CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
J1213

Project Title
Microscopic Study of Torrey Pine Needles for Moisture Condensation

Abstract

Objectives/Goals

The Torrey Pine tree is well known for its ability to efficiently condense moisture and water itself to survive under drought conditions. However, the mechanism of Torrey pine tree collecting moisture from fog is not well understood.

We want to learn how Torrey pine tree achieves this function by having what unique surface and structure properties. These learning can be used to guide moisture collection equipment design in practical.

This study is focused on learning its surface structure and properties in microscopic level. Interactions between Torrey pine needle, liquid water drop and water vapor are studied under digital microscope. Jeffrey Pine needles are reference.

Methods/Materials

Equipment: Portable microscope with PC, Cold vapor generator, Multi-meter, Eye dropper.

Material: Fresh Torrey pine tree bunch, Fresh Jeffery pine Tree bunch.

Results

The contact angles for the three sides of Torrey Pine needles were under 90° so they were all hydrophilic.

The rough surface contact angles were 34.2±8.2 degree which indicates very strong hydrophilic properties. The smooth surface has a relatively higher contact angle (49.4±10.7 degree) which still indicates hydrophilic properties.

Upon observation, small droplets of water formed on the rough sides and then quickly spread out to the smooth side due to its hydrophilic properties. Larger droplets were observed on the smooth side. As the mass of the droplet increased, they flowed towards the tip of the needles. This freed up the space in the smooth surface and more droplets were formed that soon flowed away.

A single Torrey Pine needle had 2.5 times more surface area than a Jeffrey Pine needle. A bunch had four times more surface area.

The electric resistance of Torrey Pine needles is lower than the Jeffrey Pine needles.

Conclusions/Discussion

For both Torrey Pine and Jeffrey Pine needles, the rough and the smooth surfaces were hydrophilic.

The two rough surfaces in Torrey Pine trees were much more hydrophilic than the smooth surface. They were more efficient in collecting the moisture.

For practical moisture condensation equipment design, the surface shall be as large as possible, and

Summary Statement

Study Torrey pine tree needles moisture condensation function to provide design guidelines, leading to free water resource for dry areas

Help Received

Dr. Mellisa Gingrich at The Cambridge school