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RESEARCH ARTICLE

Formulation of paper shampoo containing aloe vera extract with strawberry fragrance

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Abstract

Background: Shampoo is a specialised cleansing formulation designed for hair care, effectively removing impurities from the hair and scalp while enhancing manageability and promoting a healthy appearance. Paper shampoo was chosen as a solid formulation that is practical, lightweight, and easy to carry and use anywhere. Aloe vera extract was selected for its soothing and scalp-friendly properties, while the strawberry aroma was chosen to provide a refreshing experience when used. **Objective:** This research aimed to determine the formulation of aloe vera extract as a shampoo preparation. **Method:** This study employed an experimental method, involving the extraction of Aloe vera, followed by the formulation of shampoo with concentrations of 4%, 7.5%, and 8.5%. Tests on the preparations included organoleptic, homogeneity, pH, and foam height. **Result:** The organoleptic evaluation indicated that the formulation exhibited a brown colouration, a characteristic aloe vera scent, and a semi-solid consistency. The homogeneity analysis confirmed that all shampoo formulations were uniform in composition. The pH values were 5.81, 5.46, and 5.7 for F1, F2, and F3, respectively. The foam stability test values were 81.81%, 90.9%, and 97.45% for F1, F2, and F3, respectively. **Conclusion:** Aloe vera extract can be effectively formulated into a shampoo preparation.

Introduction

Aloe vera, a native African plant belonging to the Liliaceae family, thrives in tropical regions, particularly on sandy soils. This plant has been widely recognised as a source of natural ingredients with significant medicinal properties. Aloe vera may have been introduced to Indonesia in the 17th century (Savitri *et al*., 2022). Aloe vera is recognised for its rich composition of essential nutrients, including amino acids, proteins, minerals, and vitamins A, C, and E. Additionally, it demonstrates efficacy in inhibiting the growth of gram-positive and gram-negative bacteria, making it beneficial for addressing damaged hair and scalp-related issues (Pandey & Mishra, 2010).

One practical application of aloe vera is in hair care through shampoo products. Shampoo is a cosmetic formulation used regularly to cleanse the hair of dirt, dandruff, and other residues from hair care products. Generally, shampoos contain surfactants as the main cleanser, as well as active ingredients and additional components, such as antioxidants, buffers, dispersants, colourants, fragrances, and preservatives. This combination of ingredients cleanses and provides additional benefits, such as moisturising, lubricating the hair, and addressing various hair and scalp problems (Kumar *et al*., 2023).

Such problems, although often considered trivial, can have a profound impact on an individual's confidence and sense of comfort. One common disorder is dandruff, which is highly prevalent in Indonesia. According to data from the US Census Bureau (2004) and the International Database, approximately 43,833,262 people out of a total population of 238,452,952 in Indonesia experience dandruff, ranking Indonesia fourth after India, China, and the United States (Putri *et al*., 2020).

A hot and humid tropical climate, along with intense physical activity, can increase sweat production, creating an ideal environment for fungal growth. These fungi are one of the leading causes of scalp disorders,

including dandruff. With the high prevalence of hair and scalp disorders, effective and efficient treatment efforts are needed. Hair care products based on natural ingredients, such as aloe vera, can be a relevant solution to prevent and overcome these problems, especially in tropical environments (Novyanda, 2021).

As one solution, the development of paper shampoo preparations is expected to meet the need for hygiene products that are practical, lightweight, and easy to use. Paper shampoo is an innovation that allows cleaning products to be easily carried, stored, and used without requiring much space or water. However, this paper shampoo must meet specific quality standards, such as organoleptic, homogeneity, pH, and foam height test, to be effective and safe. Evaluating the quality of paper shampoo preparations is crucial in ensuring that these products meet the needs and are safe to use (Dasopang & Simutuah, 2017).

Therefore, researchers aim to innovate in creating a paper shampoo preparation formulation that is both efficient and effective in combating and preventing hair disorders during military operations. This preparation is also influenced by the Indonesian background, which features a diverse range of plants and herbs that are effective in preventing hair and scalp problems.

Methods

Materials

A set of glassware, Brookfield viscometer, mortar, pestle, water bath, stirring rod, 500 mL glass beaker, sieve, blades, analytical balance, parchment paper, watch glass, dropper pipette, digital pH meter, 500 mL measuring cup, and tray. *Aloe vera* extract with COA, 70% ethanol, 96% ethanol, sodium lauryl sulfate, cocamide DEA, Na-CMC, propyl paraben, citric acid, water soluble paper, aluminium foil, menthol and distilled water.

Extraction procedure

Preparation of shampoo

The Na-CMC was weighed and dissolved in hot water (1:20). It was then left to swell for a few minutes and gently stirred. Exactly 20 ml of water heated at 60-70˚C was poured into a beaker, then sodium lauryl sulfate was added and stirred until dissolved.
Menthol was dissolved in 70% ethanol for taste and stirred until completely dissolved. Then, propyl paraben was added and stirred until a homogeneous mixture was formed. Sodium lauryl sulfate solution was gradually added to the Na-CMC solution while stirring gently until a homogeneous mixture was formed. Then, the previous menthol solution was added.

Cocamide DEA was added slowly and stirred until a homogeneous mixture was formed. Aloe vera extract was added and stirred until a homogeneous mixture was formed. Citric acid was then added to balance the pH. The shampoo preparation was then applied to water-soluble paper and placed in an oven at 60-70˚C for 15-30 minutes to dry. Afterwards, it was cut into small pieces.

Aloe vera extract paper shampoo formula

The formula for the paper shampoo is listed in Table I.

Table I: Aloe vera extract paper shampoo formula

Material	Formula			
	F0	F1	F2	F3
Aloe vera extract	0 %	4 %	7.5 %	8.5%
Sodium lauryl sulfate	10 %	10 %	10 %	10 %
Cocamide DEA	4 %	4 %	5 %	6 %
Na CMC	3 %	3 %	3 %	3 %
Propyl paraben	0.2 %	0.2 %	0.2 %	0.2 %
Menthol	0.25 %	0.25 %	0.3 %	0.35 %
Citric acid	qs	qs	qs	qs
Strawberry essence	qs	qs	qs	qs
Aquadest (mL)	ad 100	ad 100	ad 100	ad 100

Physical evaluation of preparations

Organoleptic test

An organoleptic test is conducted to assess the physical appearance of the preparation by observing changes in its shape, smell, and colour, as described by Malonda and colleagues (2017).

Homogeneity test

The test was conducted by applying shampoo at various concentrations to a watch glass, as described by Malonda and colleagues (2017).

pH test

The acidity of the shampoo was measured using a calibrated pH meter. One gram of shampoo was weighed and dissolved in 10 ml of distilled water. The pH meter was then dipped into the solution shortly after preparation and during a specific storage period, as described by Malonda and colleagues (2017).

Foam height test

The test was conducted by dissolving 10 ml of shampoo in a measuring cylinder, followed by shaking the mixture three times. The foam height produced was observed for approximately 15–45 minutes. The height of the formed foam was measured, allowed to stand for five minutes, and subsequently remeasured to record the final foam height. Then the foam stability was calculated by following the formula :

$$\%\ Foam\ stability\ = \frac{Final\ foam\ height}{Initial\ foam\ height} x\ 100\ \%$$

The foam height requirement is 13 to 220 mm as described by Malonda and colleagues (2017).

Results

Evaluation of preparations

Organoleptic test results

Organoleptic evaluation was conducted by directly observing the changes in the shampoo formulation's physical characteristics, including shape, colour, and odour. The results of the analysis are presented in Table II.

Table II: Organoleptic test result

Formula	Organoleptic test		
	Colour	Smell	Shape
F0	Clear white	No smell	Solid paper
F1	Clear yellow	Typical strawberry essence	Solid paper
F2	Clear yellow	Typical strawberry essence	Solid paper
F3	Clear yellow	Typical strawberry essence	Solid paper

Homogeneity test results

Homogeneity testing involves applying shampoo preparations at various concentrations to a watch glass. The shampoo should show a homogeneous arrangement and not involve coarse grains. Table III shows homogeneity testing results.

Table III: Homogeneity test results

Formula	Homogeneity
F0	Homeogenous
F1	Homeogenous
F2	Homeogenous
F3	Homeogenous

pH test results

The measurement results showed that the preparation containing aloe vera extract had a pH ranging from 5.4 to 5.8. The test results are shown in Table IV.

Table IV: pH test results

Formula	pH
F0	-
F1	5.81
F2	5.46
F3	5.70

Foam height test results

The foam height test on aloe vera extract shampoo preparations was carried out in a quadriplate. Exactly 10 mL of shampoo was dissolved in a measuring cup and stirred for one minute. The foam height test result is shown in Table V.

Table V: Foam height test results

Formula	Foam height test		
	Initial foam height (mm)	Final foam height (mm)	Foam stability (%)
F0	-	-	-
F1	110	90	81.81
F2	110	100	90.90
F3	118	115	97.45

F0: Formula without aloe vera extract; F1: Formula containing 4% aloe vera extract; F2: Formula containing 7.5% aloe vera extract; F3: Formula containing 8.5% aloe vera extract

Discussion

Aloe vera extract paper shampoo preparations have been observed in organoleptic, homogeneity, pH and foam height tests. Organoleptic testing is conducted to produce a paper shampoo preparation with an attractive colour, an acceptable odour to the user, and a shape that is comfortable to use, as specified in SNI No. 06-2692-1992, as described by Hafyyan and colleagues (2024). Based on the results of the organoleptic test of shampoo preparations, each formula — 0%, 4%, 7.5%, and 8.5% — was found to be solid with no residues. The clear yellow colour produced was obtained from the yellow colour of the Aloe vera extract, with a distinctive smell of strawberry essence.

Homogeneity is one of the requirements for paper shampoo preparations. The homogeneity must not contain rough materials that can be felt by touch. The homogeneity test is performed visually, as indicated by the absence of coarse particles. Based on the homogeneity test of aloe vera extract with concentrations of 0%, 4%, 7.5%, and 8.5%, it was found that there were no coarse grains, indicating that the paper shampoo preparation was homogeneous.

The pH value is used to express the acidity or basicity of a solution. If the preparation falls outside the skin requirement, it is feared that it will cause scaly skin or irritation. The values obtained in this study are within the permissible levels for the skin (4.5 to 6.5) described by Malonda and colleagues (2017). The pH value of shampoo is expected to meet the requirements outlined in SNI No. 06-2692-1992, which ranges from 5.0 to 9.0. The higher the concentration, the lower the pH value. As observed in this study, the lowered pH was due to the addition of aloe vera extract, which contains acidic antioxidants. This indicates that aloe vera extract falls within the normal pH range of the skin, making it suitable for use as a shampoo preparation.

The foam height test is a critical parameter in evaluating the quality of cosmetic products, particularly shampoo formulations. This test aims to assess the foaming ability of the shampoo, as stable and long-lasting foam is highly desirable due to its aiding hair cleansing. Various factors, including the presence of surfactants, foam stabilisers, and other formulation components, influence the characteristics of shampoo foam. Based on the test results of each formula on foam height using distilled water, the foam height ranges from 70 to 105 mm. The foam height test on aloe vera extract shampoo preparations met the foam height requirements of 13-220 mm, as specified in SNI No. 06-2692-1992, so that the formula can be used as a shampoo preparation.

Conclusion

The organoleptic evaluation revealed that the formulation exhibited a transparent yellowish colour, a strawberry fragrance, and a solid paper-like structure. Of the concentrations used, 8.5% showed a good dosage form. The homogeneity analysis confirmed that all shampoo formulations exhibited uniform consistency. The pH values were within the acceptable range for use on the skin. The foam height assessment recorded final foam heights meeting the requirements of SNI No. 06-2692-1992. In conclusion, aloe vera extract can be formulated into paper shampoo preparations.

Conflict of Interest

The authors declare no conflict of interest.

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