

Algal Pigments

Introduction

All photosynthesizing plants have certain pigments in them by which they capture sunlight. All plants have in common the photosynthetic pigment of chlorophyll, but the other accessory pigments are different. These accessory pigments can be the same between two red algae, or two green algae. In this lab a red, green and brown algae will be used to extract the photosynthetic pigments from. We will also be extracting the photosynthetic pigments from *Coleus* sp., which is a red land plant leaf and, and compare the accessory pigments of this to the red algae.

Methods and Materials

We used two different kinds of red algae for this experiment. The first was *Polysiphonia* sp. and the second *Porphyra* sp. The green algae were *Enteromorpha linza*, and the brown algae were *Fucus gardneri*. The test plant we used to compare against the red algae was *Coleus* sp.

A different procedure was conducted for extracting pigments from the different colors of algae. The red algae were grinded using both water and 90% acetone in order to get all the pigments out. The green algae was crushed in 90% acetone only, and the brown algae was placed in DMSO and then in 90% acetone. We used the same technique for *Coleus* sp. as we did for the red algae.

A spectrophotometric analysis was taken of each of the seven total samples.

Polysiphonia sp. was not used in the spectrophotometric analysis because it did not seem to work as well as the *Porphyra* sp. when we were extracting the pigments.

Results

The attached graphs show the spectrophotometric analysis of each sample taken. These graphs have the peaks labeled with their corresponding photosynthetic pigments. Below is a list of the species, and the wavelength peaks they had.

Species	Wavelengths
<i>Porphyra</i> in water	418 nm, 436 nm, 496 nm, 562 nm, 620 nm, 680 nm
<i>Porphyra</i> in acetone	414 nm, 432 nm, 480 nm, 620 nm, 664 nm
<i>Enteromorpha</i> in acetone	434 nm, 458 nm, 664 nm, 656 nm
<i>Fucus</i> in DMSO	450 nm,
<i>Fucus</i> in Acetone	434 nm, 466 nm; 584 nm, 620 nm, 664 nm
<i>Coleus</i> in Water	400 nm, 436 nm; 680 nm
<i>Coleus</i> in Acetone	436 nm, 462 nm, 664 nm

Discussion

Chlorophyll a is a pigment that is present in almost all photosynthetic plants. When chlorophyll a is present, peaks should appear on a spectrophotometric reading at 430nm and 663nm. Therefore all the species used below should have peaks at approximately 430nm and 663nm. This should only be the case when using a lipophilic extracting agent such as 90% acetone or DMSO because the chlorophyll a is hydrophobic itself.

Porphyra needed to be crushed using both water and acetone because there are pigments in *Porphyra* which are hydrophobic, and hydrophilic. Therefore the water would remove the hydrophilic pigments, and the 90% acetone would extract the hydrophobic pigments. When looking at the wavelengths present in the spectrometer

reading (see graph 1) we see that the hydrophilic pigments of Phycoerythrin (565, 500nm) and Phycocyanin (620 nm) are present. There was also a peak at 436nm which is most likely a little chlorophyll a that was extracted as well.

As seen on graph 2, *Porphyra* in 90% acetone extracted chlorophyll a with peaks at 434nm and 664nm. However, we did not see peaks that represent the presence of chlorophyll d which is present in red algae. This may be that our samples were contaminated. There were some other accessory pigments present in the *Porphyra* in acetone mixture. These peaks at 462nm could be some type of carotenoid which is another hydrophobic pigments present in red algae.

Enteromorpha linza was the green algae we tested. *Enteromorpha linza* should have peaks showing where chlorophyll a and chlorophyll b appear. Both of these pigments are hydrophobic, therefore only 90% acetone was used during extraction. As seen in graph 3, the peaks are marked with the corresponding pigments. Chlorophyll a appears at 434nm and 664nm. And Chlorophyll b shows up at 458nm and 656nm. This last reading for chlorophyll b is slightly off, but this may be a simple spectrometer shift or slight contamination of the solution.

Fucus gardneri was first placed in DMSO which is good for extracting pigments which can be slightly hydrophobic, and slightly hydrophilic. Accessory pigments such as xanthophylls fall in this category, and have peaks at 450nm. Graph 4 shows *Fucus gardneri* having an accessory pigment at exactly 450nm.

The pigments in *Fucus gardneri* were also extracted using acetone in order to remove the more hydrophobic pigments such as chlorophyll a (434nm and 664nm) and chlorophyll c (466nm, 584nm, 620nm). The peaks that represent these two pigments are

labeled on graph 5. Two of the peaks for chlorophyll c are quite slight, but could still be valid readings.

When we tested our hypothesis species was *Coleus* sp. it was postulated that it would have the same accessory pigments as the red algae because *Coleus* was also red in color. However the results we got from the spectrometer readings were quite different. When pigments were extracted from *Coleus* using water (see graph 6) a trace of chlorophyll a was found at 436nm and a bunch of other peaks appeared that did not show up in *Porphyra* in water (see graph 1). The peaks present in *Coleus* in water may be other accessory pigments that have different wavelength than what we have covered.

The *Coleus* in acetone did show peaks at chlorophyll a (434nm and 664nm) as well as a peak at 462nm which is most likely a carotenoid pigment of some type.

In conclusion, the test plant, *Coleus* sp. did not appear to have the same accessory pigments as our red algae species of *Porphyra* sp. Even though the plants appeared to be the same color externally, their photosynthetic pigments are not the same.