

## Formulation test of facial serum mangosteen rind extract (*Garcinia Mangostana*) and niacinamide

Mia Marlina<sup>1</sup>, Maya Uzia Beandrade<sup>2\*</sup>, Dede Dwi Nathalia<sup>3</sup>, Reza Anindita<sup>4</sup>

<sup>1,2,3,4</sup> Department of Pharmacy, Sekolah Tinggi Ilmu Kesehatan Mitra Keluarga Bekasi, Indonesia

\*Correspondence author : [maya.uzia@stikesmitrakeluarga.ac.id](mailto:maya.uzia@stikesmitrakeluarga.ac.id)

### Abstract

Facial serum can be described as a product that contains active ingredients to treat skin and fade acne scars. Mangosteen peel has benefits as an antibacterial. The ingredients contained in the mangosteen rind are flavonoids, alkaloids, and phenols. The research design used was pre-experimental, using mangosteen rind samples. The physical stability test was carried out by organoleptic, homogeneity, pH, and viscosity tests for 14 days. Data analysis was performed with a descriptive test. The results of the phytochemical screening test on the flavonoid, phenol, and alkaloid tests obtained positive results. Organoleptic test results during 14 days of storage did not change color and smell. pH test results on F1 6.33- 6.41; F2 5.85-6.06 ; and on F3 5.48-5.69. Homogeneity test results on the three homogeneous formulas, and the F1 viscosity test 10,333- 22,500 cP; F2 11.000-21.667 cP; and F3 10.833-21.333 cP. It can be found that the decrease in the pH value was found in F1 (1%) by 0.15%, F2 (3%) by 3.4% and F3 (5%) by 3%. The decrease in viscosity in F1 (1%) was 54%, F2 (3%) was 49.22%, and F3 (5%) was 49.21%. So, it is necessary to add observation time in order to obtain information on the physical stability of a good serum preparation formula.

**Keywords:** *Mangosteen Rind Extract; Niacinamide ; Facial Serum ; Physical Stability Test*

### Introduction

Now, skin care products and cosmetics are the most important part of many people's lives. Facial care is used to maintain appearance and increase self-confidence (Pratiwi *et al.*, 2021). As time goes by, many people use dangerous cosmetics such as hydroquinone and mercury to get fast results (Kurniawan & Nugraha, 2022). However, there is a demand for plant extracts that are effective in skin care and treating skin problems.

One of the microorganisms that causes skin problems is bacteria. Several bacteria can occur on facial skin, namely *P. vulgaris*, *P. acnes*, *S. epidermidis*, and *S. aureus* (Gidde, 2021). These bacteria can cause blockages, inflammation and acne on the skin or acne vulgaris (Budiman *et al.*, 2018). Acne Vulgaris, or acne, is a disease that results from excessive secretion of oil glands on the face (Duru & Örsal, 2021). Acne vulgaris can be characterized by the presence of comedones, papules and pustules (Tayel *et al.*, 2020). The prevalence of acne vulgaris in the world is 9.4%, and it is the most common disease throughout the world (Layton *et al.*, 2021). The prevalence of acne vulgaris in Southeast Asia is around 40-80% of the population, and the prevalence of acne vulgaris in Indonesia is 80-85% in adolescents aged 15-18 years (Pramuningtyas and Oktafiani., 2022).

The problem of acne vulgaris can be caused by hormones, sun exposure, and using inappropriate skincare on a person's facial skin. Apart from that, it can also be caused by age and sleep quality (Yang *et al.*, 2020). The impact of acne vulgaris itself is that it can cause a person to lack self-confidence, stress, depression, cause feelings of embarrassment, and can also cause anxiety or sadness (Layton *et al.*, 2021). Prevention of acne vulgaris can be carried out according to different levels of severity, systemic prevention, and topical prevention, such as retinoids. Acne treatment and skin care can use moisturizers that have been successful in reducing skin irritation. Acne vulgaris can be prevented by using cosmetics that contain active ingredients such as salicylic acid, niacinamide, retinoids, and alpha-hydroxy acids (AHA) (Dréno *et al.*, 2020). Prevention of acne vulgaris can also be prevented by using cosmetic products that contain natural extracts, one of which is mangosteen rind extract. Mangosteen peel has antibacterial, antioxidant and anti-cancer benefits. The compounds contained in mangosteen peel are flavonoids, phenols, and alkaloids (Nurdianti *et al.*, 2022). Based on previous research using mangosteen rind extract at concentrations of 0.5%, 2%, 3.5%, and 5% and without solvents, however, in this research, a product has never been developed to produce facial serum with 1%, 3% mangosteen rind extract. % and 5% and 2% niacinamide, so researchers are interested in formulating innovative facial serum products from ethanol extract of mangosteen peel and niacinamide. The four tests carried out by researchers included organoleptic tests, pH, homogeneity and viscosity tests. It is hoped that the results of this research can become a reference for further research regarding the antibacterial activity of innovative facial serum products containing ethanol extract of mangosteen peel (*Garcinia mangostana*) and niacinamide.

## Methods

### Sample Preparation

Mangosteen rind samples were taken from plantations in Yogyakarta. Determination of natural material sources of mangosteen rind was carried out at LIPI Bogor. The ethanol extract of mangosteen rind is made at Palapa Muda Perkasa, Depok. In this study, the maceration method was used, beginning with the manufacture of mangosteen rind simplicia powder, then soaked in 96% ethanol solvent for 3x24 hours. After three days, the sample was filtered, and then the filtrate was taken and concentrated with a rotary evaporator at  $\pm 40^{\circ}\text{C}$  to obtain a thick extract of mangosteen rind (Chairunnisa *et al.*, 2019).

### Making Facial Serum Innovations

Weigh the ingredients, then heat 100 mL of distilled water to a temperature of 90°C. Put the distilled water into the mortar then add 2 grams of CMC Na into the mortar little by little, grind until a serum base is formed, add 2 grams of niacinamide into the mortar until homogeneous, then add 1 gram, 3 grams and 5 grams of mangosteen rind ethanol extract to the mortar. different then grind until homogeneous then add distilled water ad 100 mL, then mix again using a mixer after that put half of the preparation into a plastic pot and put the rest into a serum bottle.

**Table 1.** Formulation of Mangosteen Peel Extract Facial Serum

Material	F1	F2	F3
Mangosteen Peel Extract	1%	3%	5%
Niaciamide	2%	2%	2%
CMC Na	2%	2%	2%
Aquadest ad	100 mL	100 mL	100 mL

### Physical Stability Test

The physical stability tests in this research include organoleptic, homogeneity, pH and viscosity tests, which refer to the research of Ariyanti *et al.* (2020), Murshid (2017) and Yuniarsih and Sari (2021). Organoleptic tests were carried out independently by looking at the color and smell of F1, F2 and F3 facial serum preparations in plastic pots. The homogeneity test is carried out by taking enough serum and placing it on the watch glass. After that, the serum is touched and rubbed. Coarse particles must not be present on the watch glass. The pH test is carried out by inserting a pH meter into the facial serum preparation in plastic pots F1, F2 and F3. Looking at the pH results of the facial serum preparation shows an acidic or alkaline pH. The viscosity test was carried out by inserting the spindle into a plastic pot containing facial serum samples F1, F2 and F3, then seeing that the viscosity results met the range of 3,000-50,000 cP.

### Phytochemical Screening

Phytochemical screening in this study was carried out based on a modified procedure from Anggriani *et al.* (2017), Reiza *et al.* (2019) and Putri *et al.* (2019). The flavonoid test was carried out by taking mangosteen rind extract and putting it in a test tube, adding pieces of Mg band and adding three drops of concentrated HCl. Orange, red or blue color indicates positive flavonoids. The alkaloid test was carried out with 0.5 g of mangosteen rind extract put into a test tube added 1 mL of 2N HCl shaken until homogeneous, then added Wagner, Mayer, and Dragendorf reagents in each test tube as much as 2-3 drops. The presence of alkaloids in Wagner's reagent shows a brownish-yellow precipitate. In Mayer's reagent, a white or yellow precipitate is indicated. The Dragendorf reagent shows a yellow or orange precipitate. A phenol test was carried out with 0.5 grams of ethanol extract of mangosteen rind in a test tube, added with  $\text{FeCl}_3$ . A change in color to green, red, purple, blue, or solid black indicates phenol positivity.

## Results and Discussions

### Organoleptic Test

Examination of organoleptic tests of facial serum on F1, F2, and F3 includes odor and color. Organoleptic testing was carried out for 14 days and observed changes in color and odor in the facial serum preparation. Organoleptic test results can be seen in **table 2**.

**Table 2.** Serum Organoleptic Test

Formula	Organoleptic Test Results	
	Day-1	Day-14
<b>F1 (1%)</b>	Color : Light Yellow Smell: Typical aromatic Mangosteen	Color: Light Yellow Smell: Typical aromatic Mangosteen
<b>F2 (3%)</b>	Color: Light Brown Smell: Typical aromatic Mangosteen	Warna : Coklat Muda Smell: Typical aromatic Mangosteen
<b>F3 (5%)</b>	Color : Dark Brown Smell: Typical aromatic Mangosteen	Color : Dark Brown Smell: Typical aromatic Mangosteen

### Homogeneity Test

The F1, F2, and F3 homogeneity tests were carried out by applying the serum preparation to a watch glass to see whether the facial serum preparation was mixed evenly. The homogeneity test results can be seen in **table 3**

**Table 3.** Serum Homogeneity Test

Formula	Homogeneity Test Results	
	Day-1	Day-14
F1 (1%)	Homogeneous There are no coarse particles	Homogeneous There are no coarse particles
F2 (3%)	Homogeneous There are no coarse particles	Homogeneous There are no coarse particles
F3 (5%)	Homogeneous There are no coarse particles	Homogeneous There are no coarse particles

### pH Test

This test is carried out to see whether the pH value of facial serum in F1, F2 and F3 is acidic, alkaline or neutral. The pH stability test on F1, F2, and F3 was carried out during 14 days of storage. The results of the pH test in this study can be seen in **table 4**

**Table 4.** Average Serum pH Value with n=3

Day	F1 (1%)	F2 (3%)	F3 (5%)
1	6,34 ± 0,10	6,06 ± 0,00	5,65 ± 0,08
3	6,40 ± 0,02	5,91 ± 0,05	5,58 ± 0,03
6	6,41 ± 0,01	6,04 ± 0,02	5,69 ± 0,02
9	6,35 ± 0,06	5,86 ± 0,10	5,62 ± 0,04
14	6,33 ± 0,13	5,85 ± 0,02	5,48 ± 0,017

### Viscosity Test

The viscosity test was carried out to determine the viscosity value of facial serum preparations on F1, F2, and F3. The viscosity stability test of the three formulas was carried out for 14 days of storage. The results of the serum viscosity test in this study can be seen in **table 5**

**Table 5** Average Serum Viscosity Values with n=3

Day	F1 (1%)	F2 (3%)	F3 (5%)
1	22.500 ± 1322,88	21.666 ± 2081,67	21.333 ± 3403,43
3	21.166 ± 1892,97	18.000 ± 500,00	20.666 ± 2362,91
6	16.833 ± 577,35	13.333 ± 288,68	13.000 ± 0,00
9	11.500 ± 1000,00	11.333 ± 1443,38	11.166 ± 763,76
14	10.333 ± 577,35	11.000 ± 0,00	10.833 ± 577,35

The formula composition (F) of this research serum preparation includes ethanol extract of mangosteen peel with concentrations of 1%, 3% and 5%, respectively, calcium carboxymethylcellulose (CMC Na) 2%, niacinamide 2% and distilled water ad 100 mL. In F1, with an extract concentration of 1%, the color is light yellow. Formula 2, with an extract concentration of 3%, is light brown, and in Formula 3, with an extract concentration of 5%, the color is dark brown. There is a difference in color between the three formulations due to the use of the ethanol extract concentration of mangosteen peel. The greater the concentration of extract used, the darker the brown color obtained.

In the physical stability test carried out during 14 days of storage, there was no change in shape. There was only a change in color, which was caused by the difference in concentration in the three formulations. This is because when storing facial serum preparations are stored in a tightly closed container and protected from light. The results of the homogeneity test showed that the serum preparation remained homogeneous during the 14-day storage period because the watch glass did not show any coarse grains or smooth surfaces. This is because, during the formulation of the active

ingredient, serum preparations and other additional ingredients have been mixed perfectly. Therefore, the results obtained are homogeneous serum preparations in the three formulations.

Based on the pH test of the facial serum preparation from the ethanol extract of mangosteen rind, which was carried out every three days during 14 days of storage at room temperature, it still falls within the permissible pH requirements of 4.5-6.5 (Fitria *et al.*, 2022). The purpose of testing the pH of the preparation was carried out several times within a predetermined time range, namely to determine the pH stability of the resulting facial serum preparation (Erwiyani *et al.*, 2018). The pH difference is caused by differences in the concentration of the extract used in facial serum preparations. The results of pH measurements for 14 days showed that the pH of all formulations rose and fell but was still included in the skin pH limit of 4.5-6.5. The environmental factors and poor storage could cause the decrease and increase in pH of the preparations during storage.

Based on the results of the viscosity test, the serum preparation from ethanol extract of mangosteen peel, which was stored for 14 days at room temperature, still met the viscosity range of a preparation. Based on the viscosity results obtained by the three facial serum preparation formulations when the stability test was carried out at room temperature, the viscosity value experienced an increase and decrease when stored for 14 days, but the viscosity value in the three preparation formulas still fell within the requirements, namely 3,000-50,000 cP. The viscosity value obtained in this study decreased during 14 days of storage at room temperature. Several factors can cause a decrease in viscosity values, one of which is stirring or mixing the preparation. Stirring for too long can damage the gel preparation and cause a decrease in viscosity (Rahayu *et al.*, 2023). Another factor that can influence changes in viscosity values is storage at room temperature, which will cause the growth of bacteria in the gel formulation, which can cause an acidic atmosphere in facial serum preparations. The viscosity can change (Mardiana *et al.*, 2020).

Research on phytochemical testing obtained positive results in the phenol, flavonoid, and alkaloid tests with dragendorf, Wagner, and mayer reagents obtained positive results. The flavonoid test was carried out by placing the extract in a test tube and then adding magnesium ribbon and concentrated HCl. Concentrated HCl acts on the benzopyrone nucleus in the flavonoid structure, which is cleaved by concentrated HCl to give red or orange flavilium salts. The results of the flavonoid test in this study were positive because there was an orange color in the sample. An orange solution is formed due to the reduction reaction between Mg and HCl, resulting in an orange solution.

In the alkaloid test, the ethanol extract of mangosteen peel was mixed with HCl, Mayer, Wagner and Dragendorf reagents. The alkaloid test begins with the addition of HCl because HCl can help increase the solubility of alkaloids. After all, alkaloid compounds can react with HCl to form salts that dissolve easily in water, while the Mayer, Dragendorf and Wagner reagents function to identify alkaloid compounds. The alkaloid test with Mayer's reagent obtained a positive result, forming a white precipitate. The white color is formed because it comes from a potassium-alkaloid complex compound. The alkaloid test with the Wagner reagent obtained a positive result, which formed a brownish-yellow precipitate. The formation of a brownish-yellow precipitate is due to the metal ion K<sup>+</sup> binding to nitrogen in the alkaloids (Parbuntari *et al.*, 2018).

## Conclusions

Stability tests of facial serum preparations at F1 concentration (1%), F2 (3%), and F3 (5%) were carried out for 30 days, but the research was only carried out for 14 days. Based on the results of the viscosity test, there was a percentage reduction in F1 (1%) of 54%; F2 (3%) was 49.22% and F3 (5%) was 49.21%. Thus, it is necessary to increase the observation time so that information on the physical stability of a good serum preparation formula is obtained.

## References

- Ariyanti, E. L., Handayani, R. P., & Yanto, E. S. (2020). Formulasi Sediaan Serum Antioksidan Dari Ekstrak Sari Tomat (*Solanum Lycopersicum* L.) Dan Ekstrak Kayu Manis (*Cinnamomum Burmannii*) Sebagai Perawatan Kulit. *Journal Of Holistic And Health Sciences*, 4(1), 50–57. <https://doi.org/10.51873/jhhs.v4i1.80>
- Budiman, A., Rusnawan, D. W., & Yuliana, A. (2018). Antibacterial activity of piper betle L. Extract in cream dosage forms against *Staphylococcus aureus* and *propionibacterium acne*. *Journal of Pharmaceutical Sciences and Research*, 10(3), 493–496.
- Chairunnisa, S., Wartini, N. M., & Suhendra, L. (2019). Pengaruh Suhu dan Waktu Maserasi terhadap Karakteristik Ekstrak Daun Bidara (*Ziziphus mauritiana* L.) sebagai Sumber Saponin. *Jurnal Rekayasa Dan Manajemen Agroindustri*, 7(4), 551. <https://doi.org/10.24843/jrma.2019.v07.i04.p07>

- Dréno, B., Araviiskaia, E., Kerob, D., Andriessen, A., Anfilova, M., Arenbergerova, M., Forero Barrios, O. L., Bukvić Mokus, Z., Haedersdal, M., Hofmann, M. A., Khamaysi, Z., Kosmadaki, M., Lesiak, A., Roó, E., Zbranca-Toporas, A., Wiseman, M. C., Zimmo, S., Guerin, L., & Fabbrocini, G. (2020). Nonprescription acne vulgaris treatments: Their role in our treatment armamentarium—An international panel discussion. *Journal of Cosmetic Dermatology*, 19(9), 2201–2211. <https://doi.org/10.1111/jocd.13497>
- Duru, P., & Örsal, Ö. (2021). The effect of acne on quality of life, social appearance anxiety, and use of conventional, complementary, and alternative treatments. *Complementary Therapies in Medicine*, 56. <https://doi.org/10.1016/j.ctim.2020.102614>
- Erwiyani, A. R., Destiani, D., & Kabelen, S. A. (2018). Pengaruh Lama Penyimpanan Terhadap Sediaan Fisik Krim Daun Alpukat (*Persea Americana Mill*) dan daun sirih hijau (*Piper betle Linn*). *Indonesian Journal of Pharmacy and Natural Product*, 1(1), 23–29. <https://doi.org/10.35473/ijpnp.v1i1.31>
- Fitria, N., & Padua Ratu, A. (2022). Karakteristik Dan Stabilitas Sediaan Serum Ekstrak Buah Kersen (*Muntingia Calabura L.*) Dengan Variasi Konsentrasi. *Jurnal Farmamedika (Pharmamedica Journal)*, 7(1), 17–27. <https://doi.org/10.47219/ath.v7i1.140>
- Gidde, N. (2021). *Formulation and Optimization of Semi Herbal Anti Acne Compact*. 11(June).
- Kurniawan<sup>1\*</sup>, E. N., & Fajar Nugraha<sup>1</sup>, H. K. (2022). Analysis of Hydroquinone Content in Whitening Cream by Spectrophotometry UV-Vis Method. *Journal Syifa Sciences and Clinical Research*, 4(3), 768–777.
- Layton, A. M., Thiboutot, D., & Tan, J. (2021). Reviewing the global burden of acne: how could we improve care to reduce the burden. *British Journal of Dermatology*, 184(2), 219–225. <https://doi.org/10.1111/bjd.19477>
- Mardiana, L., Sunarni, T., & Murukmihadi, M. (2020). Optimasi Kombinasi Carbomer dan CMC-Na dalam Sediaan Gel Pewarna Rambut Ekstrak Bunga Telang (*Clitoria ternatea L.*). *Pharmacy: Jurnal Farmasi Indonesia (Pharmaceutical Journal of Indonesia)*, 17(1), 128. <https://doi.org/10.30595/pharmacy.v17i1.6261>
- Mursyid, A. M., & Waris, R. (2021). Formulation and Evaluation of Pharmaceutically Stable Serum of *Duchesnea Indica* (Arbenan). *Universal Journal of Pharmaceutical Research*, 6(1), 38–42. <https://doi.org/10.22270/ujpr.v6i1.538>
- Nurdianti, L., Hidayat, T., & Bastian, R. (2022). Formulasi dan Evaluasi Sediaan Suppositoria Ekstrak Etanol Kulit Buah Manggis (*Garcinia mangostana L.*). *Jurnal Farmasi Dan Farmakologi Volume 2*, 2, 113–122.
- Parbuntari, H., Prestica, Y., Gunawan, R., Nurman, M. N., & Adella, F. (2018). Preliminary Phytochemical Screening (Qualitative Analysis) of Cacao Leaves (*Theobroma cacao L.*). *Eksata: Berkala Ilmiah Bidang MIPA*, 19(2), 40–45. <https://doi.org/10.24036/eksakta/vol19-iss2/142>
- Pramuningtyas, R., & Oktafiani, N. S. (2022). Efektivitas Oral Isotretinoin Sebagai Pengobatan Acne Vulgaris Derajat Sedang Dan Berat. *Jurnal Ilmiah Indonesia*, 7(8.5.2017), 2003–2005.
- Pratiwi, R. I. H., Arpiwi, N. L., & Arpiwi, N. L. (2021). Formulasi Serum Ekstrak Buah Malaka (*Phyllanthus emblica*) Sebagai Anti Aging. *Metamorfosa: Journal of Biological Sciences*, 8(2), 284. <https://doi.org/10.24843/metamorfosa.2021.v08.i02.p12>
- Putri, H. D., Sumpono, S., & Nurhamidah, N. (2019). Uji Aktivitas Asap Cair Cangkang Buah Karet (*Hevea Brasiliensis*) Dan Aplikasinya Dalam Penghambatan Ketengikan Daging Sapi. *Jurnal Pendidikan Dan Ilmu Kimia 2(2) : 97-105*, 2(2), 97–105. <https://doi.org/10.33369/atp.v2i2.7474>
- Rahayu Putri, Eva Monica, F. Y. C. (2023). Antioksidan Kombinasi Ekstrak Kulit Buah Manggis (*Garcinia mangostana L.*) Dan Lidah Buaya (*Aloe vera L.*). *Jurnal Ilmiah Sains & Teknologi Formulasi*.
- Reiza, I. A., Rijai, L., & Mahmudah, F. (2019). Skrining Fitokimia Ekstrak Etanol Kulit Nanas (*Ananas comosus Merr*). *Proceeding of Mulawarman Pharmaceuticals Conferences*, 10, 104–108. <https://doi.org/10.25026/mpc.v10i1.371>
- Tayel, K., Attia, M., Agamia, N., & Fadl, N. (2020). Acne vulgaris: prevalence, severity, and impact on quality of life and self-esteem among Egyptian adolescents. *Journal of the Egyptian Public Health Association*, 95(1). <https://doi.org/10.1186/s42506-020-00056-9>
- Yang, J., Yang, H., Xu, A., & He, L. (2020). A Review of Advancement on Influencing Factors of Acne: An Emphasis on Environment Characteristics. *Frontiers in Public Health*, 8(September), 1–16. <https://doi.org/10.3389/fpubh.2020.00450>
- Yuniarsih, N., & Meilinda Sari, A. (2021). Formulasi dan Evaluasi Stabilitas Fisik Sediaan Gel Face Scrub Ekstrak Cucumis sativus L. dan Ampas Kelapa. *Majalah Farmasetika* 6 (Suppl 1), 152. <https://doi.org/10.24198/mfarmasetika.v6i0.36706>