

Name _____

Student Work Sheet

How Dry am I? Exploring Biomimicry and Nanotechnology

Objective:

Compare and contrast physical properties of superhydrophobic coated materials with uncoated materials. Explore this practical application of nanoscale science.

Introduction:

How does nature teach us about superhydrophobic materials? The lotus flower is a symbol of purity in several Asian religions because the leaves are self-cleansing. How is this possible?

Materials: (per group)

- SEM pictures of lotus leaf and magnolia leaf structures
- Student worksheets, one per person
- 3 Droppers or Pipettes
- 4 small paper/plastic cups
- 4 pairs of Gloves
- 4 goggles
- Oil (Vegetable) (50 mL)
- Water (50 mL)
- Tomato Sauce or Ketchup (50 mL)
- Optional: potting soil (fill plastic cup)
- Index cards 3 X 5 labeled U and C
- Assorted test materials labeled U and C (pieces of wood, plastic, vinyl, tile, linoleum, siding, white poster board, etc. that you teacher will give you).

Procedure:

Pre-Lab: (Day 1)

1. Observe structure of lotus leaves and magnolia leaves using SEM images. What do you observe? What structures in each leaf creates or prevents hydrophobicity? Draw a Venn diagram to compare and contrast the structures of the leaves.
2. View: 24-Second Lotus Leaf video-clip
<http://www.youtube.com/watch?v=MFHcSrNRU5E>

Day 2

Lab Part A:

You should handle samples with gloves and wear goggles at all times!

1. Place 5 drops of water on sample 1-- C and U. Hold samples over cup of water and let drip into the cup. Record observations in chart.
2. Repeat step 1 for each sample your teacher has given you and for both C and U. Record observations in chart.
3. Now place 5 drops of oil on each sample, C and U. Drip excess oil into another cup. Record observation in chart.
4. Do the same for tomato sauce. Record observation in chart.
5. Optional: dry soil on samples and then wet the soil. Shake off.
6. Compare the data to the data you found in the Pre-lab activity *Biomimicry: The Mystery of the Lotus Effect*.
7. What do you think the C and U labels on the samples mean?
8. View Home Depot NeverWet Video-clip:

<http://www.homedepot.com/p/t/204216476?storeId=10051&langId=-1&catalogId=10053&productId=204216476&R=204216476#.UdsCh-jD9jo>

Have a class discussion of the data.

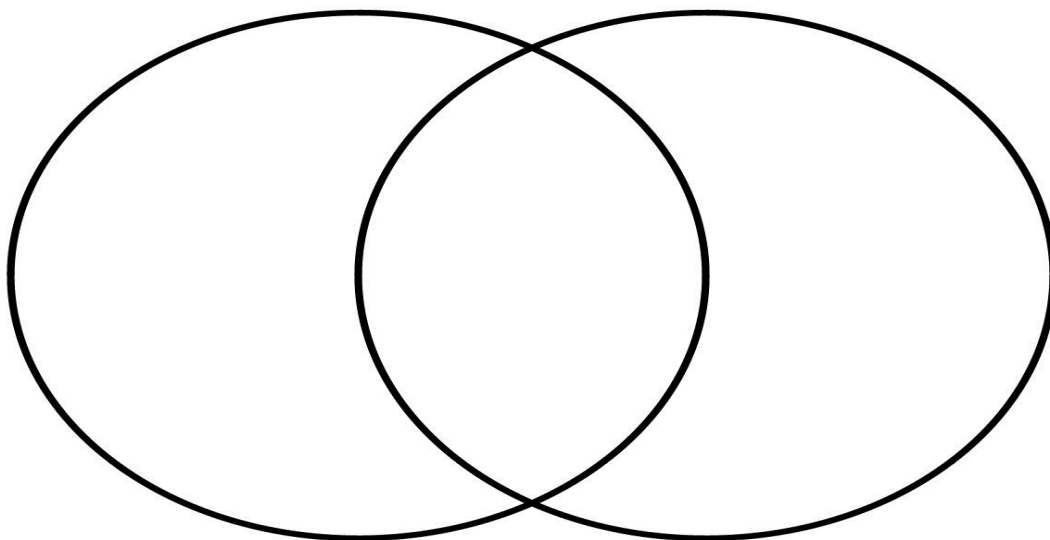
Lab Part B (Teacher Demo- The Mystery of the Pooled Water):

You will solve the mystery of the pooled water from the information learned from the past two activities. Observe your teacher's demonstration or perform the activity yourself. Then with a partner or a group, answer and do the following:

1. How would you replicate this demonstration? Be specific.
2. Draw an illustration on butcher paper showing why the water pooled up and did not fall off the plastic. Post charts on wall for discussion.

Compare and Contrast surface of magnolia leaves with lotus leaves in 2-Zone Venn diagram below:

2 Zone Venn Diagram



Lab Data:

Record description in boxes below.

| | | |
|----------|---|---|
| Sample 1 | U | C |
| Oil | | |
| Ketchup | | |
| Dry Dirt | | |
| Wet Dirt | | |
| Water | | |

| | | |
|----------|---|---|
| Sample 2 | U | C |
| Oil | | |
| Ketchup | | |
| Dry Dirt | | |
| Wet Dirt | | |
| Water | | |

| | | |
|----------|---|---|
| Sample 3 | U | C |
| Oil | | |
| Ketchup | | |
| Dry Dirt | | |
| Wet Dirt | | |
| Water | | |

| | | |
|----------|---|---|
| Sample 4 | U | C |
| Oil | | |
| Ketchup | | |
| Dry Dirt | | |
| Wet Dirt | | |
| Water | | |

| | | |
|----------|---|---|
| Sample 5 | U | C |
| Oil | | |
| Ketchup | | |
| Dry Dirt | | |
| Wet Dirt | | |
| Water | | |

Analysis:

What similarities did you notice in the uncoated samples?

What similarities did you notice in the coated samples?

How does the manmade superhydrophobic coating compare and contrast with the lotus leaf?

What do you think the nanoscale surface of the superhydrophobic coated materials looks like?

Conclusion

In your own words, write a definition for “superhydrophobic”. How do you think this technology will help people in the future?

Poster Project: Create a poster showing 10 ways superhydrophobic coatings could be used in their household