ORIGINAL ARTICLE

Nanoemulgel Based Delivery of Pometia pinnata Leaf Extract as a Potent Antioxidant

Larysa Fernenda[1]*, Kony Putriani[1], Asiska Permata Dewi[2], Yandi Syukri[3], Elsa Nurita[1], Bintang Indragiri[1]

[1]Department of Pharmacy, Faculty of Pharmacy, Abdurrab University
[2]Departement of Health Analysis, Faculty of Health Science, Abdurrab University
[3]Department of Pharmacy, Faculty of Mathematics and Natural Sciences, Islamic University of Indonesia

Correspondence:
Larysa Fernenda
Department of Pharmacy, Faculty of Pharmacy, Abdurrab University

Email:
larysafernenda@univrab.ac.id

Article History:
Received: 04 Des 2025
Revised: 05 Mar 2026
Accepted: 21 Aug 2026

DOI:
https://doi.org/10.25077/jsfk.13.02.101-107.2026

Citation:
Fernenda L, Putriani K, Dewi AP, Syukri Y, Nurita E, Indragiri B. Nanoemulgel Based Delivery of *Pometia pinnata* Leaf Extract as a Potent Antioxidant. J Sains Farm Klin. 2026;13(2):101-107

ABSTRACT

This study aimed to formulate and evaluate a nanoemulgel containing ethanol extract of *Pometia pinnata* leaf as a topical antioxidant preparation. The extract was obtained through maceration using 96% ethanol, then formulated into a nanoemulsion and incorporated into a gel base containing Carbopol 940 at concentrations of 0.5%, 1%, and 2%. The evaluations included organoleptic test, homogeneity, pH, spreadability, viscosity, physical stability, and antioxidant activity, using the DPPH method with IC_{50} as the parameter. The results showed that all formulations met acceptable physical criteria. The pH values ranged from 4.86 to 5.49, while the spreadability ranged from 4.81 to 5.95 cm. The best formulation was the nanoemulgel containing 2% Carbopol, which showed an IC_{50} value of 88.78 ppm, indicating strong antioxidant activity. These findings suggest that the *Pometia pinnata* ethanolic leaf extract nanoemulgel has promising potential as a topical antioxidant formulation for preventing premature skin aging.

Keywords: Nanoemulgel; Pometia pinnata; Antioxidant; IC_{50}; DPPH

Introduction

Skin aging is a dermatological alteration that develops due to intrinsic processes such as increasing age, as well as extrinsic factors including exposure to ultraviolet radiation. The manifestations of skin aging include dry, rough skin, hyperpigmentation, and the formation of folds or wrinkles, particularly on the face and hands, as a result of extrinsic factors, while intrinsic aging is characterized by fine, subtle wrinkles accompanied by dry and pale skin [1]. Sun exposure causes the skin to absorb UV radiation, which triggers the formation of *Reactive Oxygen Species* (ROS) [2]. To counteract free radicals present in the body, antioxidant compounds can be utilized [3]. Antioxidants are categorized into synthetic and natural types. In excessive amounts, synthetic antioxidants can be toxic and detrimental to health; therefore, natural antioxidants are considered preferable due to their non-toxic nature and health benefits [4]. Antioxidants act as anti-aging agents through their ability to maintain cellular ROS homeostasis [5].

Pometia pinnata is an indigenous plant of Papua and is commonly found growing wild in Papuan forests [6]. The leaves of *Pometia pinnata* have been widely utilized by local communities as traditional medicine, including for lowering blood pressure, reducing blood glucose levels, treating diarrhea, and managing various gynecological disorders. *Pometia pinnata* leaves are known to contain phenolic compounds, flavonoids, and vitamin C, which possess potential as natural antioxidants [7]. These bioactive compounds have the ability to protect the epidermal and dermal layers of the skin, which consist of elastin and collagen fibers that play an essential role in skin regeneration, maintaining skin softness, and preserving elasticity [8]. Previous studies have demonstrated that the ethanolic extract of Pometia pinnata leaves possesses potent antioxidant activity, with an IC_{50} value of 1.403 μg/mL [9]. However, the direct application of the extract is limited due to poor skin penetration and low stability.

Nanoemulsions are promising nanotechnology-based delivery systems consisting of oil and water stabilized by surfactants, offering advantages such as a smooth texture and improved delivery of bioactive compounds [10]. Further development of this system involves incorporating nanoemulsions into a gel matrix to form nanoemulgels, which combine the advantages of nanoemulsions and gels for topical applications [11]. Nanoemulgels are a topical drug delivery system that integrates nanoemulsions and gel technology, enabling enhanced penetration, improved stability, and increased user comfort. A previous study reported that a nanoemulsion containing 5% Pometia pinnata leaf ethanolic extract (Formula 3) exhibited the best physicochemical characteristics and strong antioxidant activity, with an IC_{50} value of 79.1 μg/mL [12]. The reaction mechanism of the nanoemulsion from the ethanolic extract of *Pometia pinnata* leaves interacting with DPPH involves the reduction of DPPH due to hydrogen atom donation, which leads to a color change to yellow as a result of electron donation and the formation of DPPH (1,1-diphenyl-2-picrylhydrazine) [13].

Although the antioxidant potential of *Pometia pinnata* leaf extract has been well established and its nanoemulsion has been successfully developed, the application of this extract in a nanoemulgel delivery system has received limited attention. Furthermore, antioxidant efficacy of *Pometia pinnata*-based nanoemulgels for topical anti-aging applications have not been comprehensively investigated. Therefore, this study aimed to develop and characterize a nanoemulgel containing ethanolic extract of *Pometia pinnata* leaves and to evaluate its physicochemical properties and antioxidant activity to assess its potential as a topical anti-aging formulation.

METHODS

Materials

The materials used in this study included ethanolic extract of Pometia pinnata leaves, virgin coconut oil (VCO), Tween 80, polyethylene glycol 400 (PEG 400), Carbopol 940, triethanolamine (TEA), methyl paraben, propylene glycol, DPPH (2,2-diphenyl-1-picrylhydrazyl), L-ascorbic acid, pH 4.01 and pH 7.00 buffer solutions, and distilled water.

Preparation of Extract

Fresh *Pometia pinnata* leaves were washed with running water to remove adhering impurities, air-dried under shade at room temperature until a constant weight was achieved, and then ground into powder using a laboratory blender. A total of 2.5 kg of powdered leaves (simplicia) was weighed and transferred into an amber bottle, followed by maceration with n-hexane. The plant material was fully immersed for two days with intermittent stirring, and then filtered using filter paper. This maceration step was repeated twice. The residue was removed from the bottle and air-dried for one hour, after which it was returned to the amber bottle and subjected to maceration using ethyl acetate for two days, followed by filtration using filter paper. This step was also performed in duplicate.

The residue obtained from the ethyl acetate maceration was removed, dried, and subsequently returned to the amber bottle for maceration with 96% ethanol for two days and the procedure was repeated for two cycles. The macerates obtained from the n-hexane, ethyl acetate, and 96% ethanol fractions were then evaporated using a rotary evaporator until concentrated extracts were obtained.

Preparation of Nanoemulgel

The nanoemulgel containing *Pometia pinnata* leaf ethanolic extract was prepared by first formulating the gel base. Carbopol 940 was dispersed in hot distilled water (70–80°C) and allowed to hydrate for 24 h until complete swelling occurred. A mixture of triethanolamine (TEA), propylene glycol, methyl paraben, and propyl paraben was then added gradually while stirring at 500 rpm using a magnetic stirrer until a homogeneous gel base was obtained. The previously

Table 1. Composition of the *Pometia pinnata* leaf nanoemulgel formulations [12].

Substance	Concentration (% w/w)		
	F1	F2	F3
Nanoemulsion Pometia pinnata leaf	30	30	30
Carbopol 940	0.5	1	2
TEA	0.6	0.6	0.6
Metylparaben Propylparaben	0.02 0.01	0.02 0.01	0.02 0.01
Propylene glycol	15	15	15
Aquadest ad	100	100	100

prepared nanoemulsion was slowly incorporated into the gel base under continuous stirring at 500 rpm for 15 min until a uniform nanoemulgel was formed. [14]. The composition of each nanoemulgel formulation is presented in **Table 1** .

Evaluation of Physical Properties

The physical properties of the nanoemulgel formulations were evaluated by assessing their organoleptic characteristics, homogeneity, pH, spreadability, and viscosity. Organoleptic evaluation included observations of color, odor, consistency, and appearance. Homogeneity was assessed by spreading a small amount of the formulation on a glass slide to detect the presence of coarse particles or phase separation. The pH was measured using a calibrated digital pH meter. Spreadability was determined by measuring the diameter of the formulation after applying a standard weight between two glass plates. Viscosity was measured using a Brookfield viscometer equipped with spindle No. 4. All measurements were performed in triplicate, and the results were expressed as mean ± standard deviation [14].

Antioxidant Activity

The antioxidant activity of the nanoemulgel formulations was determined using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay. Nanoemulgel samples were prepared at various concentrations and mixed with DPPH solution. The mixtures were incubated in the dark at room temperature for 30 min, after which the absorbance was measured at 517 nm using a UV–Visible spectrophotometer. The percentage of DPPH radical scavenging activity was calculated based on the absorbance values of the sample and control solutions. A calibration curve was constructed by plotting the percentage of inhibition against sample concentration, and the IC_{50} value was determined from the linear regression equation. L-ascorbic acid was used as the positive control [15].

RESULT AND DISCUSSION

The organoleptic properties of the nanoemulgel formulations were evaluated based on their color, odor, and consistency. Prior to evaluation, all formulations were stored in tightly closed containers at room temperature (25 ± 2°C) and protected from direct light. The visual appearance of the nanoemulgel formulations is presented in **Figure 1**. All formulations exhibited a brown gel with the characteristic odor of Pometia pinnata leaf extract and a thick consistency, indicating acceptable organoleptic characteristics for topical application. An increase in Carbopol 940 concentration produced a darker color and a firmer gel consistency, which can be attributed to the higher polymer concentration in the formulation [16]. The pH, spreadability, and viscosity values of the nanoemulgel formulations are summarized in **Table 2**.

Table 2. Evaluation Nanoemulgels of *Pometia pinnata* Extract

No	Characterization	Result		
		F1	F2	F3
1	pH	5.49 ± 0.004	5.31 ± 0.008	4.86 ± 0.026
2	Spreadability (cm)	5.95 ± 0.033	5.26 ± 0.037	4.81 ± 0.024
3	Viscosity (cP)	8926 ± 97.327	26273 ± 451.550	39945 ± 2248.160

Figure 1. Nanoemulgel *Pometia pinnata* Extract Formula 1, Formula 2, and Formula 3

The homogeneity of the nanoemulgel was examined by applying a small sample onto a glass plate to observe the presence of non-uniform particles [16]. The results showed that all formulations displayed smooth texture without visible coarse particles or clumps, confirming homogeneous dispersion and suitability for topical application.

The pH of each formulation was measured using digital pH meter to determine whether the pH values fell within a physiologically acceptable range for topical skin application. The average pH values of formulations F1, F2, and F3 were 5.49±0.004, 5.31± 0.008, and 4.86± 0.026, respectively. pH is known to affect the performance of preservatives, as certain parabens lose effectiveness in acidic conditions, which may increase the risk of microbial contamination [17]. All formulations met the standard pH requirement for topical preparations, ranging from 4.5 to 6.5 [18]. The decrease in pH values with increasing concentration of Carbopol 940 is attributed to the acidic nature of carbopol, this requiring the addition of triethanolamine (TEA) as an alkalizing agent [19].

The spreadability test was performed to evaluate the ease of application of the nanoemulgel on the skin and the level of comfort during use. The average spreadability values obtained for formulations F1, F2, and F3 were 5.95, 5.26, and 4.81 cm, respectively. The results demonstrated that variations in Carbopol 940 concentration had a significant effect on the spreadability values of the nanoemulgel formulations. A decrease in Carbopol concentration reduced the consistency of the preparation, thereby increasing its spreadability. Spreadability is closely related to viscosity; the higher the viscosity, the lower the spreadability and lower viscosity results in greater spreadability. Adequate spreadability is essential to ensure uniform distribution of the preparation on the skin surface and to achieve homogeneous delivery of the active compound [20]. Based on the obtained data, all nanoemulgel formulations met the acceptable spreadability range, which is 4–7 cm [21].

The viscosity test was conducted to spreadability of the consistency of the nanoemulgel formulations, as viscosity influences the preparation spreadability. The average viscosity values for formulations F1, F2, and F3 were 8.926, 26.273, and 39.945 cPs, respectively. The variation in viscosity among the formulations was attributed to differences in Carbopol 940 concentration. At lower concentrations, Carbopol particles remain dispersed and the polymeric network is not fully interconnected, resulting in lower viscosity. Conversely, increasing the concentration of Carbopol 940 leads to the formation of a denser polymeric network, thereby increasing the viscosity of the nanoemulgel [22]. Differences in viscosity between formulations were influenced by the ability of Carbopol to form a gel network within the aqueous phase, which contributes to viscosity enhancement [23]. All formulations fulfilled the viscosity requirement set by the Indonesian National Standard (SNI), ranging from 3,000 to 50,000 cPs [24]. The stability of the nanoemulgel formulations was evaluated using the freeze–thaw method to assess potential phase separation under extreme temperature fluctuations. The results indicated that all formulations

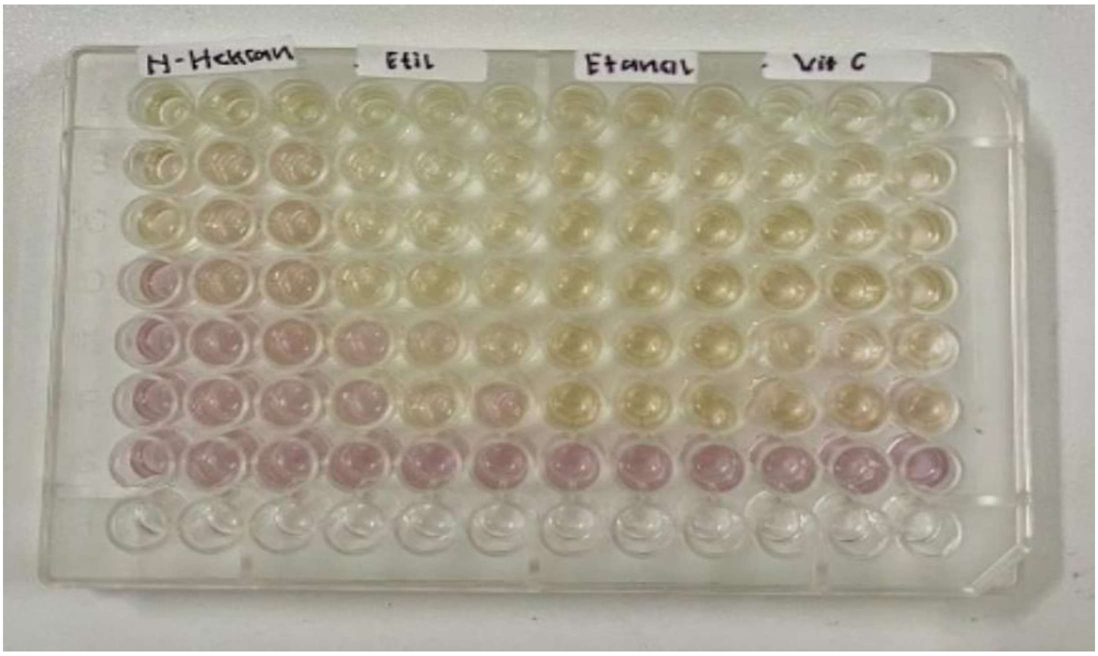

Figure 2. Antioxidant activity nanoemulgel *Pometia pinnata* extract

remained stable throughout the test period, showing no signs of phase separation, precipitation, or physical changes. The antioxidant activity results of the *Pometia pinnata* nanoemulgel formulations are presented in **Table 3**.

The antioxidant activity of the nanoemulgel formulations containing *Pometia pinnata* leaf ethanolic extract was evaluated using the DPPH assay. The results demonstrated that Formula 3 exhibited the strongest antioxidant activity, as indicated by the lowest IC_{50} value, compared with Formulas 1 and 2. A lower IC_{50} value reflects a greater free radical scavenging capacity. These findings are consistent with previous reports on *Pometia pinnata* leaf extract nanoemulsions, in which increasing extract concentrations resulted in enhanced antioxidant activity, with IC_{50} values of 126.1, 89.67, and 79.1 μg/mL at extract concentrations of 1%, 2.5%, and 5%, respectively [25]. In the present study, the antioxidant activity was evaluated only for nanoemulgel formulations containing Pometia pinnata leaf extract, whereas the antioxidant activity of the blank nanoemulgel base was not determined. Therefore, the contribution of the gel base to the overall antioxidant activity could not be established. Nevertheless, the superior antioxidant performance of Formula 3 may be associated with its denser gel network, which could improve the retention and sustained release of phenolic and flavonoid compounds from the incorporated extract [26]. In addition, previous studies have reported that nanoemulgel systems enhance the stability, skin penetration, and topical retention of bioactive compounds compared with conventional formulations, thereby supporting their potential as topical antioxidant delivery systems [27].

Table 3. Antioxidant Activity Nanoemulgel of *Pometia pinnata* Extract

Formula	IC50
L-ascorbic acid	11.450
F1	168.220
F2	121.750
F3	88.780

The mechanism of antioxidant action observed in this study is consistent with the DPPH reaction principle, in which antioxidant molecules donate hydrogen atoms to reduce DPPH free radicals into a stable non-radical form. This reduction is reflected by a decrease in absorbance and a visible color change of the DPPH solution from dark purple to pale yellow, confirming the free radical scavenging activity of the nanoemulgel [28]. Among the tested formulations, Formula 3 (Carbopol 2 %) exhibited the lowest IC_{50} value and demonstrated acceptable physical characteristics, including appropriate pH, spreadability, viscosity, homogeneity, and organoleptic properties. These findings indicate that Formula 3 provided the best overall performance among the evaluated formulations. Therefore, the nanoemulgel containing Pometia pinnata leaf ethanolic extract formulated with 2% Carbopol 940 shows promising potential as a topical antioxidant formulation for anti-aging applications.

CONCLUSION

The present study demonstrated that variations in the concentration of Carbopol 940 significantly affected the antioxidant performance of the *Pometia pinnata* leaf ethanol extract nanoemulgel. Among the three formulations, Formula 3 produced the highest antioxidant activity with the lowest IC_{50} value of 88.78 ppm, indicating superior free radical scavenging capacity. The enhanced performance is associated with the formation of a more compact and stable gel matrix that improves the entrapment, protection, and controlled release of bioactive compounds. These findings highlight the potential of matoa leaf extract nanoemulgel as a promising topical antioxidant and support its further development for dermatological applications, particularly in anti-aging formulations.

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest in this research.

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of Education, Culture, Research and Technology Republic of Indonesia for funding this work (grant numbers: 138/C3/DT.05.00/PL/2025).

REFERENCES

[1] S. Rihhadatulaisy, N. A. Putriana, and A. Penuaan, “AKTIVITAS ANTI AGING PADA BEBERAPA TANAMAN DENGAN BERBAGAI METODE PENGUJIANNYA” vol. 18, pp. 129–139, 2020. doi: https://jurnal.unpad.ac.id/farmaka/article/view/23212

[2] S. N. Yusharyahya, “Mekanisme Penuaan Kulit sebagai Dasar Pencegahan dan Pengobatan Kulit Menua Skin Aging Mechanism as A Basic Prevention and Treatment of Skin Aging,” vol. 9, no. 2, 2021. DOI: https://doi.org/10.23886/ejki.9.49.150

[3] A. Nurheni *et al.*, “LITERATUR RIVIEW : Serum dari Berbagai Bahan Alam yang Berpotensi Sebagai Antioksidan,” vol. 9, no. September, pp. 34–40, 2023. DOI: https://doi.org/10.5281/zenodo.8278300

[4] J. A. Rorong, “UJI AKTIVITAS ANTIOKSIDAN DARI DAUN CENGKEH (Eugenia Carryophyllus) DENGAN METODE DPPH,” vol. 1, no. 2, 2008. DOI: https://doi.org/10.35799/cp.1.2.2008.4961

[5] H. Damayanti, S. Wikarsa, and G. Jafar, “FORMULASI NANOEMULGEL EKSTRAK KULIT MANGGIS (Garcinia Mangostana L.),” *Jurna Ris. Kefarmasian Indones.*, vol. 1, no. 3, pp. 166–176, 2019. DOI: 10.33759/jrki.v1i3.53

[6] S. R. Garuda, “Buku Seri 1 : Tanaman Khas Papua,” *Balai Pengkaj. Teknol. Pertan. Papua*, no. 49, pp. 6(1):28–37., 2014. https://repository.pertanian.go.id/handle/123456789/20908

[7] A. D. Muaja, H. S. J. Koleangan, and M. R. J. Runtuwene, “Uji Toksisitas dengan Metode BSLT dan Analisis Kandungan Fitokimia Ekstrak Daun Soyogik (Saurauia bracteosa DC) dengan Metode Soxhletasi,” *J. MIPA*, vol. 2, no. 2, p. 115, 2013, doi: 10.35799/jm.2.2.2013.3000.

[8] Fitrianingsih Sri et al., “Studi literatur: formulasi krim dari bahan alam pada aktivitas antiaging,” vol. 6, no. 2, pp. 318–325, 2022. doi: https://doi.org/10.31596/cjp.v6i2.216

[9] D. Islami, L. Anggraini, and I. Wardaniati, “Aktivitas Antioksidan dan Skrining Fitokimia dari Ekstrak Daun Matoa Pometia pinnata,” *J. Farm. Higea*, vol. 13, no. 1, pp. 30–35, 2021, doi: 10.52689/higea.v13i1.328.

10] N. Jusnita, W. S. T, M. Sergianika, and P. Diaz, “Formulasi Nanoemulsi Ekstrak Temulawak (Curcuma Xanthorrhiza Roxb) Dengan Metode Inversi Suhu,” vol. 11, no. 2, 2019. doi: http://dx.doi.org/10.52689/higea.v11i2.229

[11] Yenny Meliana, *Peran Teknologi Nanoemulsi untuk Pengembangan Mutu Kosmetik dari Herbal Asli Indonesia*, no. November. 2022. doi: 10.55981/brin.716.

[12] F. Larysa, N. Sisri, I. Deri, K. Ratna, and F. Hannie, “FORMULASI NANOEMULSI EKSTRAK ETANOL DAUN MATOA (Pometia pinnata J . R . FORST . & G . FORST) SEBAGAI ANTIOKSIDAN Program Studi Farmasi , Fakultas Matematika dan Ilmu Pengetahuan Alam , Universitas Islam Publish By ; Jurnal Dunia Farmasi Saat ini , beber,” vol. 9, no. 3, pp. 164–177, 2025. doi: 10.33085/jdf.v9i3.6453

[13] S. Atun, A. Sinardekawati, A. C. Purpratama, N. Aznam, and A. Sangal, “CURCUMINOID NANOEMULSION FROM Curcuma xanthorrhiza EXTRACT AND ITS ACTIVITY AS ANTIOXIDANT , ANTIBACTERIAL AND ANTIFUNGAL,” vol. 15, no. 2, pp. 907–913, 2022. doi: http://dx.doi.org/10.31788/RJC.2022.1526690

[14] L. W. Ariani and Wulandari, “Formulasi Dan Stabilitas Fisik Sediaan Nanogel Minyak Biji Matahari,” *Repository.Stifar.Ac.Id*, vol. 1, no. 1, pp. 1–9, 2018. doi: https://repository.stifar.ac.id/Repository/article/view/228

[15] I. F. Kurniawati and S. Sutoyo, “Review Artikel: Potensi Bunga Tanaman Sukun (Artocarpus Altilis [Park. I] Fosberg) Sebagai Bahan Antioksidan Alami,” *Unesa J. Chem.*, vol. 10, no. 1, pp. 1–11, 2021, doi: 10.26740/ujc.v10n1.p1-11.

[16] S. P. M. K. Guseynova, “Aktivitas Antioksidan Formula Nano Gel Kombinasi Daun Sonneratia caseolaris dan Trigona sp . Propolis,” vol. 5, no. 2, 2024. doi: https://doi.org/10.31764/lf.v5i2.23417

[17] R. C. Martins, “applied sciences Paraben Compounds — Part I : An Overview of Their Characteristics , Detection , and Impacts,” 2021. doi: https://doi.org/10.3390/app11052307

[18] R. R. K. Pambudi, R. Ariastuti, and A. Ahwan, "Formulasi Nanoemulgel Ekstrak Biji Kopi Robusta (Coffea canephora Pierre) Dengan Variasi Gelling Agent Sebagai Antioksidan," *J. Farm. Indones.*, vol. 20, no. 1, pp. 11–23, 2023, doi: 10.31001/jfi.v20i1.1518.
[19] D. Erliani, M. Sari, G. P. Yudanti, S. Fitrianingsih, and R. Hidayati, "VARIASI GUAR GUM DAN KARBOPOL 940 SEBAGAI GELLING AGENT TERHADAP UJI SIFAT FISIK DAN KIMIA SEDIAAN GEL EKSTRAK," vol. 8, no. 1, pp. 71–87, 2024. doi: https://doi.org/10.31596/cjp.v8i1.268
[20] S. Favero, S. Valéria, W. C. Silvestrin, and C. Garcia, "Physicochemical Characterization and Safety Assessment of Cosmetic Gels and Emulsions Containing Sand- Extraction Clays," 2025, doi: 10.1111/jocd.70517.
[21] D. Andriani and M. S. Amin, "FORMULASI NANOEMULGEL MINYAK ATSIRI PALMAROSA (Cymbopogon martinii) DAN AKTIVITAS ANTIINFLAMASINYA," *Cendekia J. Pharm.*, vol. 7, no. 2, pp. 150–158, 2023. doi: https://doi.org/10.31596/cjp.v7i2.236
[22] N. A. Thomas, R. Tungadi, M. S. Latif, and M. E. Sukmawati, "Pengaruh Konsentrasi Carbopol 940 Sebagai Gelling Agent Terhadap Stabilitas Fisik Sediaan Gel Lidah Buaya (Aloe Vera)," vol. 3, no. 2, pp. 316–324, 2023, doi: 10.37311/ijpe.v3i2.18050.
[23] M. R. Donthi, S. R. Munnangi, K. V. Krishna, R. N. Saha, G. Singhvi, and S. K. Dubey, "Nanoemulgel : A Novel Nano Carrier as a Tool for Topical Drug Delivery," pp. 1–28, 2023. doi: https://doi.org/10.3390/pharmaceutics15010164
[24] E. Goji, B. Lycium, and D. Chandra, "UJI FISIKOKIIMIA SEDIAAN EMULSI , GEL , EMULGEL EKSTRAK," vol. 11, no. 2, pp. 219–228, 2022. doi: https://doi.org/10.48191/medfarm.v11i2.142
[25] I. F. Kurniawati and S. Sutoyo, "REVIEW ARTIKEL : POTENSI BUNGA TANAMAN SUKUN (ARTOCARPUS ALTILIS [PARK . I] FOSBERG) SEBAGAI BAHAN ANTIOKSIDAN ALAMI ARTICLE REVIEW : THE POTENTION OF BREADFUIT FLOWERS (ARTOCARPUS ALTILIS [PARK . I] FOSBERG) AS NATURAL ANTIOXIDANT," vol. 10, no. 1, pp. 1–11, 2021. doi: https://doi.org/10.26740/ujc.v10n1.p1-11
[26] S. Nurwaini and M. N. Fatimah, "Formulation And Characterization Of Gels Of Telang Flower Extract (Clitoria Ternatea L) With Variations Of Carbopol Concentration And Antioxidant Activity Test Using Dpph Methods," *Pharmacon J. Farm. Indones.*, vol. 21, no. 1, pp. 145–151, 2024. doi: 10.23917/pharmacon.v21i0.23469
[27] R. Ambarsari, Niati, Dayanti, "Literature Review: Aktivitas Antioksidan Ekstrak dan Fraksi Daun Matoa (Pometia pinnata)" vol. 5, pp. 447–452, 2023. doi: https://doi.org/10.37311/jsscr.v5i3.24251
[28] R. M. Syilfia Hasti, "AKTIVITAS ANTIRADIKAL DPPH EKSTRAK ETANOL KULIT BATANG Artocarpus altilis (Parkinson ex F.A.Zom) Fosberg Syilfia" vol. 11, no. 2, 2022. doi: 10.51887/jpfi.v11i2.1739