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DISSOLUTION OF SESEWANUWA LEAF FRACTION TABLETS WITH VARIOUS BINDERS USING UV-VIS SPECTROPHOTOMETRY

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A B S T R A C T

The sesewanua plant has potent anti-inflammatory activity, particularly in the n-Hexane: Ethyl Acetate fraction, which contains alkaloid compounds. However, consuming the fraction can cause discomfort, making it important to develop it into a tablet for more practical use. Binders are used in tablet formulations because they bind the tablet components and affect tablet quality. ***This study aimed*** *to determine the effect of the type of binder (PVP, starch, and Na-CMC) on the dissolution test results of N-Hexane: Ethyl Acetate Fraction tablets using UV-Vis spectrophotometry.* ***The dissolution test was conducted*** *to evaluate how quickly the active ingredient dissolves from the tablet. Four formulas were tested: F0 (without binder), F1 (5% PVP), F2 (5% starch), and F3 (5% Na-CMC).* ***The formula with the best results*** *was F2, containing 5% starch as the binder, with a dissolution percentage of 80.91%. This is because starch is the best binding agent because it can increase the percentage of active ingredient dissolution in tablets. Therefore, it can be said that the addition of starch provides the best results with a dissolution percentage that meets the requirements.*

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INTRODUCTION

The sesewanua plant (*Clerodendrum fragrans* Wild.) is a plant commonly found in North Sulawesi and has been reported to possess anti-inflammatory activity at a dose of 5%, even demonstrating higher inflammation inhibition than sodium diclofenac. Sesewanua leaves (*Clerodendrum fragrans* Wild.) contain secondary metabolites in the form of flavonoids, alkaloids, tannins, and saponins (A. Imran et al., 2025). After separation by column chromatography, the n-hexane:ethyl acetate fraction is the most active fraction. This fraction has strong antioxidant activity (IC_{50} = 2.56033) (Kalonio et al., 2022) and has been shown to provide therapeutic effects through nanopreparations, both orally and topically, in the form of reduced rheumatoid arthritis index and swelling in CFA-induced test animals (Sapiun et al., 2023; Pangalo et al., 2022; A. K. Imran et al., 2025). Furthermore, bioavailability tests showed an increased $AUC_{0-\infty}$ value, potentially enhancing absorption of the active ingredient in the gastrointestinal tract. Therefore, the n-hexane:ethyl acetate fraction of the ethanol extract of sesewanua leaf (*Clerodendrum fragrans* Wild.) needs to be developed into a tablet dosage form to improve ease of use and dose stability (Sapiun, Lasori, et al., 2024; Sapiun, Imran, et al., 2024).

Tablets are solid dosage forms that are easy to consume, have accurate dosages, and have good uniformity. In tablet formulation, the binder plays a crucial role because it influences the interparticle attraction and the drug release process, including the dissolution rate. Some commonly used binders are PVP, Na-CMC, and starch. PVP, a synthetic polymer, is capable of producing compact granules and tablets with high hardness. Na-CMC also has high adhesive strength with good granule properties and low tablet friability. Meanwhile, starch, a natural polymer, can improve flow properties and provide good tablet physical test results and dissolution (Eka Puspita et al., 2022). Considering their respective advantages, it is necessary to compare the effectiveness of these three binders at the same concentration, namely 5% (Anindhita et al., 2022; Zakaria et al., 2021; Shifa et al., 2024)

Dissolution is the process of dissolving active ingredients from a drug preparation over a certain time and is an important biopharmaceutical parameter to ensure drug effectiveness. Determination of the dissolved active ingredient content (Q value) can be analyzed using UV-Vis spectrophotometry at a wavelength of 200–800 nm, with high accuracy and fast analysis time (Ismail et al., 2023; Futery & Riani, 2023). Therefore, this study was conducted to determine the effect of the type of binder on the results of the dissolution test of the n-hexane:ethyl acetate fraction of sesewanua leaf (*Clerodendrum fragrans* Wild.) ethanol extract tablets using UV-Vis spectrophotometry (Rohana et al., 2024; Hambali & Suwandhi, 2024)

RESEARCH METHODE

This study is a laboratory quasi-experimental study by comparing the effect of three types of binders, namely PVP, starch, and Na-CMC (5% each) on the dissolution test results of sesewanua leaf (*Clerodendrum fragrans* Wild.) fraction tablets. The study was conducted at the Preparation Technology Laboratory of the Pharmacy Department of the Gorontalo Ministry of Health Polytechnic and Gorontalo State University in January–April 2024. Independent variable is the type of binder, the dependent variable is the dissolution value (Q),

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and the controlled variables include sieve size, drying temperature of 60°C, and Dissolution test conditions at 50 rpm and 37°C.

Table 1. Preparation formula for fraction tablets of sesewanua leaves

Material	Concentration (%)			
	F0	F1	F2	F3
Sesewanuwa Leaf Fraction	5%	5%	5%	5%
PVP	-	5%	-	-
Amilum	-	-	5%	-
Na-CMC	-	-	-	5%
Amilum	15%	15%	15%	15%
Mg Stearat	1%	1%	1%	1%
Talkum	2%	2%	2%	2%
Amilum	5%	5%	5%	5%
Avicel pH 101	72%	67%	67%	67%

(Source : Primary Data Research)

Granules were made by the wet granulation method using ethanol for the PVP formula and mucilage for the starch formula and Na-CMC, then dried, sieved, mixed with the outer phase material, and molded into tablets. The dissolution test was conducted using 900 mL of pH 1 dissolution medium, at 50 rpm, at 37°C for 60 minutes, and the solute concentration was measured using UV-Vis spectrophotometry. Ethical approval for this study was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Gorontalo.

RESULTS AND DISCUSSION

Table 2. Dissolution Test Results of Fraction Tablet Sesewanua Leaves

Formula	Time	Percent Dissolved	Explanation
F0	60 menit	88,10%	Qualify
F1		63,73%	Not Qualify
F2		80,91%	Qualify
F3		75,43%	Qualify

Source : Primary Data Research)

Description:

F0 = Tablet formula without binding materials

F1 = Formurla Tablert uses 5% PVP binding material

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F2 = Formurla Tablert uses 5% amilurm binding material

F3 =Tablet formula uses 5 % Na-CMC binder

Based on the description in Table 2, it was found that of the four formulas tested, the one with the highest isolation performance was F0. This is because F0 is a tablet formula without a binder. According to Kadek et al., 2023, using too low a binder, or even no binder, will result in tablets with a rapid disintegration time, allowing for the release of a large amount of active ingredient. This is because the ingredients in the tablet cannot be perfectly bound, so tablets without a binder are not recommended in formulations as they will result in brittle and highly disintegrating tablets. The dissolution results in F1 were said to be non-dissolving. This formula also had the lowest dissolution rate. This is due to the hygroscopic nature of PVP. This property causes water in the air to be absorbed into the tablet and can reduce its ability to expand upon contact with liquid media, resulting in a longer tablet dissolution time and a lower release of the dissolved active ingredient (Maulana & Rahmawati, 2025).

The dissolution results in F2 were found to be non-dissolving and had a higher dissolution rate than F1 and F3. According to Yuniarsih et al., 2023, tablets using starch binders have faster disintegration times and faster release of active ingredients compared to PVP and Na-CMC. This is due to the amylose content in starch. Amylose is able to absorb water, thus affecting the starch expansion process. Therefore, when the tablet comes into direct contact with a liquid medium, it will swell and cause the tablet to disintegrate easily and release a large amount of dissolved active ingredients (Nindya et al., 2024).

The dissolution results of F3 are a formula that meets the requirements, but its dissolution performance is not higher than F2. This is due to the pores of Na-CMC, which can bind particles more tightly, resulting in a harder tablet with a longer disintegration time and fewer dissolved active ingredients. Compared to F1, F3 is said to be better. This is due to the nature of Na-CMC, which is easily soluble in water, so it can break down the tablet into smaller particles (Lingga & Agus, 2024)

CONCLUSION

Based on the research results, it was found that the addition of PVP as a binder produced the lowest dissolution percentage of 63.73%, thus not meeting the requirements. The use of starch as a binder gave the best results with a dissolution percentage of 80.91% and met the requirements, while the addition of Na-CMC also produced a dissolution that met the requirements of 75.43%. Thus, the most optimal type of binder for the n-hexane:ethyl acetate fraction tablets of sesewanua leaves is starch because it is able to provide the highest dissolution percentage.

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