

Blank Activity Template

Yellow highlight = required component

Subject Area(s) AP Biology
Associated Unit Plants
Associated Lesson Plant Responses
Activity Title The Essence of Herbs

Header



Image 1

Image file: distillate.png

ADA Description: Distilled rosemary is dripping out of a copper pipe into a 1 ounce glass bottle.

Source/Rights: Taken by self

Caption: Essential oil/distillate of rosemary.

Grade Level (10-12)

Activity Dependency

Time Required 100 min,

Time Required Note: Two 50 min class periods

Group Size 3 – 4 students

Expendable Cost per Group ~US\$15 (\$5 for plant material, a \$20 pack of copper tubing can make two distillation set ups.

Summary

Comment [A1]: I'm confused... I didn't see a lesson in your unit with this title. Which lesson should this activity be associated with?

Comment [A2]: This doesn't seem to be great quality... it's okay, but if you have another one you could send, that would be great!

Formatted: Font: Times New Roman, Not Bold

Comment [A3]: What would be the target group level. For example, if it was 11, write:

11 (10-12)

Comment [A4]: I'm not sure whether this is reusable or not... but if it is, it doesn't need to be included in the expendable cost per group...

Students will learn about distillation and essential oils. This lab activity will allow students to explore how chemical engineers extract useful compounds from plants to be used in a wide range of useful products.

Engineering Connection

Distillation is a fundamental tool for purifying raw, natural substances into useful, predictable products. Chemical engineers utilize distillation columns for refinement of oil

Engineering Category = #1

Choose the category that best describes this activity's amount/depth of engineering content:

1. Engineering analysis or partial design

Keywords

Plants, Distillation, Chemical Engineering, Biology

Educational Standards

Science: Texas, science, 2009, The Texas Essential Knowledge and Skills, Chapter 112

1A demonstrate safe practices during laboratory investigations

3D evaluate models according to their limitations in representing biological objects or events

7E analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species

Pre-Requisite Knowledge

Learning Objectives

After this activity, students should be able to:

- Describe the types of defense mechanisms in plants
- Describe the chemical characteristics of plant defense mechanisms and essential oils

Materials List

Each group needs:

- 2 500mL Erlenmeyer flasks
- 1 small bottle with screw cap to capture distillate
- 2 rubber stoppers (1 with 1 hole, 1 with 2 holes)
- 300mL water
- 1 copper tube bridging the two flasks, 1 copper tube forming a column (12-24 inches tall) with a spiraling coil down to the end (Note: coils of copper tubing can be obtained at home improvement stores in the home appliance section, I use tubing for refrigerator icemakers) see Figure 2
- 1 hotplate or Bunsen burner setup

Comment [A5]: We require at least one ITEEA standard for each lesson and activity. Please add one. You can browse these standards at:

http://www.teachengineering.org/browse_standards.php?submitted=true&state=International+Technology+and+Engineering+Educators+Association&lowgrade=-1&highgrade=12&type=empty&date=latest&submit_button=Browse+Standards

Please choose from grade appropriate standard subsets.

- Enough plant material to fill a 500 mL flask (lavender, rosemary, flower petals, etc)

To share with the entire class:

- Thermometers or other temperature reading devices

Introduction / Motivation

There is no measure to how important plants are in our daily lives. They provide the air we breathe, the food we eat, medicines to cure us, and dyes to portray individuality. Every student in the classroom either has in their backpack or is wearing something that was produced with plant material. Since so many consumer products require specific, purified and quality controlled constituents from plants, a certain amount of biological, chemical and engineering understanding is necessitated. In the last lecture, we learned how distillation works and was used by the alchemists to prepare medicines. For today's activity, students will choose an herb or flower that is interesting to the members of their lab group and is easily attainable for the distillation lab.

Vocabulary / Definitions

Word	Definition
Distillation	The process of heating a liquid until it boils, then condensing and collecting the resultant hot vapors (Organic Chemistry at CU Boulder)
Essential Oil	A mixture of organic compounds dominated by terpenes and terpenoids, largely collected for fragrance and flavor.
Distillate	A liquid that has undergone the distillation process, thereby containing a higher concentration of the chemical with the lowest vapor pressure/boiling point.
Azeotrope	A mixture of at least two liquids that can no longer be altered by distillation.

Procedure

Background

This lesson is contained within the unit plant physiology, after the students have learned basic structures and functions of plants. Students will be able to discuss fictional plant properties with exciting real-life examples. There will also be a strong emphasis on scientific methods of detecting and measuring these exciting properties as well as the daily applicability.

Before the Activity

- Assemble the distillation apparatuses and have them ready at the lab stations
- If the students do not already have groups, separate them into groups of 3-4 students and place them at their lab stations

With the Students

1. Students will need to fill the first flask with water, the second with the plant material of their choice.
2. Using hot plates or Bunsen burners, the students will slowly heat the water and monitor the temperature of the column.
3. The students should adjust the temperature of their heating device to attempt to keep the temperature at the top of the column close to 80 degrees C.
4. During the distillation, students can be shown video clips from movies or other pop culture (i.e. Harry Potter) showing the brewing of magic potions. After each clip, engage in the students why certain ingredients may have been added. A wealth of knowledge on these subjects is freely available online. Teachers can also use the associated lesson on alchemy, which complements this laboratory well.
5. Once distillation is finished, the students should close their small bottles and briefly shake the contents. Then ask them to smell the contents and say whether the smell is what they had expected or not and why that might be.

Image

Comment [A6]: This picture wasn't included in the zip file you sent. Could you insert it here?

Figure 1

Image file: still.png

ADA Description: A distillation setup in a fume hood is being presented to an AP biology class.

Source/Rights: Taken by Self

Caption: Distillation Setup

Attachments

Alchemy and Distillation PowerPoint Presentation

The Essence of Herbs Pre-Lab Quiz

Safety Issues

- Burns from students touching the column, heating devices or flasks
- Students should follow safety guidelines as with any lab activity that uses a heating device

Troubleshooting Tips

Investigating Questions

Assessment

Pre-Activity Assessment

Descriptive Title: The Essence of Herbs Pre-Lab Quiz

Activity Embedded Assessment

Descriptive Title: ___?

Post-Activity Assessment

Descriptive Title: ___?

Activity Extensions

Activity Scaling

- For lower grades, ___?
- For upper grades, ___?

Additional Multimedia Support

References

Other

Redirect URL

Contributors

Comment [A7]: This is a required section and needs to be fully completed.

Please explain how the Essence of Herbs Pre-Lab Quiz assesses students, and what it covers.

Also, how is the teacher assessing if students are engaged and understanding the activity during the actual activity? Through observations? Through questions?

How are students assessed after the activity?

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Supporting Program

National Science Foundation GK-12 program, University of Houston, Department of Civil and Environmental Engineering

Classroom Testing Information

This activity was demonstrated at North Shore Senior High School, Houston TX, on May 18th 2011.