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NANOEMULSION FORMULATION OF KEPOK BANANA PEEL EXTRACT AND YELLOW WATERMELON PEEL AS A KIDNEY STONE REDUCT

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ABSTRACT

The kepok banana peel and yellow watermelon peel are still rarely appropriately used as medicine. The kepok banana peel and yellow watermelon peel contain flavonoids and potassium that function as kidney stone removers. This study aims to make a nanoemulsion formulation of kepok banana peel extract and yellow watermelon peel as a kidney stone remover. The preparation starts with extraction, testing the flavonoid content of the extract, testing the potassium content of the extract, making nanoemulsion using the homogenization method at a speed of 15,200 rpm, and analyzing the nanoemulsion formula that has been made. This study showed that the nanoemulsion extract contained flavonoids and potassium with a pH value of 7 and a viscosity value of 2.70 cP. The nanoemulsion of kepok banana peel and yellow watermelon peel extracts also has a size of 246.9 nm and a PDI of 0.618 with an oil-in-water (O/W) nanoemulsion type. The extracts of kepok banana peel and yellow watermelon peel in nanoemulsion preparation can be used as a medicine to remove kidney stones.

Keywords: extract nanoemulsion, kepok banana peel, yellow watermelon peel, kidney stone

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INTRODUCTION

Kidney stone sufferers in Indonesia are namely 0.6% or 6 per 1000 population (Riskesdas, 2013). Kidney stone sufferers have a risk of complications in the form of loss of kidney function, need for transfusions, strictures, obstruction, hydronephrosis, pyonephrosis, and death (Fauzi & Putra, 2016). Treatment for kidney stones requires a large amount of funding because it requires surgical therapy and chemical drugs (Smith, 2023).

Based on the problems above, new treatments need to be carried out with therapies that have low costs and optimal results. One of them is natural ingredient therapy. Natural ingredients containing potassium and flavonoids can dissolve kidney stones (Susanti & Janah, 2020). Kepok banana peel and yellow watermelon peel have both ingredients (Bakshi & Wadhwa, 2013; Fadhila et al., 2022; Supriyanti et al., 2015; Wardhana et al., 2016). However, people have not utilized the secondary metabolites produced by these two natural ingredients properly, especially in terms of treatment.

The challenge in using this natural ingredient is that the dose must be significant, and absorption is often hampered. This is because the preparations are still in the form of potions, extracts, and infusions. Nanoemulsion preparations are the right solution to this problem. This preparation is an oil-in-water (O/W) emulsion (Santamaría et al., 2023). Kepok banana peel and yellow watermelon peel extracts are the active ingredients in the oil phase. At the same time, the pH 7 phosphate buffer is the active ingredient in the water phase. The oil droplets will mix with the water phase (Agustinisari et

al., 2014). The nanoemulsion form was chosen because it can increase the physical stability of a bioactive component, prevent chemical damage and interaction with food ingredients, and be disseminated efficiently in water systems (Czerniel et al., 2023). The effectiveness of this preparation can be increased and maximized through the use of nanoemulsion technology (Qian et al., 2023).

Based on the description above, this research aims to analyze the nanoemulsion formulation from kepok banana peel extract and yellow watermelon peel as a kidney stone laxative. The hope is that the results of this research can become the basis for further research.

METHOD

This research design is an experimental laboratory using a quantitative research design consisting of making nanoemulsions of kepok banana peel extract and yellow watermelon peel. This research was conducted at UMY Phytomedicine Laboratory, the UMY Pharmaceutical Technology Laboratory, and UGM Pharmaceutical Technology Laboratory in about 1 month. The tools used in this research include knives, ovens (Memmert), blenders (Philips), digital scales (Mettler Toledo®), measuring cups (Pyrex), maceration vessels, stirring rods (Pyrex), spatulas, filter funnels (Pyrex), beakers (Pyrex), pans, water baths (Memmert®) porcelain dishes, closed containers for extracts, test tubes (Pyrex®), test tube racks, drip pipettes (Pyrex®), nichrome wire, spirit lamps, Ultra-Turrax homogenizer (IKA® T25,® Germany), sealed containers for nanoemulsions, Particle Size Analyzer (PSA), medical masks, and handscoons. The materials used in this research include kepok banana peel, yellow watermelon peel, 70% ethanol, filter paper, pH (MQuant®) paper, aluminum foil, concentrated HCl, magnesium metal, pH 7 phosphate buffer, Tween 80, 96% ethanol, and aquadest.

The kepok banana peel and yellow watermelon peel are thoroughly washed, cut into small pieces, and dried in a 50°C oven for 4 days. The dried banana peel and yellow watermelon peel are mashed using a blender. After that, the kepok banana peel and yellow watermelon peel were finely macerated using 70% ethanol solvent in a ratio of 1: 5. The maceration container is closed and left for 3 days stirring every 24 hours. The maceration results are filtered so that a clear filtrate is obtained. The filtrate is evaporated in a water bath at 50°C until a thick extract is obtained, then the thick extract is weighed until a fixed extract weight is obtained. The flavonoid test was performed with the Shinoda Test, the extract was put into a test tube and added 0.2 g of Mg powder and 3 drops of HCl. The presence of flavonoid compounds is characterized by the formation of orange (flavones), pink (flavonols), red (2.3 dihydroflavonols), and purple (xanthones) (Faskalia, 2014). The potassium test is performed by flame test using nichrome wire. Nichrome wire is incandescent first until it does not dye the fire before use and washed with concentrated HCl. Next, the nichrome wire is dipped in the extract and heated on the outside of the flame from the Bunsen burner. The steam released from heating will cause a purple flame if it contains potassium (Alauhdin, 2020).

The concentration of kepok banana peel extract and yellow watermelon peel was made using Ultra-Turrax homogenizer (IKA® T25, Germany) at a speed of 15,200 rpm. Kepok banana peel extract and yellow watermelon peel are prepared as an oil phase with a concentration of 20% (2 gr of kepok banana peel extract and yellow watermelon peel at 10 ml of 96% ethanol). Phosphate buffer solution pH 7 as an aqueous phase. A sample of 100 ml was obtained by mixing kepok banana peel extract and yellow watermelon peel at a concentration of 20% with Tween 80 and then dissolving in a buffer solution (Jusnita & Nasution, 2019). The formulations of nanoemulsion preparations are presented in Table 1.

Table 1 Formulation of Nanoemulsion Preparation of Kepok Banana Peel and Yellow Watermelon Skin Extract

Material	Formula	Material Function
Oil Phase		
Kepok banana peel extract + Yellow watermelon peel extract + Ethanol 96% (ml)	20	As dissolved substances
Tween 80 (g)	2	As a surfactant
Water Phase		
Phosphate buffer (ml)	78	As a solvent

The results of nanoemulsion preparations were tested to evaluate pH, viscosity, nanoemulsion size, and nanoemulsion type. The pH test was performed using a pH paper tool dipped in 0.5 grams of nanoemulsion diluted with 5 mL of aquadest. The viscosity test is performed with a rotary viscometer (Brookfield® LVT 207749, Germany) at room temperature. In addition, the particle size test and pdI test with Particle Size Analyzer (PSA). The nanoemulsion type test was performed by dissolving the sample into the aqueous phase (1:100) and oil phase (1:100). If the sample is perfectly soluble in aquadest, then the nanoemulsion type is classified as oil in water type (M/A), while if the sample is completely soluble in the oil phase, then the nanoemulsion type is classified as water in oil type (A/M) (Jusnita & Nasution, 2019).

RESULTS AND DISCUSSION

Making Kepok Banana Peel and Yellow Watermelon Peel Extract

Making kepok banana peel and yellow watermelon peel extract is a process that involves several critical stages to obtain quality extract ingredients. This process begins with collecting 305 grams and 225 grams of kepok banana peel and yellow watermelon peel powder, respectively. The powder was macerated using 70% ethanol in a ratio of 1:5 for 3 days and remacerated for 2 days. The results of combining maceration and remaceration of kepok banana peels and 1,550 ml and 925 ml of yellow watermelon peels obtained ethanol extract. The extract is thickened by evaporating it over a water bath at a temperature of 50℃. The thick extracts obtained were 37.25 grams and 22.25 grams of kepok banana peel and yellow watermelon peel extract with yield values of 12.2% and 9.8%.

The kepok banana peel and yellow watermelon peel extracts produced in this process are precious because they contain bioactive compounds that can have various health benefits. These compounds may include polyphenols, flavonoids, vitamins, and other compounds with antioxidant and anti-inflammatory properties. This extract can be used in various applications, including dietary supplements, or pharmaceutical and health research. The yield obtained in this process can also indicate the efficiency of the extraction process. It can be used in subsequent production calculations and planning.

Making kepok banana peel and yellow watermelon peel extracts is an example of how natural compounds contained in plant materials can be carefully extracted for use in various applications. This extraction process produces high-quality extracts with significant health benefits. Therefore, a good understanding of extraction techniques and the use of appropriate solvents is fundamental to obtaining maximum results from natural raw materials such as kepok banana peels and yellow watermelon peels.

Flavonoid Test and Extract Potassium Test

The results of the flavonoid test and potassium test of kepok banana peel and yellow watermelon peel extracts showed that they contained flavonoids and potassium.

Table 2 Flavonoid Test Results and Potassium Extract Test

Test	Theoretical Results	Conclusion	
		Banana	Watermelon
Flavonoids	Color changes to yellow, red, or brown	Positive	Positive
Potassium	Fire is purple if it contains potassium	Positive	Positive

The yellow, red, or brown color changes on kepok banana and yellow watermelon peels occur due to chemical reactions between oxidizing agents, such as metals or enzymes. When an oxidation reaction occurs, flavonoids will undergo structural changes and produce compounds with different colors. This compound is anthocyanin (a type of flavonoid). Anthocyanins change to red at acidic pH, while blue or purple at alkaline pH (Santoso & Mulyono, 2015).

The change in flame color to purple in the potassium test of the kepok banana peel and yellow watermelon peel occurred due to the reaction between the phenolic compounds in the two peels and potassium (Setiawan et al., 2023). This reaction forms a complex compound that emits purple light when heated (phenolate-potassium reaction). Electrons in phenolic compounds that are in an excited (stimulated) state will fall back to their ground state and release energy in the form of light at a specific wavelength (purple color spectrum) (Chen et al., 2019).

Flavonoids in kepok banana and yellow watermelon peels will form a complex compound between the calcium in kidney stones and the -OH group of flavonoids, forming Ca-flavonoids (Susanti & Janah, 2020). This complex compound is thought to be more soluble in water and helps the solubility of the water in urine. Flavonoids also act as antioxidants, protecting the body's epithelial structures, including the kidneys (Handani et al., 2015). The potassium content in both peels works by removing calcium and combining it with the calcium oxalate compound to form a salt compound, which is easily soluble in water and will slowly come out of the urine (Permata et al., 2017).

Making Nanoemulsion of Kepok Banana Peel Extract and Yellow Watermelon Peel

Making kepok banana peel extract and yellow watermelon peel nanoemulsion is a process that involves special techniques to create an excellent colloidal system. Nanoemulsion is a form of emulsion that has nano-sized oil particles, usually less than 100 nanometers, which are evenly distributed in the water phase. The process of making this nanoemulsion involves several main components, including the oil phase, water phase, and cosurfactant (Jaiswal et al., 2015).

Nanoemulsion of kepok banana peel extract and yellow watermelon peel is made using a dispersed phase, namely the oil phase, and a dispersing phase, namely the water phase. The oil phase in this nanoemulsion contains extracts of kepok banana peel, yellow watermelon peel, ethanol 96%, and Tween 80. Kepok banana peel and yellow watermelon peel extracts have been previously extracted using specific methods, perhaps with solvents such as ethanol or water. The water phase in making this nanoemulsion is the dispersion medium in which the oil particles will be dispersed.

Ethanol 96% acts as a cosurfactant in the process of making nanoemulsions. Cosurfactants are substances that help reduce the surface tension between the oil phase and the water phase, thereby allowing the formation of more stable nanoparticles. With the presence of cosurfactants, nanoemulsions can have long-term stability, which is essential for pharmaceutical, cosmetic, and food industrial applications (Pavoni et al., 2020).

Manufacturing nanoemulsions involves intensive mixing, stirring, and homogenization to ensure the oil particles are well dispersed in the water phase. The result is a very smooth and stable colloidal system, which has many potential applications.

This nanoemulsion of kepok banana peel and yellow watermelon peel extract can be used in various product formulations, such as pharmaceutical products. The advantages of nanoemulsions include increasing the bioavailability of active substances in kepok banana peel and yellow

watermelon peel extracts, as well as the ability to provide desired pharmacological effects at lower doses (Riswanto et al., 2023). Overall, the manufacture of nanoemulsion is an essential technique in the development of natural extract-based products.

Analysis of Nanoemulsion of Kepok Banana Peel Extract and Yellow Watermelon Peel

In this research, interpretation can be seen from the pH value, viscosity, size, and type of nanoemulsion. The pH test of the resulting nanoemulsion formula is 7. This can be declared safe to use as an essential ingredient for medicine because it corresponds to the pH of the small intestine (7-7.24) as the main organ for drug absorption (Alawiyah, 2020). In addition, the viscosity test obtained 2.70 cP using a Brookfield Viscometer. This test aims to determine the viscosity of the nanoemulsion preparation. The viscosity of the preparation affects the release of the active substance from the preparation. The ideal viscosity value for nanoemulsion preparations is in the range of 1-100 cP. Particle size tests and PDI tests were carried out to determine the size and particle size distribution of nanoemulsion preparations. Testing the size and distribution of these particles using a Particle Size Analyzer (PSA) resulted in a nanoemulsion size of 246.9 nm and PDI (Polydispersity Index) of 0.618.

The particle size in the formula meets the range of nanoemulsion particle size criteria, namely around 20-500 nm. In contrast, the PDI value of the nanoemulsion formula shows a number greater than 0.50. This indicates that the preparation of the nanoemulsion extract formula is not uniform. A good polydispersity index is below 0.5, while a value above 0.5 indicates that the globule distribution is non-uniform (Branco et al., 2020). The type of nanoemulsion formed can be determined by dilution. The principle of the test is to dilute the system formed with the oil or water phases. In this test, the type of oil in water (O/W) is obtained.

CONCLUSION

Based on this research, a nanoemulsion preparation was obtained with the formulation of kepok banana peel extract and yellow watermelon peel, which contains flavonoids and potassium. This can be seen from qualitative tests with color reactions and flame reactions. These two skin extracts have great potential for removing calcium. Hence, they have the potential to solve problems related to kidney disease. Analysis of nanoemulsion of kepok banana peel extract and yellow watermelon peel in this research, interpretation can be seen from the pH value, viscosity, size, and type of nanoemulsion. The nanoemulsion extract has a pH value of 7 and a viscosity value of 2.70 cP. The nanoemulsion of kepok banana peel and yellow watermelon peel extracts also has a size of 246.9 nm and a PDI of 0.618 with an oil-in-water (O/W) nanoemulsion type.

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