

“Essential Oil Dilution: A Laboratory Experiment”

Introduction

Essential oils are concentrated liquids extracted from plants that offer various therapeutic properties. However, due to their potency, applying them directly to the skin can be irritating. This experiment will instruct you through the process of preparing safe & effective dilutions of essential oils using alcohol & Tween 20, a surfactant that helps disperse the oil in the solution.

Materials:

- ★ Safety goggles.
- ★ Nitrile gloves.
- ★ Fume hood (optional, but recommended for strong-smelling essential oils)
- ★ Analytical balance (for high accuracy) or graduated cylinder
- ★ Pipettes (various sizes)
- ★ Magnetic stir plate with stir bar.
- ★ Beakers (different sizes)
- ★ Isopropyl alcohol (HPLC grade)
- ★ Tween 20.
- ★ Essential oil (choose one with readily available dilution recommendations)
- ★ Amber glass bottles with dropper tops (consider larger bottles for 100ml)
- ★ Permanent marker.

Procedure

Preparation:

- Use your safety goggles & gloves before starting.
- If working with strong-smelling essential oils, utilize a fume hood for proper ventilation.

Essential Oil Selection:

Choose an essential oil with well-established dilution guidelines. Common options include lavender, tea tree, or lemon. Research the recommended dilution range for your chosen oil.

Dilution Calculations:

- Decide on three different dilution percentages (e.g., 10%, 15%, 20%) for your experiment.
- Use the following formula to calculate the amount of essential oil needed for each dilution:

$$\text{Amount of essential oil (mL)} = \text{Dilution (\%)} \times \text{Total volume (mL)} / 100$$

For example, to prepare a 10% dilution in a total volume of 5 mL, you would need:

$$\text{Amount of essential oil (mL)} = 10\% \times 5 \text{ mL} / 100 = 0.5 \text{ mL.}$$

For example, to prepare a 10% dilution in a total volume of 100 mL, you would need:

$$\text{Amount of essential oil (mL)} = 10\% \times 100 \text{ mL} / 100 = 10 \text{ mL.}$$

Alcohol-Tween 20 Solution:

- ★ Using the analytical balance or graduated cylinder, measure 90 mL of isopropyl alcohol (HPLC grade).
- ★ Pipette 10 mL of Tween 20 into the alcohol and stir gently with a stir bar on a magnetic stir plate. Alternatively, mix in a clean beaker for a few minutes.

Dilution Preparation (Perform for Each Concentration):

- ★ Label three beakers clearly with your chosen dilution percentages (e.g., 10%, 15%, 20%).
- ★ Using a pipette, transfer the calculated amount of essential oil (e.g., 10 mL for 10% dilution) to its corresponding labelled beaker.
- ★ Measure the desired total volume (100 mL) of the prepared alcohol-Tween 20 solution into each beaker using a graduated cylinder (ensure it can measure up to 100 mL).
- ★ Stir the mixture in each beaker with a clean stir bar for at least 5 minutes to ensure proper homogenization.

Calculating the amount of Alcohol-Tween 20 solution:

- We'll use the formula:

Remaining Volume (mL) of Alcohol-Tween 20 solution = Total Volume (mL) - Essential Oil Volume (mL)

This is because the total volume of your final solution (100ml) will consist of two parts:

- The essential oil you add based on your desired dilution percentage.
- The remaining volume from your pre-prepared Alcohol-Tween 20 solution (which needs to be calculated).

Let's see this for each of your chosen dilution percentages:

10% dilution:

- You'll add 10ml of essential oil (10% of 100ml).
- Remaining Volume = 100ml (total volume) - 10ml (essential oil) = 90ml of Alcohol-Tween 20 solution.

15% dilution:

- You'll add 15ml of essential oil (15% of 100ml).
- Remaining Volume = 100ml - 15ml = 85ml of Alcohol-Tween 20 solution.

20% dilution:

- You'll add 20ml of essential oil (20% of 100ml).
- Remaining Volume = 100ml - 20ml = 80ml of Alcohol-Tween 20 solution.

Therefore, you'll need:

- ★ **90ml** of Alcohol-Tween 20 solution for your 10% dilution.
- ★ **85ml** of Alcohol-Tween 20 solution for your 15% dilution.
- ★ **80ml** of Alcohol-Tween 20 solution for your 20% dilution.

Remember to use a graduated cylinder to measure these calculated remaining volumes of the Alcohol-Tween 20 solution for each dilution preparation.

Bottling & Labeling:

- ★ Filter each diluted essential oil solution (optional but recommended for removing any undissolved particles) using a syringe filter attached to an empty amber glass bottle.

- ★ If not filtering, carefully transfer the solution from each beaker to a separate amber glass bottle with a dropper top.
- ★ Label each bottle clearly with the following information:
 - ★ Essential oil name.
 - ★ Dilution percentage.
 - ★ Date of preparation.

Storage:

- Store the prepared dilutions in a cool, dark place away from direct sunlight & heat.

Data Analysis & Observations:

- ★ Note any visual differences between the different dilution preparations.
- ★ You can calculate the final volume of the solution after adding the essential oil (accounting for slight volume changes) to ensure accuracy.

Safety Precautions:

- ★ Essential oils can be potent & irritating. Always wear gloves & safety goggles when handling them.
- ★ Work in a well-ventilated area, especially with strong-smelling essential oils.
- ★ Never ingest essential oils.
- ★ If skin irritation occurs, discontinue use & wash the affected area with soap & water.
- ★ Research & follow recommended dilution guidelines for your chosen essential oil.

Final Thoughts:

This experiment demonstrates the proper technique for preparing essential oil dilutions using alcohol & Tween 20. By following these steps &

referencing safety protocols, you can create safe & effective dilutions for various applications. Remember to consult a qualified aromatherapist or refer to scientific literature for in-depth information on specific essential oil properties & uses.

Essential Information

- ★ **Carrier Oil Compatibility:** While alcohol is a common carrier for essential oil dilutions, it's important to note that some essential oils may not mix well with it. In such cases, alternative carrier oils, such as vegetable oils (e.g., jojoba oil), can be explored. **Crucially, before using any carrier oil with an essential oil, always research & confirm their compatibility to ensure a safe & effective blend.**
- ★ **Storage Recommendations:** To preserve the quality of your prepared essential oil dilutions, store them in airtight containers. This will help minimize evaporation & maintain the potency of the essential oil components.
- ★ **Waste Disposal:** Responsible disposal of essential oil solutions & leftover materials is essential. Due to the potential environmental impact of essential oils, consult your local regulations for proper disposal guidelines.

Safety Precautions

- ★ **Strict Adherence to Dilution Guidelines:**

Essential oils are potent & can be irritating or even toxic if used improperly. It's crucial to **strictly follow the recommended dilution guidelines** for

your chosen essential oil. **Exceeding the recommended dilution can be harmful** & cause skin irritation, allergic reactions, or other health problems. Always consult reliable sources like safety data sheets (SDS) or qualified aromatherapists for specific dilution recommendations for your chosen essential oil.

Enhancing Your Experiment

- ★ **Carrier Oil Compatibility:** Explore resources for researching compatibility between specific essential oils & carrier oils (e.g., online databases, reference books).
- ★ **Optional Steps:** Consider filtering solutions for a cleaner final product (technique details provided upon request).
- ★ **Data Analysis Examples:** Look for visual differences (clarity, color variations) in dilutions. Calculate final solution volume after adding essential oil (example available upon request).
- ★ **Resource List:** Utilize websites, books, or scientific journals for further information on essential oil properties, dilution recommendations, & safety data sheets (SDS).

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