A study of pigment affecting colored leaves

What is colored leaves?

Japan has four seasons.
Spring, summer,
autumn and winter.

In autumn, the
maple's color turns red
and yellow from green.

Purpose

- To study how to pigment contained in leaves changed before and after leaves change color

The method of experiment

- Extract the pigment into the extraction liquid

  Ex①:methanol: acetone=3:1,

  Ex②:ethyl ether ,

  Ex③:ethanol

- Compare the result of

  Ex①③:paper chromatography

  developer (petroleum benzine: petroleum ether: acetone =4:1:1

  Ex②:, thin-layer chromatography

  developer (petroleum ether: acetone=6:4)

- Then study how leaves change their color.

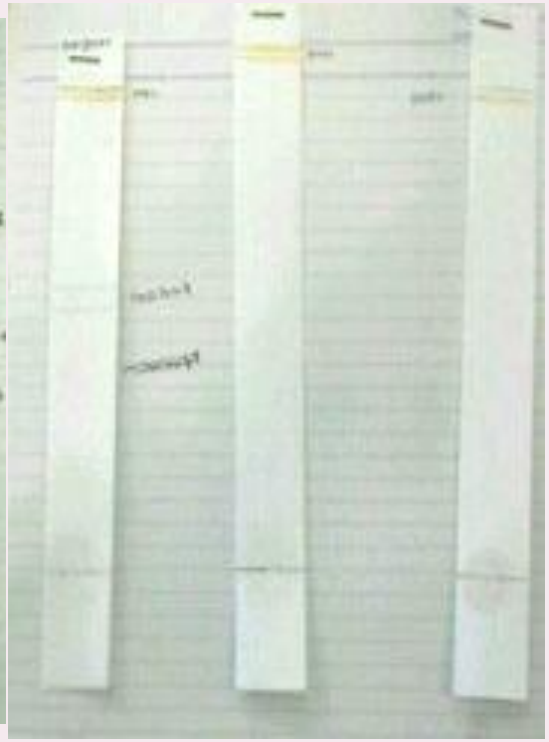
Result

Green Yellow Red

Experiment 1
Maple

GreenYellow Red

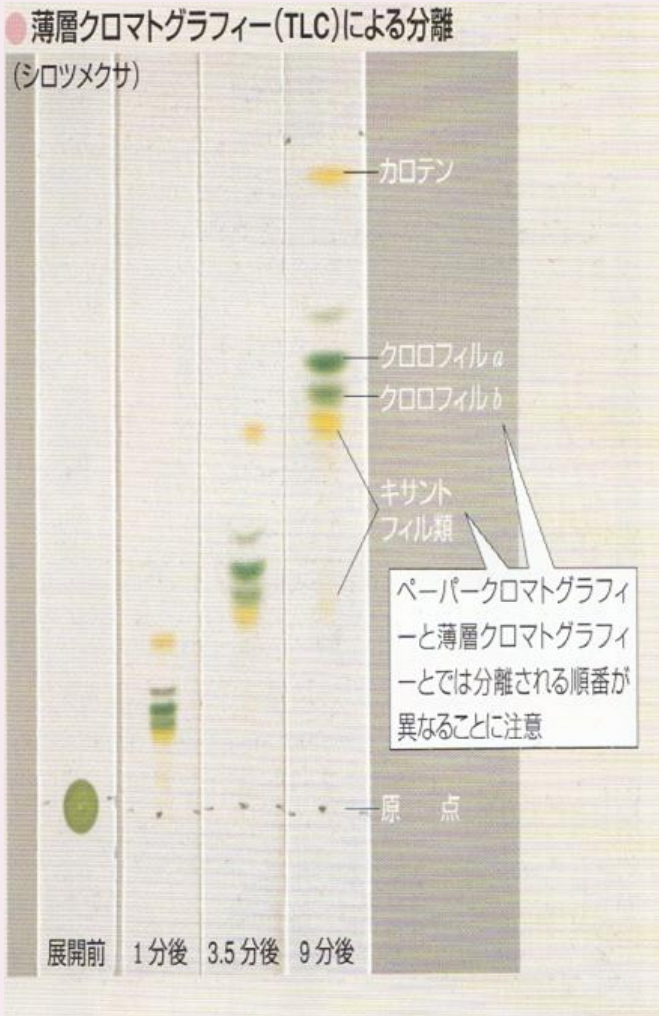
Experiment 1
Leaf



Green Yellow Red

Experiment 3
Maple

Thin layer chromatography



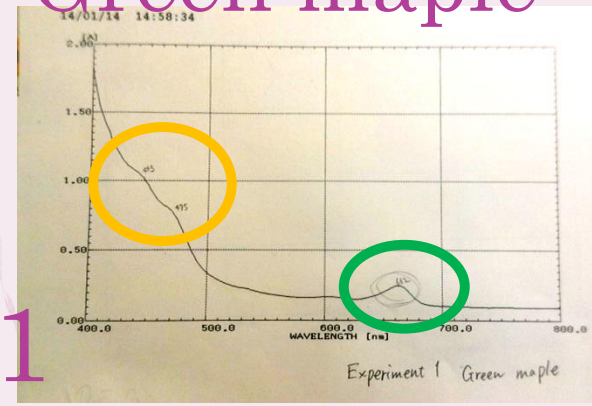
Experiment 2

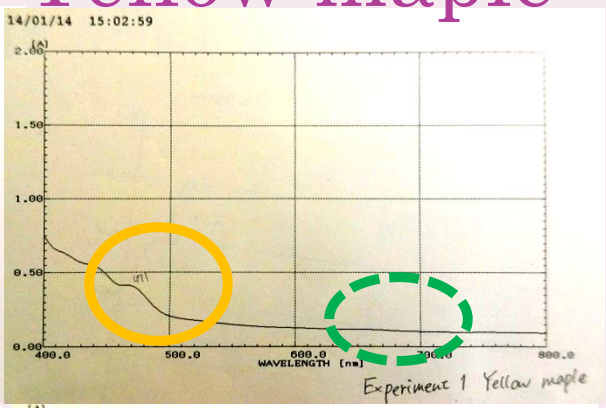
Chlorophyll a, b
Carotene etc.

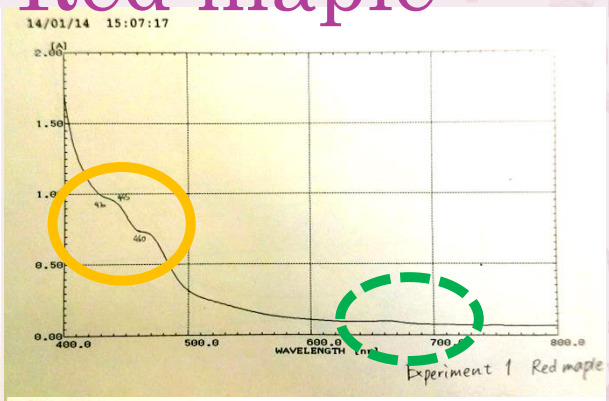
Chlorophyll a, b

Green maple　Yellow maple　Red maple

1







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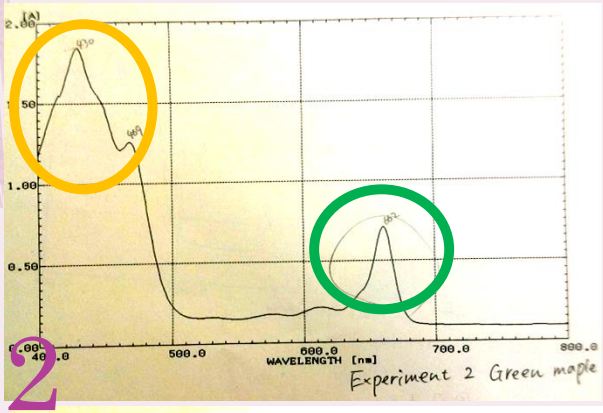

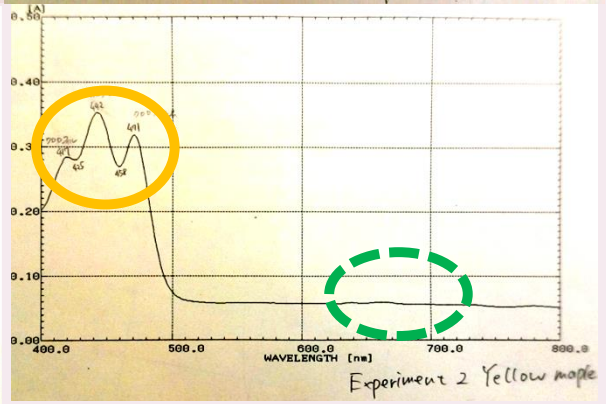

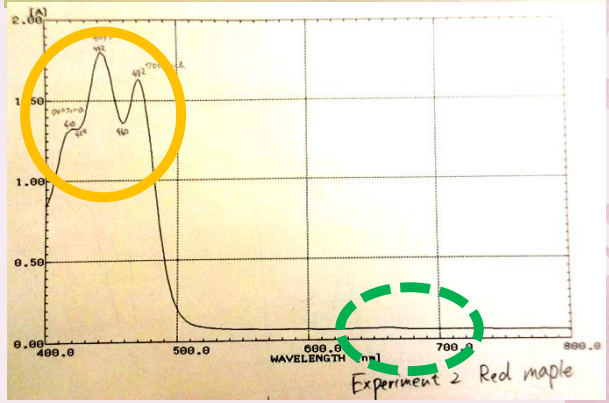

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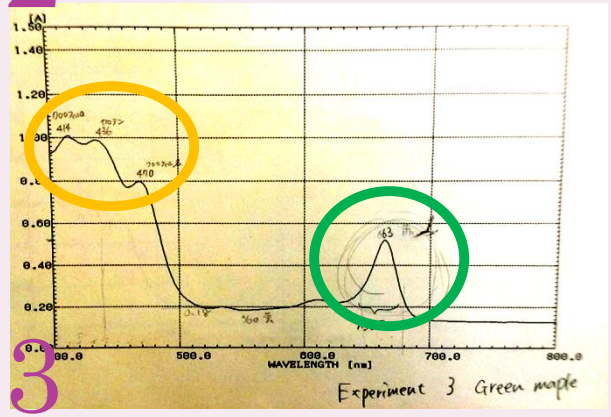
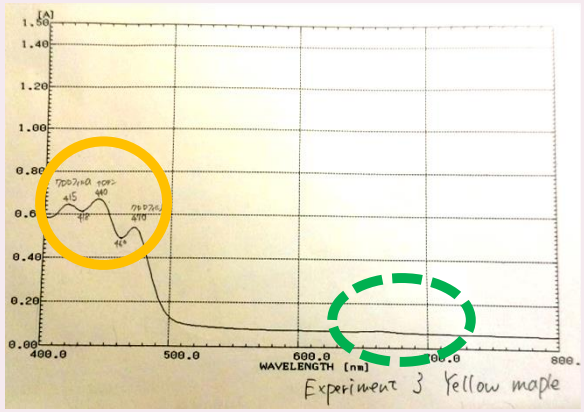
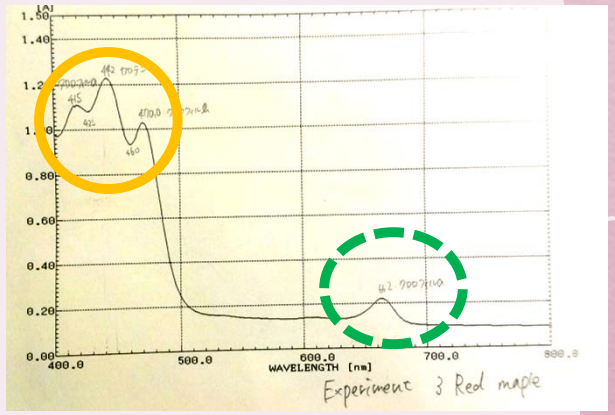






Chlorophyll a, b
Carotene etc.

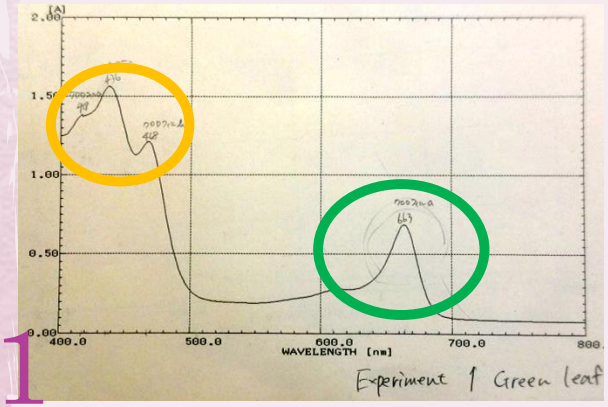
Chlorophyll a, b

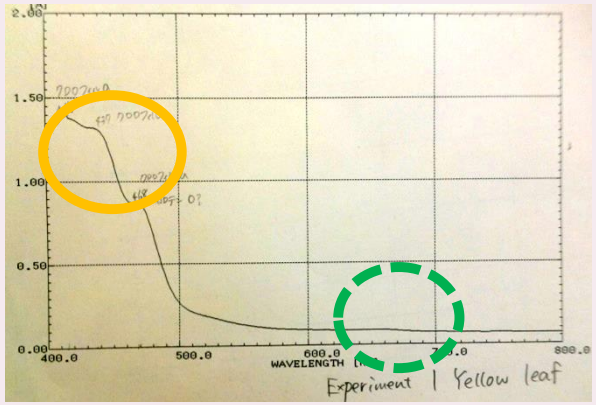
Green leaf

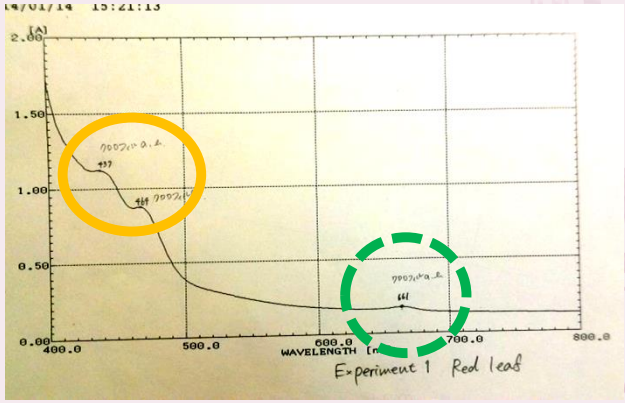
Yellow leaf

Red leaf

1







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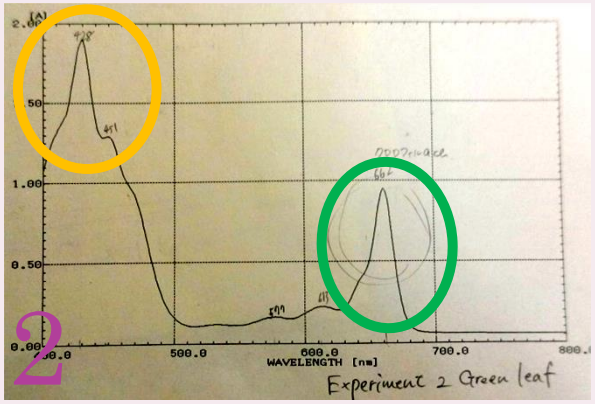
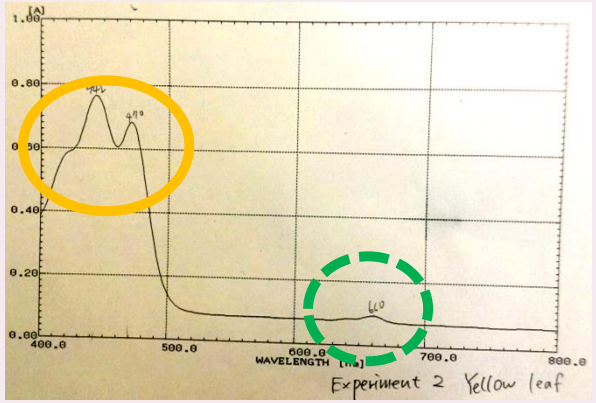
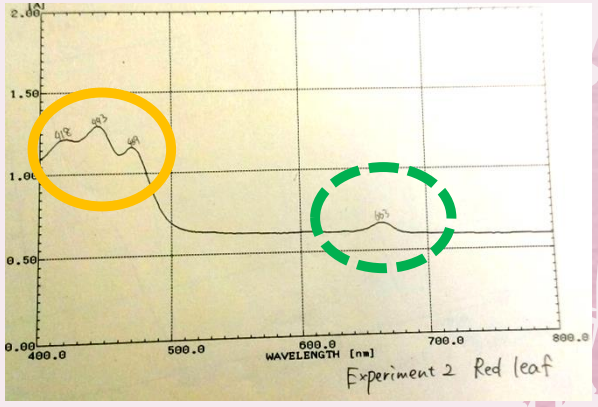
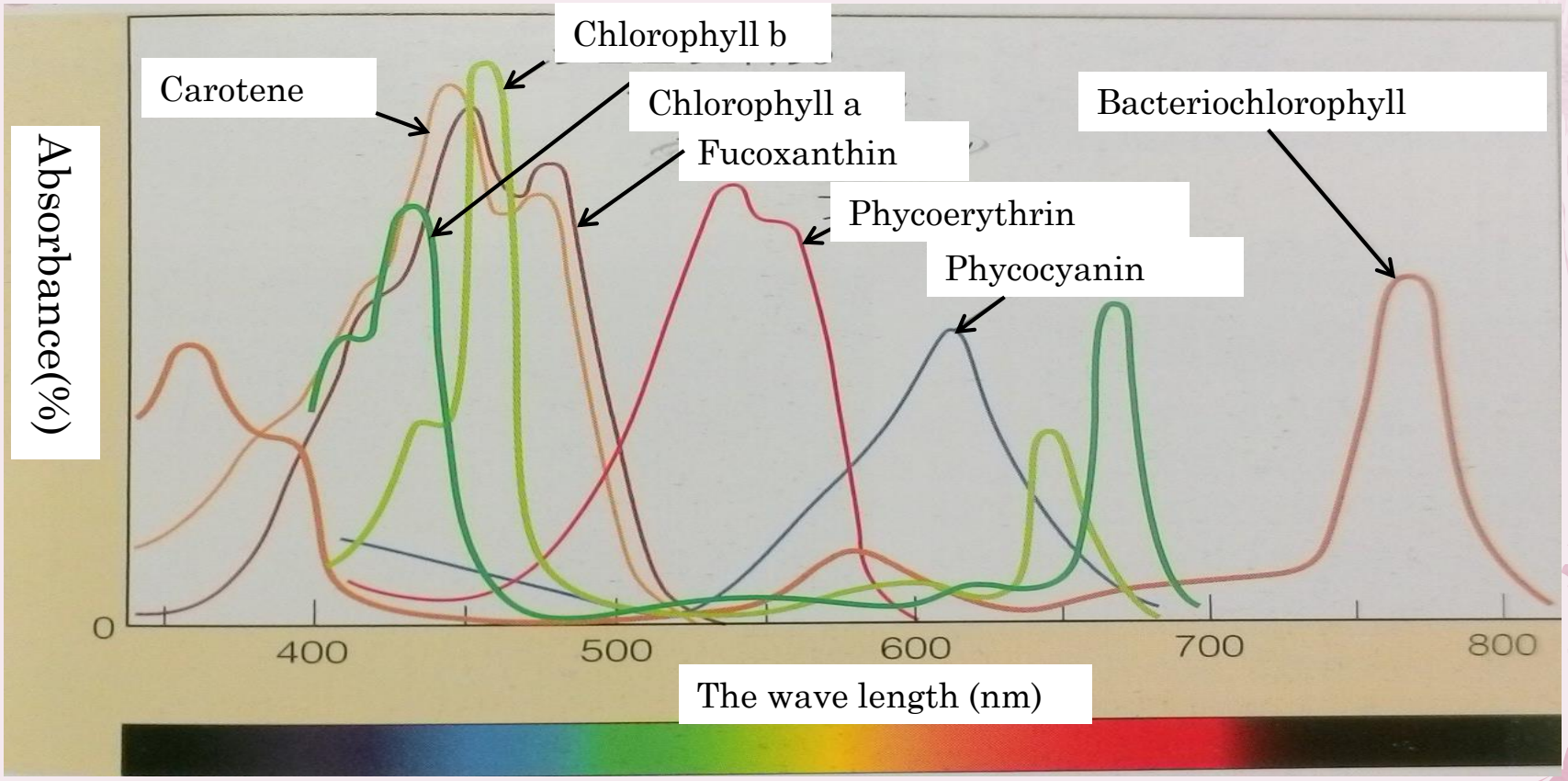






Absorption spectrum about pigments of photosynthesis



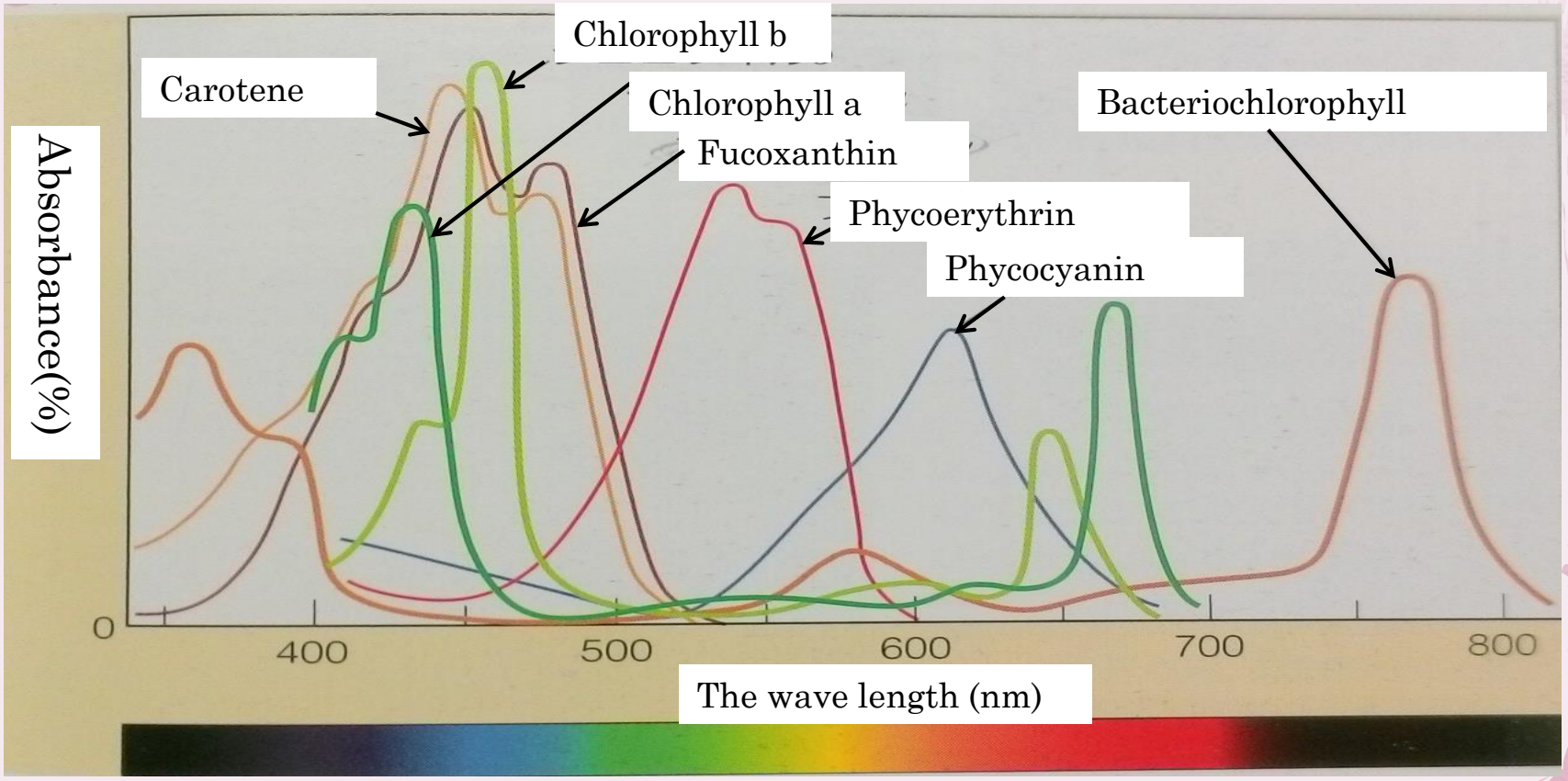
Study ~about experiments~

- There are many kinds of pigment between 400nm and 500nm. So we could not distinguish pigment clearly.
- But according to the results of paper chromatography in experiment 1, we found that every leaf has carotene and xanthophylls. And we found that green leaves have a lot of chlorophyll a and b.
- The starting point of paper chromatography of green, yellow and red leaves in experiment 1, 3, all turned red, but they did not spread out.

  Also, the starting point of thin layer chromatography in experiment 2 did not turn red. From this, it could be inferred that the red pigment is anthocyan.

  It easily melts in the extraction liquid of experiment 1, 3 or ethanol, methanol and does not melt in developer, ethyl ether which is contained in green, yellow and red leaves.
- The wave length of the spectrum graph for maple in experiment 1 was between 400nm and 500nm, which was very different from that of maple in experiment 2.
- In experiment 2, we compared the spectrum of green, yellow and red maples.
- We couldn't detect chlorophyll a and b in yellow and red maples. So, we inferred that the green pigment, chlorophyll a and b disappeared and the yellow pigment, carotene or red pigment, anthocyan appeared when leaves change color.

Absorption spectrum about pigments of photosynthesis



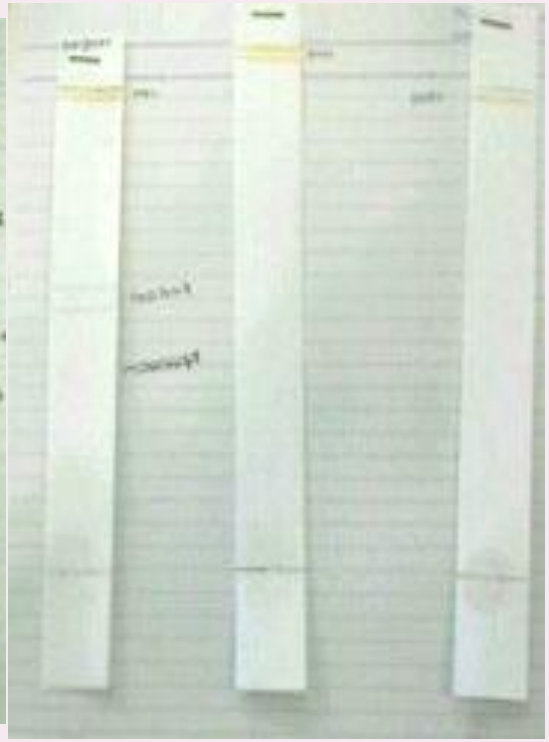
Paper chromatography

Green Yellow Red

Experiment 1
Maple

GreenYellow Red

Experiment 1
Leaf



Green Yellow Red

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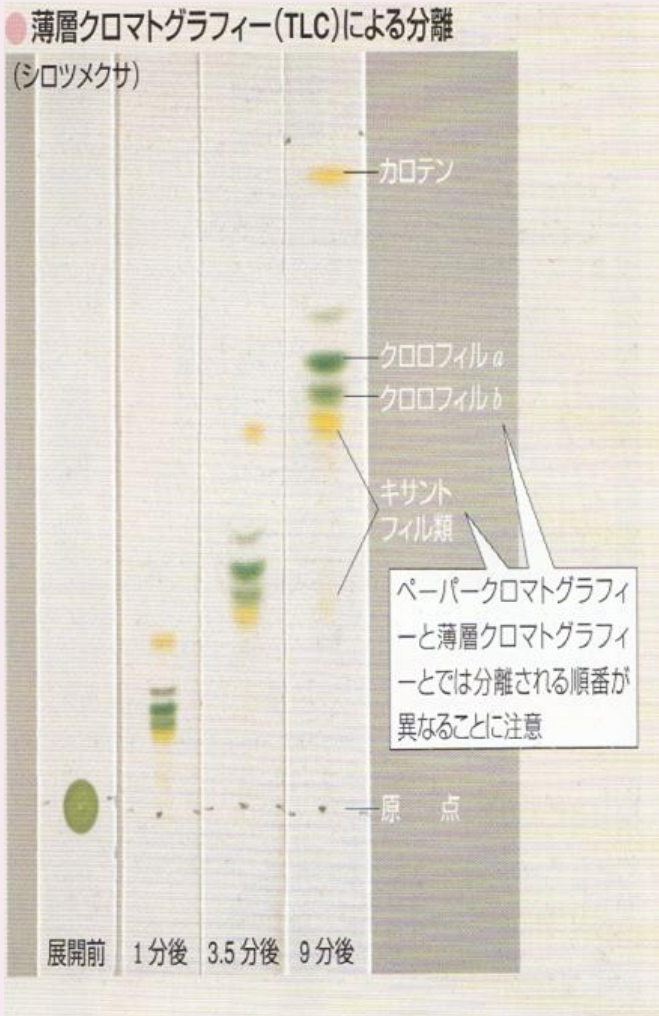
Thin layer chromatography



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Chlorophyll a, b
Carotene etc.

Chlorophyll a, b

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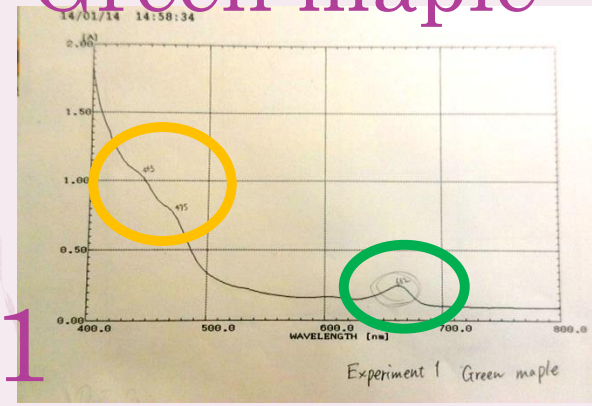

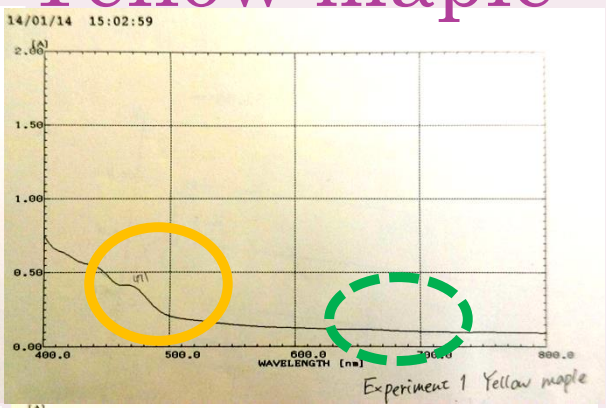

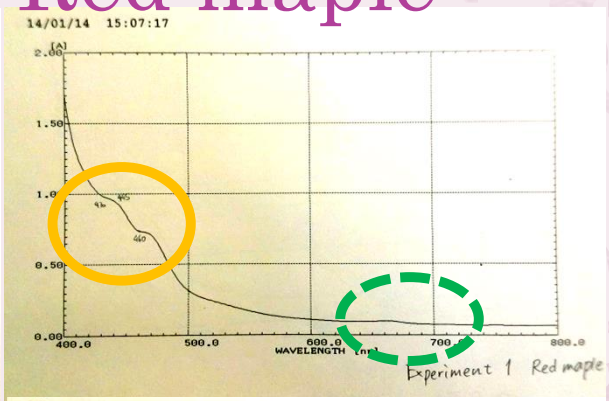

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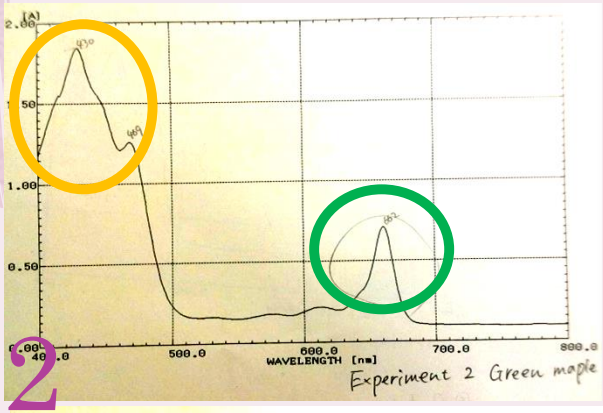

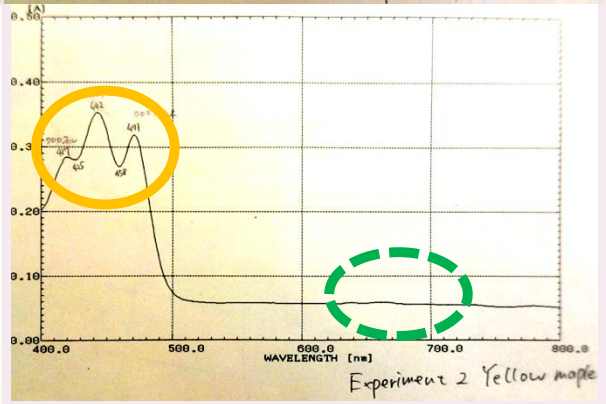

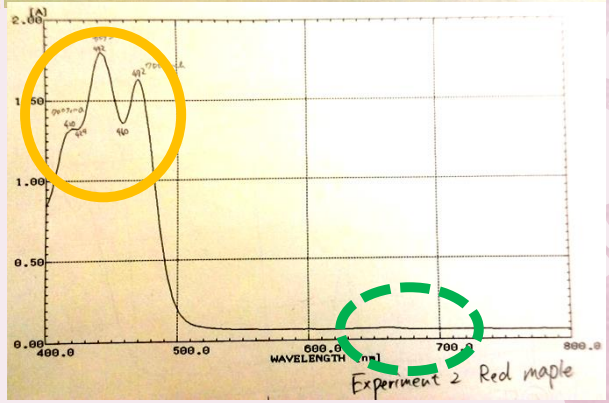

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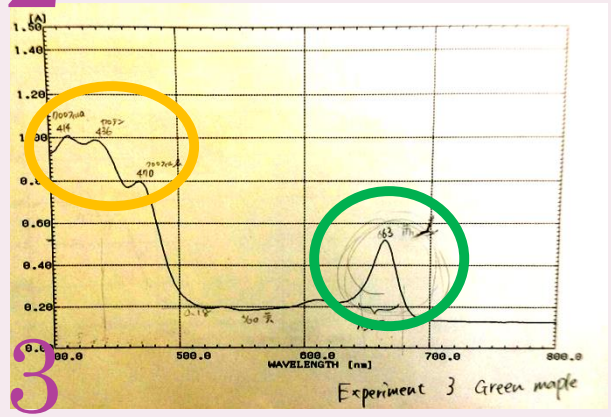

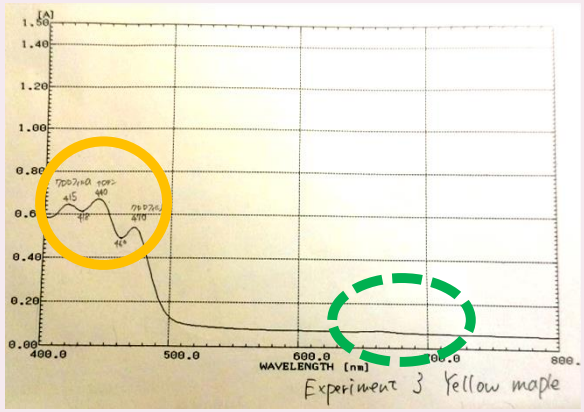

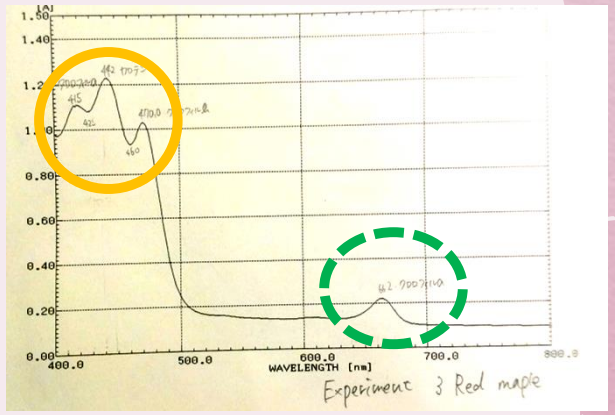

Study ~after experiments~

- In autumn, trees make membranes between the branch and the leaf.

  They stop the nutriment from running to leaves. So photosynthesis are stopped, and chlorophyll a and b are decomposed.

- Then, blood sugar react a protein, and generate anthocyan .

Conclusion

- Every leaf contains chlorophyll a and b, xanthophylls, carotene and anthocyan mainly.
- When leaves change color, chlorophyll a and b are decomposed. And the leaves turn either the yellow of carotene and xanthophylls or the red of anthocyan.
- If we had kept the concentration of pigment extraction liquid, we could have observed results more easily.

Thank you for your attention!!