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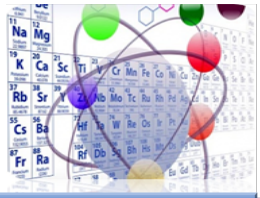

Effect of Fixatives on the Thermal Stability of Perfume Formulations from Rose, Jasmine, and Frangipani Extracts

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ABSTRACT

Perfume is a mixture of aromatic compounds, essential oils, fixatives, and solvents designed to produce a long-lasting aroma. This study investigated the effect of temperature on the stability of jasmine, rose, and frangipani flower extracts in perfume formulations using benzyl alcohol and benzyl salicylate as fixatives. Essential oils were extracted using the leaching method, and aroma and mass stability were evaluated at 25 °C, 50 °C, and 70 °C. Jasmine extract showed high volatility at all temperatures, with significant mass loss. Rose extract exhibited greater thermal stability than jasmine and frangipani. In contrast, frangipani extract experienced the highest mass reduction, particularly at 70 °C, indicating high temperature sensitivity. Benzyl alcohol reduced evaporation but was less effective at high temperatures, whereas benzyl salicylate provided better aroma stabilization. Hedonic testing showed that jasmine and rose perfumes were preferred. These results demonstrate that fixative selection plays a crucial role in improving perfume aroma durability.

Keywords: perfume, fixative, volatility, benzyl alcohol, benzyl salicylate

1. INTRODUCTION

Substances have several phases, namely solid phase, liquid phase and gas phase. Phase comes from Greek which means emergence. Phase is a form of the same element or cannot change in chemical composition and physical state. To determine the three phases depends on the temperature and pressure of a molecule so that it is depicted on a graph called a phase diagram, where the diagram shows the relationship between pressure and temperature so that phase changes occur. If two mixtures have slightly different properties so that they have a very large deviation from the ideal solution, then each mixture will have limited solubility to one another.[1]

When a substance is dissolved in a solvent at a constant temperature T, initially it forms only one phase. After point a, the solute does not dissolve, but forms another layer so that two phases are formed, until the

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composition b is reached, and another phase is obtained. In the area between a and b there are two phases called conjugate solutions at the same time. When the temperature is increased, the solubility also changes. Solubility increases with increasing temperature, and above the temperature Tc, the liquids can dissolve completely, and one phase is obtained. Temperature, Tc is called the critical solution temperature and is also called the upper solubility temperature. As the temperature increases, the solubility of one component in the other component increases.[2]

In today's modern era, we are already familiar with the name perfume. The word perfume itself comes from the Latin "per fumum" which means through smoke. The history of perfume has existed since ancient Mesopotamia around more than 4000 years ago. In ancient times, people used herbs, spices and flowers and mixed them together to make fragrances. Then in the mid-15th century perfume began to be mixed with oil and alcohol.[3] Perfume is a liquid preparation/preparation used as a fragrance consisting of natural or synthetic materials and fixatives. Perfume is made by mixing various substances or chemicals, both natural and artificial (synthetic) with a certain formula.[4] Perfume is a mixture of aromatic compounds, essential oils, fixatives, and solvents used to provide a fragrant odor.[5]

In creating a long-lasting fragrance, the long-lasting nature of perfume is obtained by providing a material that we call a perfume fixative. Perfume essence has a very good level of volatility so that it can make the scent of perfume on clothes not last long, so by providing a fixative (binder) it can suppress the rate of volatility of the perfume.[6] Benzyl alcohol is an alcohol derivative that has antibacterial activity. Benzyl Alcohol here acts as a natural preservative that prevents the growth of microbes in the perfume mixture. Benzyl Salicylate is an ester compound. Esters are a group of compounds that generally smell fragrant. Ester is the name of the functional group -COO- found in the alkyl-alkanoate compound group. The general formula for esters is RCOOR or $C_nH_{2n}O_2$. Esters are derivatives of carboxylic acids or alkanoic acids, RCOOH. Derivatives of cinnamic acid and salicylic acid are esters that have long carbon chains.[7]

As an ester compound, benzyl salicylate is able to bind aroma molecules and create stable interactions. This makes it effective in maintaining the original aroma characteristics without changing them, thus providing a "long-lasting" effect on the fragrance. There are many variations of fragrances in perfume today, the most common being rose and jasmine. The chemical content of roses is quite diverse, namely tannin, geraniol, nerol, citronellol, geranic acid, terpene, flavonoids, pectin polyphenol, vanillin, carotenoids, stearopten, farnesol, eugenol, phenylethyl alcohol, vitamins B, C, E, and K. The fragrant aroma of roses is due to the content of essential oils in them, essential oils in roses contain compounds of phenyl ethyl alcohol, geraniol, nerol, and citronellol. The content of these compounds is a fragrant perfume ingredient.[8] As for jasmine flowers that are often used as perfume, jasmine plants are widely known for their flowers and distinctive fragrance. This fragrance comes from the essential oil content in jasmine flowers.[9]

Apart from these two flowers, frangipani flowers can also be used to make perfume. Frangipani flowers have not been optimally utilized and often become waste. So far, frangipani flowers are generally only used in religious ceremonies. Frangipani flowers have a fragrant and fairly long-lasting smell. The fragrant smell of frangipani flowers is because the flowers contain several essential compounds. The essential compounds contained in frangipani flowers include geraniol, farnesol, citronellol, phenethyl alcohol, and linalool. Frangipani oil (Frangipani Essential Oil) has many benefits including as an additive in soap, mosquito repellent, cosmetics, and perfume.[10]

The manufacture of perfume using ethanol is for flower extraction. Flower extraction technology is currently developing in small-scale industries, namely distillation. However, this technology has many

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weaknesses, because essential oils that contain a lot of esters are easily hydrolyzed and evaporate at high temperatures. To overcome these obstacles, it is necessary to conduct research using solvent extraction.[11]

Essential oils are known as etheric oils or volatile oils produced by plants. Obtained from roots, stems, leaves or at room temperature without decomposition, have a bitter taste (pungent taste), smell fragrant according to the smell of the plant, generally a solution in organic solvents and insoluble in water. Essential oils in industry are used as cosmetics, perfumes, antiseptics, medicines, flavoring agents for food or beverages and aromatherapy. Essential oils are a mixture of highly concentrated, volatile, and hydrophobic chemicals extracted from plants. Essential oils are most often extracted by steam distillation, while organic solvent extraction is also sometimes used. Essential oils have distinctive flavors and aromas, and many also have other biological activities.[12]

Essential oils are volatile plants or essential oils, namely natural aromatic materials derived from plants. Essential oils have characteristics including being volatile at room temperature without decomposition, having a bitter taste, smelling fragrant according to the plant that produces it and being soluble in organic solvents and insoluble in water.[13] The first product as a raw material for perfume is called concrete, as a result of flower extraction using solvents. Extraction is a way to separate a mixture of several substances into separate components.

There are 2 requirements for a solvent to be used in the extraction process, namely the solvent must be the best solvent for the material to be extracted and the solvent must be able to separate quickly after shaking. In selecting a solvent, what must be considered is toxicity, availability, price, non-flammability, low critical temperature, and critical pressure to minimize operating costs and reactivity. The appropriate solvent for extraction is hexane, because the amount and quality of concrete produced are the best.[14]

Extraction of essential oils is carried out using the solid-liquid extraction method (leaching). Solid-liquid extraction (leaching) is divided into four, namely maceration, percolation, reflux, and soxhletation. The advantages of soxhletation compared to other methods are that the process is faster than maceration and the use of solvents repeatedly so that less solvent is needed. The speed of the extraction process is influenced by the process temperature, surface area of the particles (sample), type of solvent, ratio of the amount of solute to solvent, speed and duration of stirring. The ideal requirements for organic solvents include dissolving specifically, having a low boiling point, being insoluble in water, being inert, and being cheap. Essential oils are known by several terms such as volatile oil, etheric oil, aromatic oil or essential oil which come from plants. Each plant has a different essential oil. Essential oils are one of the residual results of the metabolic process in plants, which are formed due to the reaction between various chemical compounds with the presence of water. Chemically, essential oils are composed of a complex mixture of compounds, but a particular compound is usually responsible for a particular aroma. Most essential oils belong to the class of organic compounds terpenes and terpenoids that are soluble in oil (lipophiles).[15]

2. EXPERIMENTAL

2.1. Chemicals, Equipment and Instrumentation

In this case, the researcher made a different innovation from the previous one, namely utilizing several types of flowers to create a perfume that we usually use in everyday life. Some of the tools and materials used in this experiment are: Roses, Jasmine Flowers, Frangipani Flowers, Ethanol, Benzyl Alcohol, Benzyl Salicylate, Beaker Glass, Erlenmeyer, Tube Clamp, Measuring Cup, Glass Funnel, Thermometer, and Water Bath.

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2.2. Research Procedure

In this study, there are several steps that must be prepared and carried out to obtain optimal results. The first step is to make flower extracts from three types of flowers that have been prepared, namely roses, jasmine, and frangipani. This process begins by soaking each flower in an ethanol solution for several hours to extract the aromatic compounds contained in the flowers. After the soaking process is complete, an evaporation stage is carried out to accelerate the release of aroma from the flowers, so that the resulting extract is better and has an optimal concentration. After the flower extract is successfully obtained, the flowers that are still in the solution are taken so as not to interfere with the research process in the next stage. After obtaining the flower extract, the next step is to divide each extract into three parts for further experimental purposes. The first part is left in the form of a pure extract without the addition of other substances so that it can be used as a comparison. The second part is mixed with benzyl alcohol, a compound that is often used in the perfume industry because of its ability to increase aroma and fragrance durability. Meanwhile, the third part is mixed with benzyl salicylate, a compound that is also commonly used in perfumes because it can provide a softer aroma and blends well in fragrance formulations. With this division, research can evaluate the differences in aroma characteristics produced from each mixture and determine the most optimal combination for the final research purposes.

After the flower extract making process is complete, the next step is the making and testing of perfume from the three flower extracts that have been obtained. In this study, nine perfume samples that have been made were then tested at various temperature conditions to determine the stability of the aroma and the quality of the perfume produced. Testing was carried out at three different temperature levels, namely 25°C, 50°C, and 70°C, with each test lasting for 30 minutes. This test aims to evaluate how temperature changes can affect the aroma, stability, and durability of the formulated perfume. In the first stage, the perfume was tested at 25°C for 30 minutes, which represents room temperature or normal storage conditions. Furthermore, testing was carried out at 50°C for 30 minutes to simulate warmer environmental conditions, such as inside a vehicle or a storage place with moderate heat exposure. Finally, the perfume was tested at 70°C for 30 minutes to observe its resistance to high temperatures, which may occur when the perfume is stored in a place with extreme heat exposure. From all the tests that have been done, the results show that the perfume remains stable and does not experience significant changes in its aroma characteristics. Therefore, the perfume produced in this study has met the standards for use both for personal use and for commercial purposes.

3. RESULTS AND DISCUSSION

3.1. Analysis of Organoleptic Test Characterization Results

Organoleptic Test is a test that utilizes the human five senses to observe texture, color, shape, aroma, and taste. In addition, organoleptic tests also include preference tests where this preference test is included in the hedonic test.[16] In this study, the results of the organoleptic test were carried out visually by the researcher by observing each sample of perfume, including the fragrance, aroma and color which appears in Table 1, 2 & 3.

Table 1. Organoleptic Testing of Jasmine Perfume

Sample	Shape	Color	Smell
Sample I	Liquid	Bright Light Green	Fragrant and very pungent

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Sample II	Liquid	Bright Light Green	Fragrant and slightly pungent
Sample III	Liquid	Bright Light Green	Very fragrant and not pungent

Description: Sample I: Jasmine Extract, Sample II: Extract + Benzyl Alcohol, Sample III: Extract + Benzyl Salicylate

The most striking difference is seen in the aroma aspect. Sample I has a fragrant aroma but is very pungent because it only contains pure jasmine extract. Sample II has a fragrant aroma but is not too pungent because it contains a mixture of jasmine extract with benzyl alcohol. Benzyl alcohol is known as a solvent that can help balance and slightly soften the aroma of perfume. Meanwhile, Sample III has a very fragrant aroma but is not pungent at all because Benzyl salicylate is a compound that is often used in perfumes as a fixative, which functions to maintain the aroma longer while making it softer.

Table 2. Organoleptic Testing of Rose Perfume

Sample	Shape	Color	Smell
Sample I	Liquid	Bright Pink	Fragrant and very pungent
Sample II	Liquid	Bright Pink	Fragrant and slightly pungent
Sample III	Liquid	Bright Pink	Fragrant and not pungent

Description: Sample I: Rose Extract, Sample II: Extract + Benzyl Alcohol, Sample III: Extract + Benzyl Salicylate

The results of the organoleptic test on rose perfume are similar to jasmine perfume, only having a difference in color where the color of jasmine perfume is bright green while rose perfume is bright pink and in Sample III the rose perfume only has a fragrant aroma unlike Sample III jasmine perfume which has a very fragrant aroma.

Table 3. Organoleptic Testing of Frangipani Perfume

Sample	Shape	Color	Smell
Sample I	Liquid	Light Brown	Fragrant and very pungent
Sample II	Liquid	Light Brown	Slightly fragrant and slightly pungent

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Sample III	Liquid	Light Brown	Slightly fragrant and not pungent

Description: Sample I: Frangipani Extract, Sample II: Extract + Benzyl Alcohol, Sample III: Extract + Benzyl Salicylate

The same color consistency in the three samples shows that the addition of benzyl alcohol and benzyl salicylate does not affect the visual aspect of the perfume much. The most striking difference is seen in the aroma aspect. Sample I smells fragrant but very pungent. This is due to the volatile compound content in pure frangipani extract, such as linalool, benzyl acetate, and farnesol, which produce a strong floral aroma. Sample II's fragrance decreases compared to Sample I, and its odor is not too pungent. This is due to the presence of benzyl alcohol, which is known as a solvent that can soften and balance the aroma. While Sample III has almost no strong aroma. This shows that benzyl salicylate in the mixture can suppress or stabilize volatile compounds, so that the aroma of the perfume becomes much softer and less sharp.

3.2. Analysis of Hedonic Test Characterization Results

The hedonic test is used to measure the subjective attitudes of respondents based on organoleptic properties where respondents are asked for their personal responses regarding liking or disliking.[17] The results of the hedonic test of jasmine, rose and frangipani perfumes from 15 panelists can be seen in Table 4. It can be seen that the panelists prefer jasmine extract perfume with benzyl salicylate, then the second is rose extract perfume with benzyl salicylate and overall jasmine and rose extract perfumes have more fans than frangipani extract perfume. The selection of the "like" criteria from the panelists as a whole is more towards Jasmine extract perfume with a higher preference value, then the second is rose extract perfume and the last is frangipani extract perfume has few fans.

Table 4. Result of Hedonic Test

Preference for the smell	**Jasmine**			**Rose**			**Frangipani**		
	E	**E + BA**	**E + BS**	**E**	**E + BA**	**E + BS**	**E**	**E + BA**	**E + BS**
Positive	5	5	11	4	4	8	3	1	1
Neutral	7	10	4	8	10	7	7	8	3
Negative	3	0	0	3	1	0	5	6	11

Description:
E = Extract
E + BA = Extract with Benzyl Alcohol
E + BS = Extract with Benzyl Salicylate

3.3. Analysis of Characterization Results of Flower Extract Perfume

The results of the evaporation process carried out on the three types of pure flower extracts, namely jasmine, rose, and frangipani flower extracts, can be further analyzed to determine how temperature affects the

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characteristics of the resulting extracts. Evaporation was carried out using a water bath heater at three different temperature variations, namely 25°C, 50°C, and 70°C.

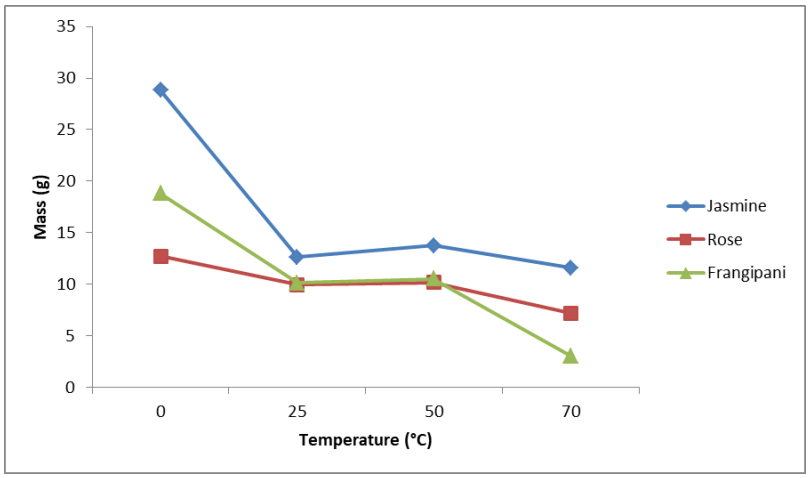

Figure 1. The changes that occur in the only flower extract at different temperatures

The effect of temperature on the mass of each flower extract made into perfume. In Jasmine flower extract experienced a significant mass loss at all heating temperatures, but remained stable without drastic fluctuations. At 25°C, there was a mass loss of 16.9 grams, slightly reduced to 15.06 grams at 50°C, and increased again to 17.2 grams at 70°C. This indicates that most of the solvents in jasmine extract evaporate consistently at various temperatures. The content of volatile compounds such as cis jasmine, z-jasmone, benzyl acetate, linalyl acetate, and linalool[18] make this extract volatile even at low temperatures.

In Rose extract showed the smallest mass loss compared to the other two extracts. At 25°C and 50°C, this extract only experienced a decrease of about 2.74 grams and 2.55 grams, indicating that most of the solvents and volatile compounds in this extract are not easily evaporated at low to moderate temperatures. However, at 70°C, the mass loss increased drastically to 5.51 grams, Rose extract contains volatile compounds that are more stable to heat than jasmine and frangipani extracts. Some of the main compounds such as geraniol, citronellol, phenylethyl alcohol, and nerol have relatively higher boiling points, so they do not evaporate easily at low to moderate temperatures (25°C–50°C). Indicating that at high temperatures there was more significant solvent evaporation and possible decomposition of some compounds in the extract.

The frangipani flower extract showed a fairly extreme mass reduction pattern, especially at high temperatures. At temperatures of 25°C and 50°C, the reduction was still quite large, namely 8.69 grams and 8.29 grams, respectively. However, at a temperature of 70°C, there was a very drastic mass reduction of up to 15.41 grams, which was the highest reduction among all extracts. The extreme decrease in the mass of the frangipani extract occurred due to the content of volatile compounds with low boiling points (benzaldehyde, linalool, benzyl acetate, farnesol) and the possible use of light solvents such as ethanol which evaporate quickly, especially at high temperatures (70°C). This indicates that the frangipani extract contains volatile compounds that are much more volatile at high temperatures than jasmine and rose extracts. This high sensitivity to heat indicates that the frangipani extract may contain volatile compounds or lighter solvents, which evaporate quickly as the temperature increases.

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3.4. Analysis of Characterization Results of Flower Extract Perfume with Benzyl Alcohol

In the perfume making process, Benzyl Alcohol is used as a fixative to maintain the stability and durability of the aroma of the three flower extracts used, namely jasmine, rose, and frangipani flower extracts.

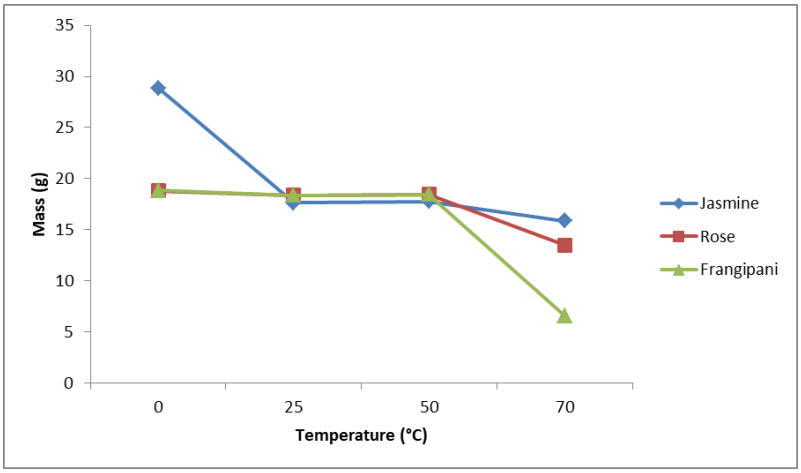

Figure 2. The changes that occur in the flower extract with benzyl alcohol as fixative at different temperatures

A significant difference in mass in each flower extract that has been added with benzyl alcohol as a fixative. Fixatives such as benzyl alcohol in perfumes serve to stabilize and extend the durability of the aroma by slowing the evaporation of volatile compounds. Benzyl alcohol helps bind the fragrance molecules so that they do not evaporate quickly, so that the perfume lasts longer on the skin or clothing. In addition, benzyl alcohol also acts as a solvent that helps mix essential oils and other components in the perfume homogeneously. The addition of benzyl alcohol to jasmine flower extract helps reduce the evaporation of solvents and volatile compounds compared to conditions without fixative, but the decrease is still quite large. At temperatures of 25°C and 50°C, this extract loses about 11 grams of its mass, while at a temperature of 70°C the decrease reaches 13 grams. Although benzyl alcohol acts as a fixative, compounds with low to medium boiling points such as benzyl acetate, linalool, and benzaldehyde remain volatile, especially at 70°C. This is what causes jasmine extract to still experience a significant decrease in mass, although slower than without a fixative.

In rose flower extract, it shows the highest stability after the addition of benzyl alcohol. At temperatures of 25°C and 50°C, the mass change is very small, even slightly increasing at a temperature of 50°C, The cause of this change is benzyl alcohol which acts as a fixative that slows down the evaporation of volatile compounds, by binding aroma molecules and increasing the viscosity of the solution, so that its volatility decreases. The decrease in mass only becomes more significant at a temperature of 70°C, where there is a reduction of 5.31 grams. This showed that although benzyl alcohol is effective in maintaining the mass of the extract at low to moderate temperatures, there is still an increase in the volatility of the compounds at high temperatures. At this temperature, the solvent in the extract (ethanol) begins to evaporate more quickly, and some volatile compounds in the rose extract that have lower boiling points also begin to evaporate. There is a reduction in mass in the sample. This is caused by the decomposition of organic materials due to the high temperatures used.[19]

As for the frangipani flower, the addition of benzyl alcohol provides a stabilizing effect on the frangipani flower extract at low and medium temperatures, but this extract still experiences a significant decrease in mass

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at high temperatures. At temperatures of 25°C and 50°C, the mass change is very small, similar to rose extract. However, when heated at 70°C, the decrease is quite drastic, which is 12.24 grams, although smaller than the condition without fixative. Although benzyl alcohol as a fixative can slow down evaporation, compounds with high volatility such as benzaldehyde and linalool still evaporate quickly at high temperatures. This shows that the frangipani extract still contains volatile compounds that are very volatile at high temperatures, even though benzyl alcohol has been added as a fixative.

3.5. Analysis of Characterization Results of Flower Extract Perfume with Benzyl Salicylate

In the perfume making process, Benzyl Salicylate is used as a fixative to maintain the stability and durability of the aroma of the three flower extracts used, namely jasmine, rose, and frangipani flower extracts. Each flower extract is added with benzyl salicylate as a fixative, there is a clearly visible difference. In the perfume making process, benzyl salicylate is used as a fixative to increase the aroma resistance of three types of flower extracts, namely jasmine, rose, and frangipani. This test aims to understand how temperature changes affect the durability of the resulting perfume and determine the stability of each flower extract against the evaporation process under different environmental conditions. Benzyl salicylate has oil-soluble properties and is able to blend with various aroma compounds in perfume, thus creating a smoother aroma transition and improving the balance of the perfume composition. Alkyl salicylate compounds have the ability as UV-B sunscreen compounds although the intensity is relatively low. The dominant activity of the dominant alkyl salicylate compound is as a UV-C sunscreen compound.[20] As a UV absorber, benzyl salicylate helps protect perfume from degradation due to exposure to sunlight, thus extending the stability and quality of its aroma. With these characteristics, benzyl salicylate is one of the fixatives commonly used in the perfume industry to increase the durability of the aroma and maintain a more consistent fragrance impression over time.

The addition of benzyl salicylate to jasmine flower extract showed effectiveness in maintaining mass stability at various temperatures, but still experienced a significant decrease in mass. Jasmine extract still contains volatile compounds with relatively lower boiling points compared to compounds in rose extract. The main compounds in jasmine extract have quite high volatility, so they still experience evaporation even though fixatives are used. At low to moderate temperatures (25°C and 50°C), the decrease in mass of jasmine extract occurred consistently, with a loss of about 10-11 grams of its initial mass. This shows that although benzyl salicylate is able to retain some volatile compounds, evaporation of compounds with lower boiling points still occurs as well as the possibility of evaporation of residual solvents used in the extraction process. Jasmine extract is more sensitive to temperature than rose extract because of its lighter and more volatile compound content. However, at high temperatures (70°C), jasmine extract actually shows better stability than rose and frangipani extracts. This can be explained by the role of benzyl salicylate which is more effective in inhibiting evaporation at high temperatures, especially for compounds with higher boiling points. Compared to rose extract which experienced a mass decrease of 10.11 grams at 70°C and frangipani extract which experienced an extreme decrease of up to 15,78 g, jasmine extract remains more stable because most of its compounds are still in the higher boiling point range and not all of them experience rapid decomposition or evaporation. Rose flower extract with the addition of benzyl salicylate showed quite good stability at low to moderate temperatures due to the fixative properties of benzyl salicylate which can inhibit the evaporation of volatile compounds. At temperatures of 25°C and 50°C, the relative mass decrease was small, indicating that the volatile compounds in rose extract. Benzyl salicylate works by increasing the viscosity of the mixture and forming weak interactions with volatile compounds, thereby slowing down the rate of evaporation

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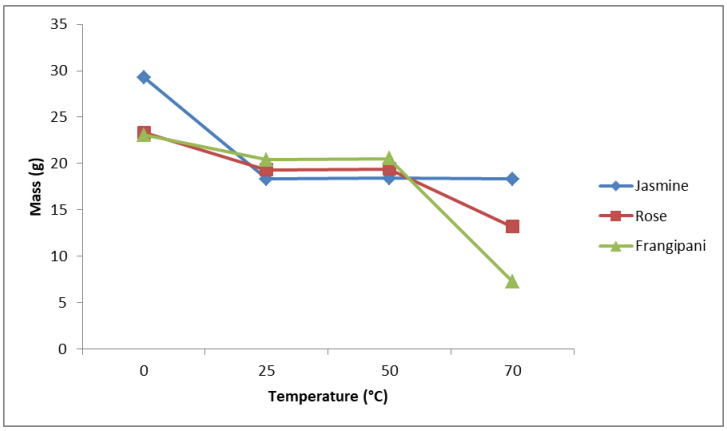

Figure 3. The changes that occur in the flower extract with benzyl salicylate as fixative at different temperatures

In addition, compounds in rose extract have higher boiling points than volatile compounds in other flower extracts, which makes them more stable at low to moderate temperatures. However, when the temperature increased to 70°C, there was a greater mass decrease, namely 10.11 grams. This is due to several factors. Higher temperatures increase the kinetic energy of the molecules, causing the intermolecular bonds in the extract to become weaker and allowing more volatile compounds to evaporate more quickly. In addition, the evaporation of the remaining solvent in the extract (ethanol) that is still left over from the extraction process, also contributes to the decrease in mass at high temperatures. Another factor is the potential for thermal decomposition. Where high temperatures can cause certain chemical reactions that change or decompose some components in the extract, At the component decomposition stage, mass reduction occurs more slowly, but can reduce the overall mass.[21]

The addition of benzyl salicylate to frangipani flower extract showed quite good effectiveness in inhibiting the evaporation of volatile compounds at low to moderate temperatures. This is due to the nature of benzyl salicylate as a fixative that can bind volatile molecules and slow down the rate of evaporation, thereby helping to maintain the stability of the extract. At temperatures of 25°C and 50°C, the mass decrease was relatively small compared to jasmine and rose extracts, indicating that the majority of volatile compounds in frangipani extract had not yet experienced significant evaporation. However, when the temperature increased to 70°C, the frangipani extract experienced a very large mass decrease, namely 15.78 grams. This shows that although benzyl salicylate is able to withstand evaporation at low temperatures, the volatile compounds in frangipani extract remain very sensitive to high temperatures. One of the main reasons is the content of volatile compounds in frangipani extract that have lower boiling points, such as benzyl acetate, linalool, and farnesol. These compounds have higher volatility than the main compounds in jasmine and rose extracts, so they evaporate more easily at high temperatures. Although benzyl salicylate acts as a fixative that slows evaporation, its effectiveness is reduced at high temperatures because the greater thermal energy increases the rate of evaporation of the molecules.

4. CONCLUSION

This study shows that the aroma and stability of three types of flower extracts: jasmine, rose, and frangipani are affected by the addition of benzyl alcohol and benzyl salicylate as fixatives. In terms of aroma, the pure

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extract has a sharp and pungent aroma, while the addition of benzyl alcohol makes it softer, and benzyl salicylate produces a more lasting and less pungent aroma. From the hedonic test, jasmine perfume with benzyl salicylate is the most preferred, followed by rose perfume, while frangipani perfume has the fewest fans. The addition of fixatives also has no significant effect on the color of the perfume. The evaporation test showed that frangipani extract evaporates the most easily, especially at high temperatures, compared to jasmine and rose extracts. Rose extract is the most stable against temperature, with the least mass loss, especially at 25°C and 50°C. Benzyl alcohol helps slow evaporation but is less effective at high temperatures, while benzyl salicylate is better at stabilizing the aroma at high temperatures. Overall, benzyl salicylate was more effective in increasing the longevity of perfume scents than benzyl alcohol, although it still experienced a decrease in mass due to the volatility of certain compounds in the flower extract.

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