Journal of Social Research
P-ISSN: 2827-9832
E-ISSN: 2828-335x
Vol. 4, No. 12, November 2025
http://ijsr.internationaljournallabs.com/index.php/ijsr

Physical Stability Evaluation of 5% Curcuma Longa Extract Using the Maceration Extraction Method

Azhar Arrosyid*, Nurrachmat Mulianto, Nugrohoaji Dharmawan
Universitas Sebelas Maret, Indonesia
Email: a.arrosyid83@gmail.com*

ABSTRACT

Curcuma longa (turmeric) is a medicinal plant widely used for its anti-inflammatory, antioxidant, and antimicrobial properties. Cream formulations are ideal for topical delivery due to their ease of application, good absorption, and patient acceptability. The maceration method is a simple and cost-effective technique for obtaining plant extracts without compromising bioactive compounds. This study aimed to evaluate the physical stability of a cream formulation containing 5% *Curcuma longa* extract prepared using the maceration extraction method. The extract was prepared through maceration of dried turmeric rhizome using ethanol, followed by evaporation to obtain the concentrated extract. The cream was formulated with stearic acid, cera alba, vaselin album, triethanolamine, propylene glycol, and distilled water as base components. Physical stability parameters were tested over seven days, including pH, dispersion, and adhesion tests. Statistical analysis was performed using the Friedman test. The pH values ranged from 7.33 to 7.50 ($p = 0.006$), indicating mild alkalinity but remaining within an acceptable range for topical application. Dispersion remained stable throughout the observation period ($p = 0.452$), while adhesion increased significantly from 182.71 to 200.04 seconds ($p = 0.006$), suggesting improved cohesiveness. The 5% *Curcuma longa* extract cream demonstrated good physical stability, indicating that the maceration method is a viable approach for developing stable topical herbal formulations.

Keywords: *Curcuma Longa; Maceration Extraction; Physical Stability.*

INTRODUCTION

Herbal medicine, widely used as an alternative and complementary therapy for its safety and accessibility, includes *Curcuma longa* (turmeric), a Zingiberaceae plant whose principal bioactive compound, curcumin, exerts anti-inflammatory, antioxidant, and wound-healing effects through inhibition of the NF-κB and COX-2 pathways (1–3). These properties make turmeric a promising candidate for dermatological formulations (Memarzia et al., 2021).

Cream formulations are preferred for topical delivery because they offer excellent spreadability, aesthetic acceptability, and hydration balance, while vanishing creams in particular provide faster absorption and minimal greasiness, thereby enhancing patient compliance (4) (Mohiuddin, 2019). To ensure product efficacy and safety, physical stability tests such as pH, dispersion, and adhesion are crucial (5) (Sengupta, Chatterjee, & Tekade, 2018). These parameters determine whether the preparation maintains consistent quality, texture, and compatibility with the skin during storage and use (Raghavan, Brown, Michniak-Kohn, Ng, & Sammeta, 2019).

The maceration extraction method is a conventional technique that involves soaking plant materials in a suitable solvent to extract active constituents (Rasul, 2018). Although time-consuming, it offers the advantage of simplicity and minimal degradation of heat-sensitive compounds (6).

Several studies have explored the formulation and stability of *Curcuma longa* extracts (Syed, Liew, Loh, & Peh, 2015). For instance, developed and evaluated a cream containing

curcumin, reporting favorable physical properties but employing a different extraction technique (soxhletation) (Manasa, Kamble, & Chilakamarthi, 2023). investigated the stability of a nanoemulsion containing turmeric extract, highlighting the challenge of curcumin degradation but focusing on a more complex delivery system (Zheng & McClements, 2020). A study by compared extraction methods and found that maceration, while yielding a lower extract, better preserved the antioxidant activity of heat-sensitive compounds compared to methods like reflux (Osorio-Tobón, 2020). Furthermore, assessed the physical stability of a *herbal* gel formulation, establishing a benchmark for stability testing protocols in semi-solid *herbal* preparations (Choudhary, 2024). However, a focused evaluation of the physical stability of a simple, maceration-derived *Curcuma longa* extract in a standard vanishing cream base, specifically at a 5% concentration, remains inadequately documented in the literature. This leaves a gap in understanding the practical viability of using this accessible extraction method for developing stable topical products (Mohite et al., 2025).

The urgency of this research is underscored by the growing demand for standardized, stable, and effective *herbal* topical products(Wang et al., 2023) . The lack of comprehensive stability data for formulations using simple extraction methods like maceration hinders the reliable development and commercialization of *Curcuma longa*-based creams, especially in resource-limited settings. Without such studies, there is a risk of product inconsistency, reduced efficacy, and potential consumer dissatisfaction, which could impede the integration of evidence-based *herbal* remedies into mainstream dermatological care. Establishing the stability of a formulation derived from a simple, cost-effective method is crucial for ensuring product quality, safety, and accessibility (Wang et al., 2023).

The novelty of this research lies in the specific investigation of the *physical stability* of a 5% *Curcuma longa* extract cream prepared exclusively using the maceration method (Al-Busaid, Akhtar, Alam, & Shehata, 2020). While *Curcuma longa* and creams have been studied separately, this study provides dedicated empirical data on the stability profile of this specific combination (5% concentration + maceration extraction + vanishing cream base) over time (Mphahlele, 2019). It explicitly addresses the gap left by previous studies that often use more complex extraction techniques or delivery systems, thereby offering valuable insights for formulating stable *herbal* products with traditional and accessible methods (Devi, Jain, & Valli, 2010). Therefore, this study aims to assess the *physical stability* of a 5% *Curcuma longa* extract cream prepared using the maceration method, providing essential data for the development of reliable topical *herbal* formulations (Saraf, Jeswani, Kaur, & Saraf, 2011).

METHOD

This experimental study was conducted at the Laboratory of the Faculty of Pharmacy, Setia Budi University, Surakarta, in March 2024. Fresh Curcuma longa rhizomes (1 kg) were obtained from local sources and authenticated by a botanist. Stearic acid, cera alba, vaselin album, triethanolamine, propylene glycol, and distilled water were used as cream base ingredients.

The Curcuma longa rhizomes were cleaned, sliced, and dried in the shade until a constant weight was achieved. The dried material was then powdered and subjected to maceration using ethanol for three consecutive 24-hour periods with periodic stirring to maximize extraction efficiency. The resulting filtrate was evaporated under reduced pressure to obtain a

concentrated extract, which was subsequently stored at 4°C until use. For cream preparation, the formulation process involved the combination of oil and aqueous phases under controlled heating. In the oil phase, stearic acid, cera alba, and vaselin album were melted together at a temperature range of 70–90°C. Simultaneously, the aqueous phase was prepared by dissolving triethanolamine and propylene glycol in water and heating it to the same temperature. Both phases were then gradually combined and homogenized using a mortar until the mixture reached room temperature, ensuring uniform consistency. The Curcuma longa extract was then incorporated slowly into the base to form a homogenous cream preparation (Figure 1).

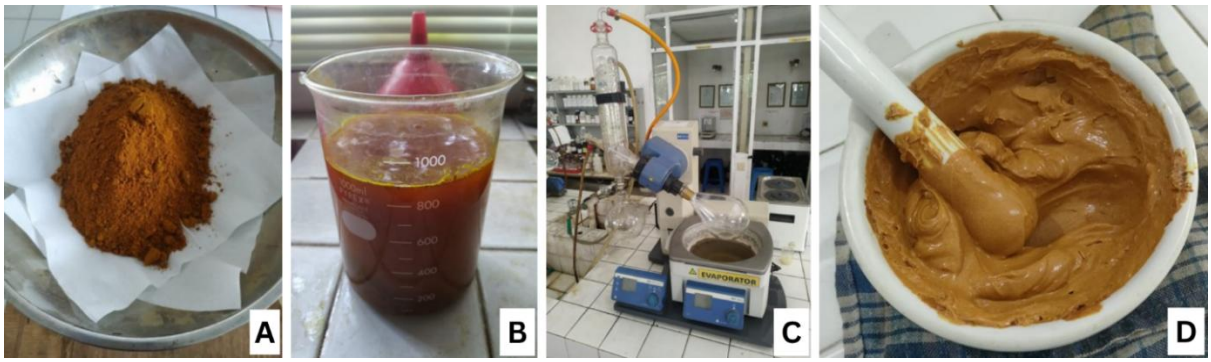

Figure 1. Sequential stages of the 5% Curcuma longa cream preparation process: (A) drying of turmeric rhizomes, (B) maceration using ethanol solvent, (C) evaporation to obtain concentrated extract, and (D) incorporation of the extract into the vanishing cream base to form the final 5% Curcuma longa cream.
Source: Research Documentation (2024)

The physical stability of the cream formulation was assessed over seven consecutive days under room temperature conditions. The pH test was performed using a calibrated digital pH meter to determine the acidity or alkalinity of the preparation. The dispersion test was carried out by placing 0.5 g of cream between two glass plates under a 50 g weight for one minute, after which the diameter of the spread was measured to evaluate spreadability. Meanwhile, the adhesion test was performed by placing 0.5 g of cream between two glass slides with a 1 kg load for three minutes, and the time required for the slides to separate was recorded in seconds to assess the adhesive strength of the cream.

Data were analyzed using SPSS version 26. Each test was performed in triplicate, and the mean ± SD was calculated. The Friedman test was applied to determine significant differences between mean values ($p < 0.05$ was considered significant).

RESULTS AND DISCUSSION

Table 1. Statistical result pH test

	Day							p value
	1	2	3	4	5	6	7	
Mean	7.33	7.37	7.41	7.45	7.48	7.49	7.50	0.006
Standard Deviation	0.02	0.01	0.02	0.00	0.00	0.00	0.00	

Source: Primary Data from Laboratory Testing (2024)

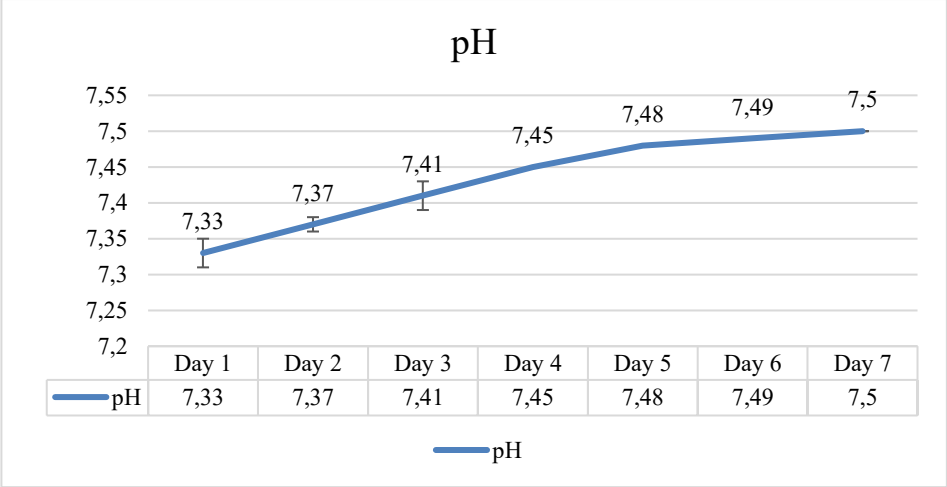

Figure 2. pH result for 7 days

Source: Processed from Primary Data (2024)

The pH test results (Table 1, Figure 2) showed a gradual increase from 7.33 on day 1 to 7.50 on day 7. The overall p-value (0.006) indicated a statistically significant change over the seven days. Despite the slight increase, the pH values remained within the acceptable range for topical formulations (4.5–8.0).

Table 2. Statistical result dispersion test

	Day							p value
	1	2	3	4	5	6	7	
Mean	4.18	4.21	4.18	4.21	4.19	4.18	4.22	0.452
Standard Deviation	0.02	0.03	0.01	0.01	0.04	0.02	0.02	

Source: Primary Data from Laboratory Testing (2024)

The dispersion test (Table 2) demonstrated consistent spreadability of the cream over the seven-day observation period, with mean values ranging between 4.18 cm and 4.22 cm. The p-value (0.452) indicated no statistically significant difference, suggesting that the cream retained uniform consistency and viscosity. A dispersion diameter within 3–5 cm is considered ideal for topical creams, ensuring adequate spread on the skin without excessive thinning or stiffness. The stable dispersion result supports the conclusion that the cream's emulsified system remained physically stable throughout the study.

Table 3. Statistical result adhesion test

	Day							p value
	1	2	3	4	5	6	7	
Mean	182.71	183.72	194.04	196.06	198.68	200.02	200.04	0.006
Standard Deviation	0.57	0.55	0.03	0.02	0.58	0.00	0.00	

Source: Primary Data from Laboratory Testing (2024)

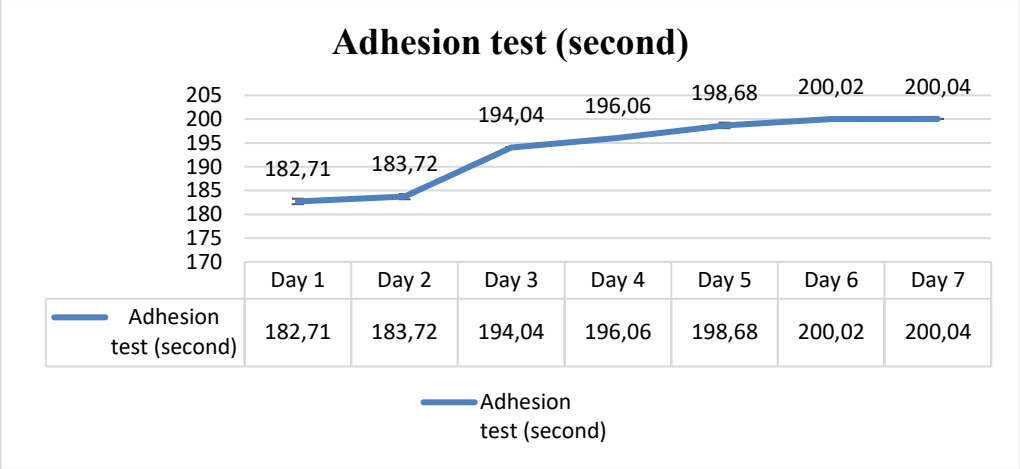

Figure 3. Adhesion test result for 7 days

Source: Processed from Primary Data (2024)

The adhesion test (Table 3, Figure 3) showed a significant increase in the cream's stickiness over time, with mean adhesion duration rising from 182.71 seconds on day 1 to 200.04 seconds on day 7 ($p = 0.006$). This increase indicates improved cohesiveness and a stronger binding capacity of the cream to surfaces, which enhances its potential to adhere to the skin upon application. Adequate adhesion is essential to ensure that the active ingredients remain in contact with the skin for an optimal period. The gradual increase in adhesion might be due to the stabilization of the emulsion and reduction in free water content as the cream equilibrates.

Overall, all three physical parameters showed acceptable values over seven days, indicating that the formulation-maintained homogeneity and structural integrity under room temperature storage.

Discussion

This study demonstrated that the 5% Curcuma longa extract cream formulated via maceration exhibited stable physical properties during seven days of observation. The pH of the cream ranged between 7.33 and 7.50, which is slightly alkaline but within a tolerable range for topical formulations (7). A pH value close to neutral ensures that the cream does not irritate the skin barrier while maintaining product stability. The slight alkalinity could be attributed to the presence of triethanolamine in the cream base, which acts as an emulsifier and pH adjuster (8). These results suggest that the formulation maintains chemical stability without producing an excessively alkaline environment that could cause skin irritation.

The dispersion test results showed no significant difference ($p=0.452$), indicating that the spreadability of the cream remained consistent over time. Adequate spreadability is crucial for uniform application, optimal skin absorption, and consumer acceptability (9).

Adhesion values increased significantly ($p=0.006$), reflecting enhanced cohesiveness and improved adherence to the skin surface. This property is essential for sustained contact and better therapeutic effect of the active compound. Similar stability outcomes were reported by Rahmawati et al. (2019) in a hydrogel formulation of herbal extracts, indicating comparable

physicochemical resilience and confirming that herbal-based topical formulations can maintain their structural integrity under similar test conditions (10).

Compared with the study by Oktafiani et al. (2024) on Cyperus rotundus gel extracted using Microwave-Assisted Extraction (MAE), both formulations demonstrated stability in key physical parameters (11). However, the MAE method offers faster extraction and higher yield, while maceration preserves heat-sensitive phytochemicals like curcumin. The slight alkalinity in the Curcuma longa cream may result from the presence of triethanolamine, a weak base commonly used as an emulsifying agent in creams (8).

Overall, these findings suggest that the maceration method effectively produced a stable and homogenous cream containing Curcuma longa extract with favorable physical characteristics comparable to other stable herbal formulations. A limitation of this study is the short duration (seven days) and the lack of accelerated stability testing under varying temperatures.

CONCLUSION

The cream formulation containing 5% Curcuma longa extract obtained via maceration demonstrated good physical stability in terms of pH, dispersion, and adhesion over seven days. The results indicate that the formulation is physically stable, homogenous, and suitable for topical use. These findings support the use of maceration as an accessible extraction method for small-scale or traditional pharmaceutical formulations of Curcuma longa cream. Further studies evaluating its microbiological stability and pharmacological efficacy are recommended.

REFERENCES

Al-Busaid, M. M., Akhtar, M. S., Alam, T., & Shehata, W. A. (2020). Development and evaluation of herbal cream containing curcumin from Curcuma longa. Pharm Pharmacol International Journal, 8(5), 285–289.

Al-Busaid, M. M., Akhtar, M. S., Alam, T., & Shehata, W. A. (2020). Development and evaluation of herbal cream containing curcumin from Curcuma longa. Pharm Pharmacol International Journal, 8(5), 285–289. https://medcraveonline.com/PPIJ/development-and-evaluation-of-herbal-cream-containing-curcumin-fromnbspcurcuma-longa.html

Choudhary, S. (2024). Formulation and evaluation of topical antimicrobial herbal cream. Journal of Pharma Insights and Research, 2(1), 97–101.

Devi, V. K., Jain, N., & Valli, K. S. (2010). Importance of novel drug delivery systems in herbal medicines. Pharmacognosy Reviews, 4(7), 27–31.

Manasa, P. S. L., Kamble, A. D., & Chilakamarthi, U. (2023). Various extraction techniques of curcumin: A comprehensive review. ACS Omega, 8(38), 34868–34878.

Memarzia, A., Khazdair, M. R., Behrouz, S., Gholamnezhad, Z., Jafarnezhad, M., Saadat, S., & Boskabady, M. H. (2021). Experimental and clinical reports on anti-inflammatory, antioxidant, and immunomodulatory effects of Curcuma longa and curcumin: An updated and comprehensive review. BioFactors, 47(3), 311–350.

Mohite, P., Puri, A., Munde, S., Ade, N., Yadav, V., Singh, S., & Datta, D. (2025). Meticulous standards for bio-relevant method development and validation of in vitro release testing for regenerative topicals: A comprehensive review. Regenerative Engineering and Translational Medicine, 1–22.

Mohiuddin, A. K. (2019). Skin care creams: Formulation and use. Dermatology Clinics & Research, 5(1), 238–271.

Mphahlele, M. P. (2019). Sustained delivery system of curcuminoids-rich plant Curcuma longa L. for topical application (Master's thesis). University of Johannesburg.

Osorio-Tobón, J. F. (2020). Recent advances and comparisons of conventional and alternative extraction techniques of phenolic compounds. Journal of Food Science and Technology, 57(12), 4299–4315.

Raghavan, L., Brown, M., Michniak-Kohn, B., Ng, S., & Sammeta, S. (2019). In vitro release tests as a critical quality attribute in topical product development. In The role of microstructure in topical drug product development (pp. 47–87). Springer.

Rahmawati, D. A., & Setiawan, I. (2019). The formulation and physical stability test of gel fruit strawberry extract (Fragaria x ananassa Duch.). Journal of Nutraceuticals and Herbal Medicine, 2(1), 38–46. http://journals.ums.ac.id/index.php/jnhm

Rasul, M. G. (2018). Conventional extraction methods used in medicinal plants: Their advantages and disadvantages. International Journal of Basic Sciences and Applied Computing, 2(6), 10–14.

Saraf, S., Jeswani, G., Kaur, C. D., & Saraf, S. (2011). Development of novel herbal cosmetic cream with Curcuma longa extract-loaded transfersomes for anti-wrinkle effect. African Journal of Pharmacy and Pharmacology, 5(8), 1054–1062.

Sengupta, P., Chatterjee, B., & Tekade, R. K. (2018). Current regulatory requirements and practical approaches for stability analysis of pharmaceutical products: A comprehensive review. International Journal of Pharmaceutics, 543(1–2), 328–344.

Syed, H. K., Liew, K. B., Loh, G. O. K., & Peh, K. K. (2015). Stability-indicating HPLC–UV method for detection of curcumin in Curcuma longa extract and emulsion formulation. Food Chemistry, 170, 321–326.

Wang, H., Chen, Y., Wang, L., Liu, Q., Yang, S., & Wang, C. (2023). Advancing herbal medicine: Enhancing product quality and safety through robust quality control practices. Frontiers in Pharmacology, 14, 1265178.

Zheng, B., & McClements, D. J. (2020). Formulation of more efficacious curcumin delivery systems using colloid science: Enhanced solubility, stability, and bioavailability. Molecules, 25(12), 2791.