Presenting *Practical Botany* to Engage Students

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Introduction

These lab exercises highlight economically useful plants and botanical products to engage non-majors in the *Plants and Society Laboratory*, a course in the general curriculum for the science requirement. Exercises include: viewing free-hand sections of parsnips with differential staining to understand the functional organization of roots; ; demonstrating a drying test for plant oils to understand the importance of unsaturated fatty acids; examining fibers from plant-derived fabrics to illustrate the differences between primary cell walls and secondary cell walls; making soap from plant oils; and making paper from plant fibers. Students readily embraced these laboratory activities and came to recognize the importance and value of plants to society.

Materials

General

1000 and 400 ml beakers
Distilled water
Glass slides
Scissors
Water bath
Compound light microscopes
Dropper pipets
Razor blades
Thermometers

Per Lesson

Differential staining of parsnip root x.s.

Parsnip roots
Phloroglucinol-HCl

Cut two thin cross sections of a parsnip root. Place each on a separate glass slide. Floor one sections with IKI; the other with phloroglucinol-HCl. Observe without coverslips under the scanning (4x) objective or 10x (low power)objective.

Drying test for plant oils

Petri dishes
Paint brushes (small)
Variety of plant oils – soybean, olive, canola, avocado, walnut & others

Paint a thin veneer of each plant oil on separate (and labeled) petri dish lids. Lay the lids in on a lab bench away from the direct sunlight. Check daily and record when the oil veneer has dried.

Fibers from fabrics

Fabric or rope samples: Cotton, linen, jute, manilla hemp, sisal
Phloroglucinol-HCl

Tease out thin strands of each fiber and place on separate glass slides. Add phloroglucionol-HCl to each slide; cover with a cover slip. Observe fibers under the compound light microscope.

Soap from plant oils

NaOH (lye)
Rubber gloves
Themometers
Oils: Crisco (cottonseed oil) or palm, coconut, & olive
Soap molds
Wooden spoons

Measure out 240ml of distilled into a 400ml beaker. Carefully add 85 g of NaOH. Stir with a wooden spoon until the lye is dissolved. Place the beaker in a 35°C water bath to cool. Warm oils to 65°C. Measure out 225 ml of crisco or palm oil; 210 ml of coconut oil, and 180 ml of olive oil into a 1000ml beaker, stir, and set to cool to 35°C in a water bath. When both oils and lye reach 35°C, add the lye to oils while stirring constantly with a wooden spoon. Continue stirring until a trace is seen. A trace is the temporary impression left when some of the soap mixture is dribbled onto the surface. Add colorant and fragrances. Poor into molds. After 24 hrs., pop out soaps from molds; place in zip-lock plastic bags that are partially unsealed. Soap will be cured and ready for use in 2-4 weeks.

Making paper

Blender
Rolling pin
Sponges
Mold (bottom mesh frame) & Deckle(open frame)
Shredded paper an/or fibrous plant material
Wire screen

Place the deckle on top of the mold and place in a tub of lukewarm water so that the water level is just below the top of the deckle. Fill a blender one-half to two-thirds full of lukewarm water; add shredded plant material or paper to the blender. Let is soak for a few minutes. Blend into a smooth slurry, the pulp. Pour pulp into the mold and deckle; smooth the pulp to eliminate lumps . Lift the mold and deckle out of the tub allowing the water to drain off. Place on the lab bench and carefully lift off the deckle. Place a piece of screen on top of the pulp; flip the mold over. Use sponges to soak up as much water as possible . Lift the mold away. Place blotting paper on the new paper, flip the new paper over and remove the wire screen. Replace with another sheet of blotting paper. Use a rolling pin to squeeze out as much water as possible from the new paper sandwiched between the blotting paper sheets. Dry the new paper in a microwave for1 to 2 minutes on high. It may take several drying cycles.

References

Levetin, E. , K. McMahon, and R. Reinsvold. 2002. *Laboratory manual for Applied Botany*. McGraw-Hill: New York. 264 pages.

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Thank you to all of the fantastic students in the *Plants and Society Laboratory* (Biol. 1011) since 2002. I have re-lived the thrill of first discovery through your eyes.

Results

Fig. 1. Parsnip root x.s. a. IKI stained starch grains in the cortex .

b. Phloroglucinol-HCl stained xylem in the vascular cylinder.

Fig. 2. Set-up for drying times for various plant oils.

Fig. 3 Phloroglucinol-stained plant fibers illustrate differences in lignin content in a. Cotton. b. Jute.

Fig. 4. a. Soap molds. b. Soaps from plant-oils.

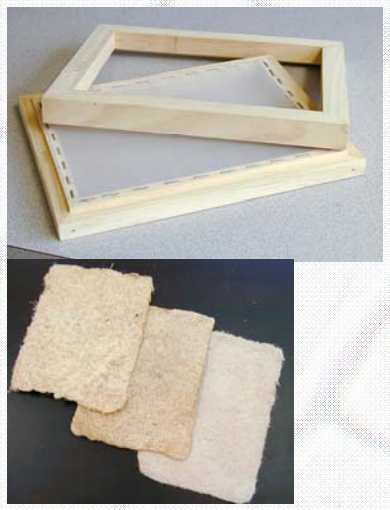

Fig. 5. Paper-making. a. Mold and deckle. .

Background photomicrograph of onion epidermis

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