Leaf chromatography lab answers sheet answers questions and answers

This allows the accessory pigments (carotene, xanthophyll) to take over the light-capturing process because they are able to trap different wavelengths of light. Why do you think we rip the leaves into little pieces? Chlorophyll a and b are two common types of chlorophyll found on the thylakoid membrane in several photosynthetic units. From here, I removed the paper towel strips and let my experiment hang out, covered, overnight) If you wait overnight, what differences do you notice from what you set up the day before? The lipid-soluble pigments will travel up the paper until their bonds between the water are so weak that they must stop following the movement of the solvent, and get placed at a certain height above the original concentrated dot. In comparison to the spinach leaf, this plant doesn't have a massive storage "unit" at the base of the plant. Or try both! (Photo of experiment set up with paper towels dipped into nail polish remover/rubbing alcohol and leaf pieces, taped to a stick above the cups – note the darker liquid color because the leaves sat in the liquid overnight) If you're continuing right now, or if it is the next day: carefully place a paper towel strip into the leaf-liquid so that it is just touching the liquid. Rest a stick on the top of your cup and tape the paper towel to this stick to hold the paper towel in place. This happens because as the water travels up the paper, the water soluble pigments' bonds become attracted to the water molecules due to dipole-dipole forces. Please help us to share our service with your friends. The beet leaf contained more pigments in the leaf compared to the spinach leaf. Related Posts Some factors that affect paper chromatography are: READ: Light Energy and Photosynthetic PigmentsSolvent: the solvent is a major factor that plays in the outcome of the experiment. As the solution travels up the paper, like soluble pigments will travel with the solvent until the bonds between the solvent and pigment become so weak that it must break the attraction and imprint itself a certain height up the paper. The green leaf color is the chlorophyll, which helps plants absorb the yellow and blue wavelengths of light. Spinach will have mainly chlorophyll A and B because the leaf is completely green, compared to the beet leaf which consists of both a red and green shade showing that other pigments are present in this leaf. This could be because the beet has a root where it stores starch. Paper chromatography is a process in which pigments are separated, from an initial concentrated solution, through the process of capillary action. What colors are the leaves you collected? The combined trapping ability of the accessory pigments and the regular pigments (chlorophyll A and B) allows for greater combined absorption of light because there are more pigments trapping a greater range of light from the visible light spectrum. What colors do you see at the end of 20 minutes? We need your help to maintenance and improve this website. Chlorophyll is the main pigment used for photosynthesis, or harvesting energy from sunlight! Those leaves have so much chlorophyll in them that it hides the other pigments from view. Some of these other pigments are carotenoids (yellow, orange, red, or brown in color; absorb blue light) and anthocyanin (pink-red colored; absorb blue-green light) – these two pigments help plants absorb additional wavelengths of light and help plants deal with some of the stress that sunlight can cause (Harvard Forest). This results in the plant being able to perform more photosynthesis because more photons of light are being absorbed which will result in more glucose being formed which will ultimately be stored as potential energy (in the form of sugars) during the winter months when photosynthesis doesn't occur. Materials to Collect Leaves – spinach, kale, plants outside Nail polish remover or rubbing alcohol Tall cups Paper towel or coffee filter cut into long, 2-inch wide strips Tape A stick Don't Pick That!: Please please please do not use poison ivy or poison oak for this activity! (Photo of poison ivy vine climbing a tree – HowStuffWorks.com) Check out this guide and this UConn poison ivy guide for identifying and dealing with poison ivy, poison oak, and poison sumac. We are right in the middle of summer, so the trees around us are full of bright green leaves. If you're like me, the above picture is enough to make you feel itchy for the rest of the day! Try it out! (Photo: The leaves I picked for the experiment today – you don't need this many!) Go find some leaves that you are curious about! I chose (what I believe to be) two different types of maple leaves (on the left) and oak leaves (on the right). Wait for 15-20 minutes then check back and see what you notice! (I didn't notice anything except for a faint green creeping up my paper towels. Therefore it doesn't need to undergo photosynthesis as rigorously so it doesn't require as many accessory pigments. Her scientific interests are: biology – how living things have adapted different strategies to survive in their environments, insects, and plants. The purpose of the experiment is to determine the specific types of pigments found in a beet leaf and in a spinach leaf by using paper chromatography and two solvents: water soluble solvent and lipid soluble solvent. If this lipid-soluble solvent is present, as opposed to the water-soluble solvent, then the lipid-soluble pigments will move up the chromatography paper instead of the water-soluble pigments. Hypothesis If a water soluble solvent is present, then there will be the movement of only the water soluble pigments up the chromatography paper. Click here for a more general don't touch/don't eat that plant guide for North America. Thank you for using our services. Therefore, they will remain in the concentrated area unless a lipid-soluble solvent is present. What differences do you notice in the liquid that sat overnight? For example, this experiment used water-soluble and lipid-soluble solvents. Chlorophyll b is an accessory pigment, meaning it always passes its excited electrons to chlorophyll a. Explore the colorful pigments leaves have hidden inside of them. The same idea will happen. This would require it to undergo photosynthesis more times in order for it to create more glucose to store. You want to break them up as much as possible so you can explore the pigments, or color molecules, that they have inside the leaves. You can also explore some leaves you might have in your fridge like spinach or kale! Tear those leaves into tiny pieces and put them in a cup – make sure you have a different cup for each leaf type! Mash the leaves with a spoon or a mortar and pestle. In her free time, Jessie likes to go rock climbing, hiking, and skiing. More to Explore Try using different colored leaves! Red cabbage is another great leaf to try, it gets its color from anthocyanins – a really neat pigment that changes color based on pH! (To learn more about cabbage juice, check out our blog!)- Link to Andrew and Samantha's cabbage juice SAP video Science at Play: Pen Chromatography – if you enjoyed this activity, my colleagues Aoife Ryle and Andrew Fotta have another chromatography experiment that you can try as well! Seek by iNaturalist – excellent app for kids to help identify plants, insects, fungi and animals iNaturalist – great app for older kids and adults that allows users to help you identify the plants, animals, insects, and fungi that you took pictures of LeafSnap – I have not tried this app yet, but it can identify trees using pictures of their leaves – perfect for this activity if you're curious about what tree you took leaves from! Share photos or videos of your leaf chromatography with us by tagging us @CTScienceCenter and #ScienceAtPlay ! Jessie Scott is a STEM Educator who enjoys encouraging students' enthusiasm for science. Through capillary action, these pigments will travel up the paper until the bonds between the water and pigment become so weak that the pigment must break the attraction and leave itself imprinted at a certain height up the paper. Leaves appear green because chlorophyll is a very poor absorber of green wavelengths, therefore it reflects green light the best. Spinach leaf contain: Chlorophyll A and B. If you didn't see any colors in the 20 minutes that you had the paper towel in the liquid (don't worry, I only saw a little bit of a color change!), remove the paper towels and cover the liquid overnight – this will give the leaves some time to release more pigments. This means that when one of these solvents is present in the trial, only that type of pigment will travel with the movement of the solvent (lipid-soluble solvent with lipid-soluble pigment and water-soluble solvent with water-soluble pigment). Both have a similar purpose: to trap light to ultimately convert it into energy. This is the base step of photosynthesis. I would recommend sticking to leaves from trees you know or leaves from your groceries for this activity. Add nail polish remover or rubbing alcohol, whichever you happen to have on hand, just enough to cover the leaves in liquid. The increased number of accessory pigments allows for a wider range of light to be taken in and converted into energy (excitation of electrons on the chlorophyll) for the photosynthetic process. She teaches classes to students visiting the Science Center and brings STEM lessons to schools across Connecticut. Where/when have we seen these colors before? You can try the same experiment tomorrow with fresh paper towel strips and see if you notice any differences! Ask Your Young Scientists What differences do you notice in the leaves you collected? In the fall, the chlorophyll in leaves breaks down and the nutrients are reabsorbed by the plant, leaving behind the other leaf pigments – this is why we get to see so many gorgeous red, orange, and yellow trees! By breaking down the leaves and separating out the pigments, we're able to get a sneak preview of the different colors we might see on these trees in the fall! But wait a minute – how did we separate out those pigments?! That paper towel that you dipped into the leafy-liquid started to absorb that liquid. Because leaves are very rich in chloroplasts containing chlorophyll for photosynthesis (photosynthesis occurs mainly on leaves), they reflect a lot of green light wavelengths, which our eyes interpret as the color green. On the other hand, Lipid soluble pigments won't move due to the molecules' lack of polarity. What do you notice as the leaf pieces sit in the nail polish remover/rubbing alcohol? Now is where you have two options! You can either dip a strip of paper towel into the liquid right now, or you can put a cover on those cups and let the leaf pieces break down even more overnight. This was shown when the paper chromatography was done, the beet leaf trials had many different colored pigments over the paper, vs the spinach leaf only a green pigment which represented that only chlorophyll was present. A solvent is placed at the bottom of the paper. A certain solvent will only attract certain pigments up the paper. As the fall comes so do the shorter days. This is where the plant's leaves begin to change color. While the liquid was climbing the paper towel, it took plant pigments with it! The plant pigments are different sizes and shapes so they were carried different distances up the paper towel by the liquid. In the beet leaf/petroleum ether acetone trial, the carotene pigment travelled the furthest with a displacement of 9.0 cm [up]. Chlorophyll a is the main absorber, meaning only it can pass the excited electrons to other molecules. Calculations Carotene (yellow orange colour)Rf = Distance pigment travelled = 9.0cm = 0.9375 Distance solvent travelled 9.6cmXanthophylls (light yellow):Rf = Distance pigment travelled = 5.7cm = 0.59375 Distance solvent travelled 9.6cmChlorophyll A (blue green):Rf = Distance pigment travelled = 3.7cm = 0.385416 Distance solvent travelled 9.6cmChlorophyll B (yellow green):Rf = Distance pigment travelled = 2.5cm = 0.260416 Distance solvent travelled 9.6cmAnthocyanin (red):Rf = Distance pigment travelled = 0.6cm = 0.0625 Distance solvent travelled 9.6cm In the beet leaf/petroleum ether acetone trial, the carotene travelled the fastest because it displaced the furthest distance in a period of time. To keep our site running, we need your help to cover our server cost (about $500/m), a small donation will help us a lot. The liquid travelled up the paper towel in a process called capillary action – the liquid filled tiny holes in the paper towel and gradually climbed up the paper towel. The next morning, I put new paper towel strips in the liquid for 20 minutes and saw some beautiful results! (Photo of chromatography results showing different bands of color from the leaves!) What is the Science? Leaf chromatography is an experiment that allows us to see the colorful pigments that leaves have hidden inside them. We are a non-profit group that run this service to share documents. This results in less light during the day for the plant to undergo photosynthesis. Go outside and collect some leaves you find interesting, then come back here and learn how to experiment with leaf chromatography. The molecules do this by absorbing specific wavelengths of light rays (red and blue-violet light) which excite electrons contained within the double bonds of the porphyrin ring of the chlorophyll molecule. Chlorophyll b passes its exited electrons to chlorophyll a, which passes its excited electrons to other molecules, which store the energy as chemical potential energy. Conclusion The experiment was carried out and it was proven that: Beet leaves contain: Carotene, Xanthophylls, Chlorophyll A and B, and Anthocyanin as a pigment in the leaf. What is happening when we dip the paper towel into the liquid? Jessie completed her Master of Science degree in Microbiology at Dartmouth College and worked as a science educator at the Montshire Museum of Science before coming to the Connecticut Science Center.

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