

## Shampoo With Basic Ingredients Chamomile Flower Extract (*Matricaria Chamomilla*): Formulation and Evaluation of Preparations

Adi Permadi <sup>a,1,\*</sup>, Stradivary Maulida Firdaus <sup>a,2</sup>, Abdul Aziz <sup>a,3</sup>, Ahmad Fatwa Zufar <sup>b,4</sup>

<sup>a</sup> Department of Chemical Engineering, Faculty of Industrial Technology, Universitas Ahmad Dahlan, Jl. Jend. Ahmad Yani, Banguntapan, Bantul, Yogyakarta, Indonesia

<sup>b</sup> Departement of Chemical Engineering, Faculty of Engineering, Universitas Gadjah Mada, Jl. Grafika No. 2, Kampus UGM, Yogyakarta, Indonesia

<sup>1</sup>adi.permadi@che.uad.ac.id\*; <sup>2</sup>2307054002@webmail.uad.ac.id; <sup>3</sup>abdul2000020038@webmail.uad.ac.id;

<sup>4</sup>ahmadfatwazufar@mail.ugm.ac.id

\*corresponding author

### ARTICLE INFO

#### Article history

Received January 24, 2024  
Revised February 14, 2024  
Accepted February 16, 2024

#### Keywords

Hair care  
Shampoo  
Apigenin  
Chamomile  
1,3,4-trihydroxyflavones

### ABSTRACT

*Proper hair maintenance is a crucial component of one's daily beauty regimen. Shampoo, a commonly utilized hair care solution, has a chemical blend that effectively eliminates filth while also offering moisturization and safeguarding. The objective of this study is to create shampoo formulations and preparations with chamomile extract. The chamomile flower extract contains active chemicals, specifically 1,3,4-trihydroxyflavones called apigenin and apigenin 7-o-glucoside. These compounds have several beneficial effects such as enhancing hair brightness and shine, as well as possessing antibacterial, antifungal, hypoglycemic, and antioxidant qualities. Shampoo's chemical composition is determined by analyzing factors such as pH, foamability, homogeneity, total plate count, yeast mold count, and other similar parameters. Upon examination of these criteria, it is evident that the formulation and shampoo formulations successfully complied with the test requirements outlined in SNI 06-2692-1992.*

*This is an open access article under the [CC-BY-SA](#) license.*



## 1. Introduction

Hair care is essential in the daily routine, with shampoo being one of the most frequently used products. Shampoo is a mixture of chemicals specially formulated to cleanse hair of dirt, excess oil, and sebum, while providing additional benefits such as moisture, shine, and protection from damage. However, detailed information on the chemical composition of shampoo and its effects on hair health is often limited [1]. Hair not only has aesthetic value, but also plays an important role in protecting the body. Apart from supporting the appearance, hair serves to protect the head and other body parts from injury and external factors such as dust. Hair health is not solely dependent on the body's daily routine. Problems that often arise in the hair, such as dandruff or hair loss, are a major concern. Hair acts as a key element in protecting the body from the adverse effects of sunlight, pollution, the use of cosmetic products, and other harmful substances. UV A rays trigger free radicals through the natural photosensitization process, while UV B rays reduce the production of melanin and keratin in the skin [2]. Hair, as the body's outermost layer, is susceptible to harmful impacts such as sun exposure, pollution, cosmetics, and cleaning chemicals. UV B sunlight damages melanin and hair keratin, while UV A produces free radicals through endogenous photosensitization [3-4].

Dandruff is a scalp disease characterized by excessive flaking of the stratum corneum, resulting in fine scales. This disease is associated with inflammation, dryness, and greasy hair [5]. Dandruff is

mostly caused by excessive sweat gland production or bacteria on the scalp [6]. Chemical treatments cannot totally cure dandruff. Dandruff is a chronic, non-inflammatory skin disorder affecting the scalp. It is characterized by severe scalp tissue damage [7]. Dandruff can also be induced by sebaceous gland secretions [8].

Shampoo consists of several compositions, including active substances, surfactants, anti-dandruff agents, cooling agents, thickening agents, colors, perfumes and also preservatives [9]. The cleaning agents commonly found in shampoos are known as detergents or surfactants. These substances are artificial compounds that do not contain soap and have a structure that is both fat-loving (lipophilic) and water-loving (hydrophilic). The fat-loving part interacts with sebum, while the water-loving part allows sebum to be carried away when rinsed with water. The chemical characteristic of this ingredient is amphiphilic [10]. Commonly used detergents are Sodium lauril sulfate, Trietanolamina lauril sulfate, Ammonium lauril sulfate, Ammonium lauril sulfate, Dietanolamin lauril sulfate, and Sodium olefin sulfonate [11]. Apart from using chemical cleansers, shampoos can also be made using natural ingredients. Examples of natural ingredients that can be added to shampoo include coconut oil, aloe vera, honey, jojoba oil, green tea extract, and almond oil [12]. People have long used herbs and their extracts to cleanse, detangle and treat hair. Today, there is an increasing reuse of hair care products that use natural ingredients [13]. Interest in herbal products also has a strong reason because herbal products are considered cheaper and have no side effects. [14]. However, formula development and manufacturing techniques for herbal-based products are still a challenge.

Chamomile (*Matricia chamomilla*) is one of the medicinal plants that has been recorded since ancient times and is still widely used as it was thousands of years ago. Today, chamomile flowers are still part of the commercial production of cosmetics, soaps, hair care products, bath products, and perfumes. One of the traditional ways of using chamomile flowers to give shine to hair is to make a solution of 25 grams of dried chamomile flowers with seven tablespoons of boiling water, which is then strained and poured and rubbed into the hair, then left for 20 minutes before rinsing. Chamomile flowers have a role in hair care products such as shampoos, conditioners, and hair lotions because they provide natural protection, softness, and freshness to the hair. Chamomile flower extract contains active components such as 1,3,4-trihydroxyflavones known as apigenin and apigenin 7-O-glucoside which can brighten and shine blonde hair [2].

**Table 1.** Shampoo Test Parameter Table

<b>Parameter</b>	<b>Evaluation of Liquid Herbal Shampoo</b>
Physical appearance	Foaming ability and foam stability
pH determination	Surface tension measurement
Determination of %solid content	Viscosity measurement
Dirt dispersion	Stability test
Wetting time	Eye irritation test
Cleaning action	Skin sensitivity test
Rheology profile	-

Chamomile essential oil contains antibacterial, antifungal, anti-inflammatory, hypoglycemic, neuroprotective, cytotoxic, and antioxidant properties [15]. Chamomile flowers have antioxidant activity with an IC50 value of 101.5 ppm [16]. Chamomile essential oil is efficient as an antioxidant at concentrations ranging from 0.5% to 10% [17]. Shampoos that are already on the market have their own quality and safety, therefore the formulated liquid herbal shampoo needs to be evaluated by comparing the parameters listed in Table 1 [13]. Creating a shampoo involves mixing detergents to achieve the desired pH for cleaning hair. Usually, several types of detergents are combined to achieve the desired end result. For example, when creating a shampoo for oily hair, the detergent with the best ability to remove sebum will be chosen for use [18]. It is important to realize that the quality of shampoo can vary significantly, and not all shampoos have the same effect on hair. Therefore, this research is expected to provide a deeper insight into hair care products that are often

used by the public. References relevant to the topics to be covered in this study, and chemical analysis and testing of various shampoos will be conducted to achieve the objectives of this study. Chamomile flowers can be used in hair care products, including shampoo, conditioner, and lotion. Chamomile can naturally protect, soften, and rejuvenate hair. Chamomile flower extract includes active ingredients. Apigenin, a 1,3,4-trihydroxyflavone, and its 7-o-glucoside can enhance hair shine.

This study aims to evaluate the efficacy of shampoo formulations including both chemical compounds and chamomile flower extract, in accordance with the standards set by SNI 06-2692-1992. The intention is to continue the development of this composition for use in subsequent shampoo products including chamomile flower extract.

## 2. Research Methodology

### 1. Materials

The research method carried out is an experiment to determine shampoos that can eliminate dandruff, moisturize, blacken and shine. The shampoo preparation formula used can be seen in Table 2. All the ingredients in this shampoo come from CV. Fashihul Alfarizki lab, Krapyak Kulon RT 05 No.164 Panggunharjo Sewon, Bantul, Yogyakarta.

**Table 2.** Shampoo Formula Table

<b>Ingredient Name</b>	<b>Percentage (%)</b>
Aquadest	70.83
Texapon / SLS	17.34
CAPB (cocamidopropyl betaine)	1.28
NaCl	5.20
Glycerine	1.06
Propylen Glycol	0.43
Polisorbet/Tween 80	0.43
Dimeticone	0.17
Exstrak Chamomile	0.43
Citrid Acid	0.04
Parfum Jasmine	0.43
Pearl Concentrat	2.17
Penoxyetanol	0.17
Total	100

### 2. Procedures

The experimental technique involves the evaluation of shampoo samples that have been prepared. Prior to creating shampoo samples, it is necessary to gather the required tools and materials. Begin by measuring the Texapon and Aquadest components, then whisk them gently and allow them to dissolve completely. The Next step CAPB is added to the same mixture and swirl gently until it is uniformly distributed. Subsequently glycerin is added to the mixture and stirred until evenly mixed. The mixture was then treated with propylene glycol. The chamomile essence is then added to the mixture and swirled until evenly combined. The next step is to pour dimethicone into the mixture. The mixture is then treated with citric acid, fragrance, and penoxyethanol. Afterwards, NaCl is added to the mixture and stirred slowly until evenly mixed. Later, include the pearl concentrate into the mixture and stir gently until it is uniformly dispersed. Subsequently, the pH of the shampoo mixture is verified. Once the pH of the shampoo preparation aligns with the requirements provided in SNI-06-2692-1992, transfer the shampoo preparation into a container for testing other parameters specified in SNI-06-2692-1992.

### Testing Shampoo Quality Requirements

Shampoo quality testing is conducted at CV. Fashihul Alfarizki and PT Saraswanti Indo Genetech. The tests conducted cover pH parameters, Organoleptics, shampoo cleansing efficacy, spreadability, homogeneity, surface tension, Pb metal content, foam power, foam stability, viscosity, total plate count (ALT), yeast mould count (AKK), eye and skin irritation.

### 3. Results and Discussion

This test was used to conduct pH test, organoleptic test, shampoo cleaning power, spreadability, homogeneity, surface tension, Pb metal, foamability, foam stability, viscosity, ALT, AKK, and eye and skin irritation testing. Table 3 explains the Shampoo testing parameters according to SNI-06-2692-1992

**Table 3.** Shampoo Test Result from CV. Fashihul Alfarizki Lab

Tests	Test Results	Standart	Description
pH	Rep 1: 5.0	5-9	Qualified
	Rep 2: 5.5	(SNI -06-	
	Rep 3: 5.0	2692-1992)	
Organoleptics	Color:Glossy	no deposition	-
	yellowish white	occurs	
	Odor: Jasmine	(SNI -06-	
Cleaning power of shampoo (% of dirt removed)	Texture: Thick	2692-1992)	-
	Rep 1: 18.5%	-	
	Rep 2: 19.2%	-	
Spreadability (100 grams load)	Rep 3: 17.5%	-	-
	Rep 1: 5.5 cm	5-7 cm	
	Rep 2: 5.3 cm		
Homogeneity	Rep 3: 5.6 cm		Qualified
	Rep 1: homogeneous	Homogeneous	
	Rep 2: homogeneous		
Surface tension	Rep 3: homogeneous		-
	Rep 1: 67.95 dyne/cm	-	
	Rep 2: 74.8 dyne/cm	-	
Pb metal	Rep 3: 74.8 dyne/cm	-	-
	Negative	Negative	
	Rep 1: 13.5 cm	-	
Foamability (foam height)	Rep 2: 14.0 cm	-	-
	Rep 3: 13.5 cm	-	
	Minutes 1: 12.5 cm	-	
Foam stability (foam height)	Minutes 2: 11.8 cm	-	-

	Minutes 3: 9.8 cm		
	Minutes 4: 8.3 cm		
	Minutes 5: 6.5 cm		
Viscosity	17970 cps		
ALT	<10 colony/gram	Negative	Qualified
AKK	<10 colony/gram	Negative	Qualified
Eye and skin irritation testing	Non-irritating (subjektive)	Non-irritating (subjektive)	-

\*Rep : Repetition

Several shampoo formulation product tests are conducted, with some referring to the SNI 06-2692-1992 standard [19]. However, prior studies have seldom conducted testing specifically focusing on lead concentration, Total Plate Number (ALT), Yeast Mold Number (AKK), as well as skin and ocular irritation tests. The results of the tests can be seen in Table 3 and Table 4. Consulting SNI 06-2692-1992 on test criteria for non-baby shampoo will yield specifications for organoleptic properties, pH level, water content, volatile compounds, and Sodium Lauryl Sulphate (SLS) concentration. In addition to these prerequisites, certain scholars employ alternative sources. The purpose of the pH test is to determine whether the final preparation is compatible with the pH of the skin. The pH of normal skin often falls between the range of 4.5 to 6.5. The pH test findings indicate that this shampoo formulation complies with the specifications of SNI 06-2692-1992.

This is important for ensuring safety and providing a comfortable experience when using the product. If the preparation does not align with the skin's pH, it may lead to irritation and interior pain when used. An excessively acidic or alkaline pH level in the shampoo might cause irritation to the skin and scalp. The requirement specified in SNI-06-2692-1992 is that there should be no presence of precipitation during organoleptic tests. The organoleptic test findings indicate that there is no formation of precipitation in the shampoo, hence satisfying the criteria set by the SNI. The color of the shampoo is determined by the inherent hue of the extracted material utilized. The specified foam height range, as stated by Mitsui (1997) [20], is 1.3 to 22 cm. The test findings indicate that the foam height measures between 13.5 and 14 cm. The results satisfy the stated criteria.

**Table 4.** Shampo Test Result from PT SARASWANTI INDO GENETECH

Parameter	Units	Result	Limit Of Detection	Method
Viscosity	Cp	17970.0	-	18-11-11/MU/SMM-SIG (Viscosmeter)
Lead (Pb)	mg/kg	Not detected	0.05	18-13-9/MU/SMM-SIG (ICP OES)
Total Plate Number	Colony/g	<10	-	ISO 21149 : 2017
Yeast Mould Number	Colony/g	<10	-	ISO 16212 : 2017

It can be seen in the test results that have been carried out testing the pH test on this shampoo meets the requirements. Then in the organoleptically test the color of the shampoo that has been

made is shiny yellowish white, smells of jasmine, and has a thick texture. Then in the cleaning power test the shampoo produced was the highest at 19.2% of dirt removed. The spread ability of this shampoo is the highest at 5.6 cm in a 100 grams load. From the test results, this shampoo is also homogeneous in the manufacturing process. The surface tension generated in this shampoo sample test is the highest at 74.8 dyne/cm. Pb metal testing on this shampoo sample resulted in a negative which is considered qualified.

The foamability test (foam height) generated from the test sequentially is 13.5 cm, 14.0 cm, and 13.5 cm. The SNI 06-2692-1992 test criteria do not consider foamability (foam height) and foam stability. Nevertheless, some studies adhere to the guidelines established by Wilkinson (1982), which specify a foam height range of 1.3 – 22.0 cm. The height of the foam serves as an indicator of the surfactant's foam-forming capability. The foam acts as a binding agent, ensuring that the shampoo remains on the hair. It facilitates the process of washing the hair and prevents the individual strands from adhering to one another, thus preventing the formation of tangles [21]. Then in the foam stability test sequentially at minutes 1-5, namely 12.5 cm, 11.8 cm, 9.8 cm, 8.3 cm and 6.5 cm. The viscosity test resulted in 17970 Cp.

The purpose of viscosity measurement is to ascertain the viscosity of the shampoo formulation. The measured viscosity of the shampoo is 17970 centi poise (cps). The viscosity of this shampoo formulation is high, indicating a low water content. Nevertheless, SNI 06-2692 -1992 does not incorporate viscosity as a test criterion. Nevertheless, Salsabila, *et al.*, (2022) sets the range of 4 - 400 dpas as the limit for star fruit leaf extract shampoo formulation, whereas Sari, *et al.*, (2019) sets the range of 400 - 4000 cps as the limit for ginger extract shampoo formulation [21-22]. The ALT and AKK tests resulted in <10 colony/gram which means negative and qualified. The last test is the eye and skin irritation test which results in no irritation to the eyes and skin.

#### 4. Conclusion

After analyzing the shampoo preparation made from chamomile extract, it was determined that chamomile extract can be used to make a physically stable shampoo preparation, as evidenced by its clear, homogenous appearance and lack of color or odor change. This shampoo turns glossy yellowish white and smells of jasmine. The test results of this study on shampoo formulations indicate that a significant proportion of shampoos satisfy the requirements outlined in SNI 06-2692-1992, while other test outcomes fail to meet these requirements. The shampoo formulation tests conducted by CV. Fashihul Alfarizki demonstrated that the formulated shampoo did not induce any irritation to the eyes or skin. Hence, this shampoo formulation is deemed appropriate for downstreaming and production.

#### Acknowledgment

The author wishes to thank Pharmacist Laili and Pharmacist Rahmad from CV. Fashihul Alfarizki Laboratory. The author would also like to thank the UAD chemical engineering master's program for facilitating this laboratory and research collaboration with many stakeholders.

#### References

- [1] M. S. Roberts, V. R. Leite-Silva, and K. A. Walters, *Cosmetic Formulation*. 2019.
- [2] Y. Nia et al., "Formulasi Dan Evaluasi Sediaan Shampoo Dengan Bahan Dasar Ekstrak Bunga Chamomile (*Matricaria Chamomilla*): Literature Review Article," vol. 9, no. 16, pp. 1–7, 2023.
- [3] U. Nafisah, Y. Diyan Permata Sari, and L. Nur Latifah, "Formulasi dan Evaluasi Fisik Sediaan Gel Sampo Minyak Atsiri Bunga Chamomile (*Matricaria recucita* L.) dengan Variasi Konsentrasi HPMC," *Parapemikir J. Ilm. Farm.*, vol. 12, no. 1, p. 136, 2023, doi: 10.30591/pjif.v12i1.4435.

- [4] E. Fernández, B. Martínez-Teipel, R. Armengol, C. Barba, and L. Coderch, "Efficacy of antioxidants in human hair," *J. Photochem. Photobiol. B Biol.*, vol. 117, pp. 146–156, 2012, doi: 10.1016/j.jphotobiol.2012.09.009.
- [5] E. Laelasari and I. Musfiroh, "Indonesian Journal of Biological Pharmacy Review Article : Potential of Herbal Plants Against *Pityrosporum ovale* Fungus Causes of Dandruff," vol. 2, no. 3, p. 153, 2022.
- [6] T. C. Malonda, P. V. Y. Yamlean, and G. Citraningtyas, "Formulasi Sediaan Sampo Antiketombe Ekstrak Daun Pacar Air (*Impatiens balsamina* L.) dan Uji Aktivitasnya Terhadap Jamur *Candida Albicans* Atcc 10231 secara *In Vitro*," vol. 6, no. 4, 2017.
- [7] H. Azzahra et al., "Indonesia Bachelor Program of Chemistry Education, Faculty of Teacher Training and Education," *Univ. Sebel. Maret.*, vol. 8, no. 1, pp. 114–127, 2023, [Online]. Available: <https://jurnal.uns.ac.id/jkpk>
- [8] R. S. Pal, N. Saraswat, P. Wal, A. Wal, and Y. Pal, "Preparation & Assessment of Poly-Herbal Anti-Dandruff Formulation," *Open Dermatol. J.*, vol. 14, no. 1, pp. 22–27, 2020, doi: 10.2174/1874372202014010022.
- [9] A. R. Saraswati, N. A. Putriana, F. Farmasi, and U. Padjadjaran, "13323-29034-1-Pb," vol. 15, pp. 248–261.
- [10] R. D. Sinclair, "Healthy Hair: What Is it?," *J. Investig. Dermatology Symp. Proc.*, vol. 12, no. 2, pp. 2–5, 2007, doi: <https://doi.org/10.1038/sj.jidsymp.5650046>.
- [11] R. BPOM, "Peraturan BPOM RI No. 17 Tahun 2022 Tentang Persyaratan Teknis Bahan Kosmetika," *Bpom Ri*, no. 702, pp. 1–337, 2022.
- [12] E. Nurhikma, D. Antasari, and Austin Selfyana tee, "Formulasi Sampo Antiketombe dari Ekstrak Kubis Kombinasi Ekstrak Daun Pandan Wangi," *J. Mandala Pharmacon Indones.*, vol. 4, no. 1, pp. 61–67, 2018.
- [13] G. Jennifer, R. Vito, F. Paola, and C. Pinalysa, "Hair Care Cosmetics: From Traditional Shampoo to Solid Clay and Herbal Shampoo, A Review," *Cosmetics*, vol. 6, no. 1, pp. 1–16, 2019, doi: 10.3390/cosmetics6010013.
- [14] K. Al Badi and S. A. Khan, "Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoos," *Beni-Suef Univ. J. Basic Appl. Sci.*, vol. 3, no. 4, pp. 301–305, 2014, doi: 10.1016/j.bjbas.2014.11.005.
- [15] A. E. Al-Snafi, "Medical Importance of *Anthemis Nobilis* (*Chamaemelum Nobile*): A Review" *Asian Journal of Pharmaceutical Science & Technology*, vol. 2, no. 2, pp. 89–95, 2016, [Online]. Available: [www.ajpst.com](http://www.ajpst.com)
- [16] S. Sulistiana and S. Tarini Darijanto, "Formulasi Dan Evaluasi Mikroemulsi Gel Minyak Chamomile Serta Uji Aktivitas Antioksidan," *Indones. J. Pharm. Educ.*, vol. 2, no. 1, pp. 52–66, 2021, doi: 10.37311/ijpe.v2i1.11231.
- [17] U. S. Abelan et al., "Potential use of essential oils in cosmetic and dermatological hair products: A review," *J. Cosmet. Dermatol.*, vol. 21, no. 4, pp. 1407–1418, 2022, doi: 10.1111/jocd.14286.
- [18] Z. D. Draelos, "Shampoos, Conditioners, and Camouflage Techniques," *Dermatol. Clin.*, vol. 31, no. 1, pp. 173–178, 2013, doi: 10.1016/j.det.2012.08.004.
- [19] S. Kusmiati and R. Yulianti, "Formulasi Sampo Ekstrak Buah Mengkudu (*Morinda citrifolia* L.) dan Uji Aktivitas terhadap *Pityrosporum ovale*," *Prosing Semin. Nas. Disem. Has. Penelit.*, vol. 2, pp. 144–151, 2022.
- [20] T. Mitsui, "New Cosmetsc Science. First Edition," Elsevier Sci. B.V., pp. 13–21, 1997.

- [21] A. S. Sari and R. H. Hayati, "Formulasi Sediaan Shampo Antiketombe Ekstrak Jahe (*Zingiber officinale* Rosc)" *Indones. J. Pharm. Nat. Prod.*, vol. 2, no. 1, pp. 4–7, 2019, doi: 10.35473/ijpnp.v2i1.195.
- [22] H. G. Salsabila, N. M. Zamruddin, and H. Herman, "Optimasi Konsentrasi Basis HPMC Sediaan Sampo Antiketombe Ekstrak Daun Belimbing Wuluh (*Averrhoa bilimbi* L.) Kombinasi Ekstrak Daun Pandan Wangi (*Pandanus amaryllifolius* Roxb)," *Proceeding Mulawarman Pharm. Conf.*, vol. 15, pp. 94–99, 2022, doi: 10.25026/mpc.v15i1.624.