wang J. Effect of CTAB Concentration on Foam Properties and Discussion Based on Liquid Content and Bubble Size in the Foam. Int J Oil, Gas Coal Eng 2018;6:18. https://doi.org/10.11648/j.ogce.20180601.13.

[30] Bey H, Wintzenrieth F, Ronsin O, Höhler R, Cohen-Addad S. Stabilization of foams by the combined effects of an insoluble gas species and gelation. Soft Matter 2017;13:6816–30. https://doi.org/10.1039/c6sm02191c.

[31] Zuhdi M, Khairi AN. Analysis of organoleptic properties and consumer acceptance of frozen noodle products. J Halal Sci Res 2022;3:15–9. https://doi.org/10.12928/jhsr.v3i1.6828.

[32] Florentini M, Kinchla AJ, Nolden AA. Based Meat Analogs and Meat Extenders : A Scoping Review 2020.

[33] Friciu M, Zaraa S, Leclair G. Stability of extemporaneously compounded tacrolimus in glass bottles and plastic syringes. Can J Hosp Pharm 2017;70:51–3. https://doi.org/10.4212/cjhp.v70i1.1629.

[34] Kaiser PK, Yun J, Kim S, Kim J, Park SJ. Physicochemical and Biological Stability Assessment of SB11 (Ranibizumab Biosimilar) Under Ambient and In-Use Storage for Intravitreal Administration. Ophthalmol Ther 2023;12:985–98. https://doi.org/10.1007/s40123-022-00645-1.