Fluorescence of Scopoletin and Other Related Coumarins

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Introduction

Muyskens lab's interest in coumarins that are found in nature started with Narra wood in the Philippines which gives off a strong fluorescence when put in water. The compound that makes it fluoresce was identified by a group in Spain, so the Muyskens lab shifted their interest toward other naturally occurring coumarins found locally.

Last summer, the Muyskens lab identified scopoletin as the compound that fluoresces in sycamore extracts, so our goal for this summer was to characterize scopoletin by measuring its lifetime.

Research Objectives

Revalidating

- Re-test pH dependence of fluorescence that was carried out last summer

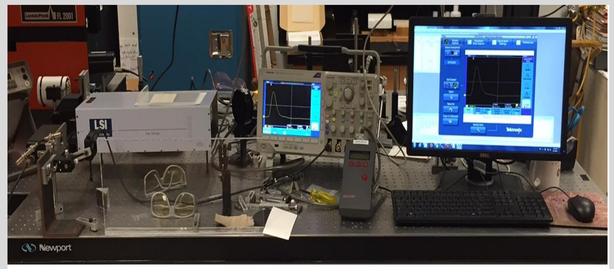
Characterizing

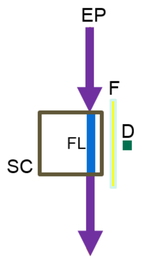
- Characterize scopoletin and other coumarins by measuring the lifetime, which is the rate at which fluorescence occurs

Comparing

- Comparing fluorescent properties of scopoletin with other closely related coumarins, esculetin and umbelliferone.

Methods

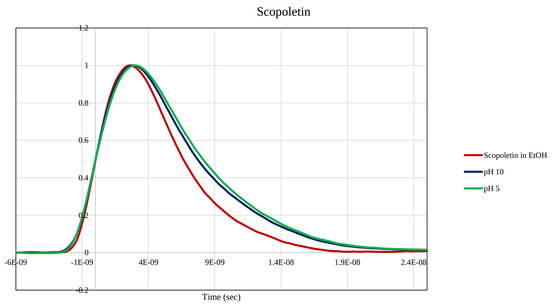


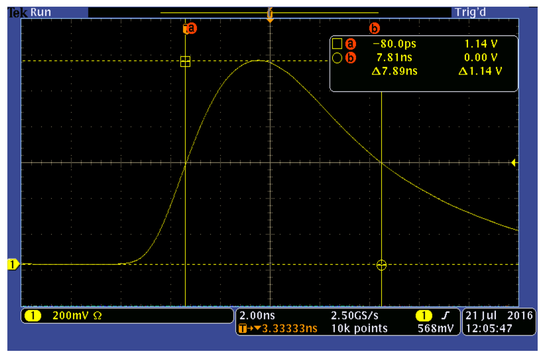


EP: Excited pulse
FL: Fluorescence
SC: Spectrophotometer Cuvette
F: Filter
D: Detector

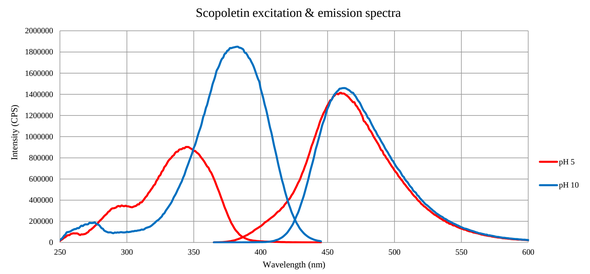
	Calvin College	MSU
Method	Total fluorescence	TCSPC
Excitation Pulse (EP)	Nitrogen laser	Doubled dye laser
Exc wavelength	337nm	337nm
Pulse Width	4.0 ns	5 ps
Filter (F)	Polycarbonate	Monochromator
Detector (D)	Silicon photodiode	MCP-PMT
Measurement	FWHM	Exponential decay constant

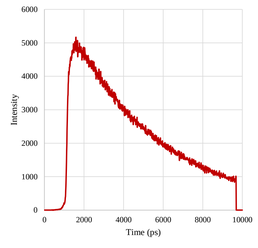
A comparison chart between Calvin and MSU's method of measuring lifetime.

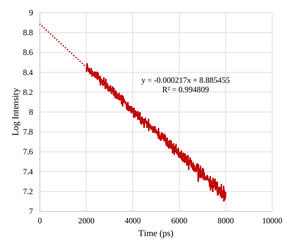




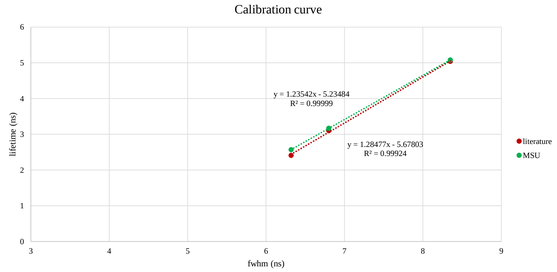
Results

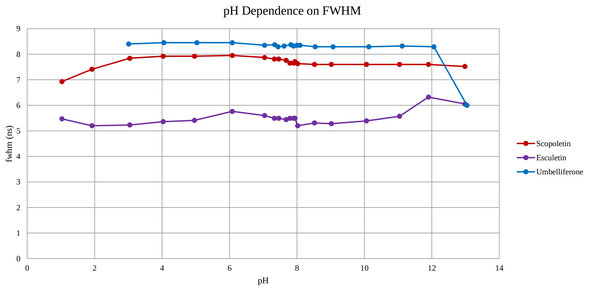






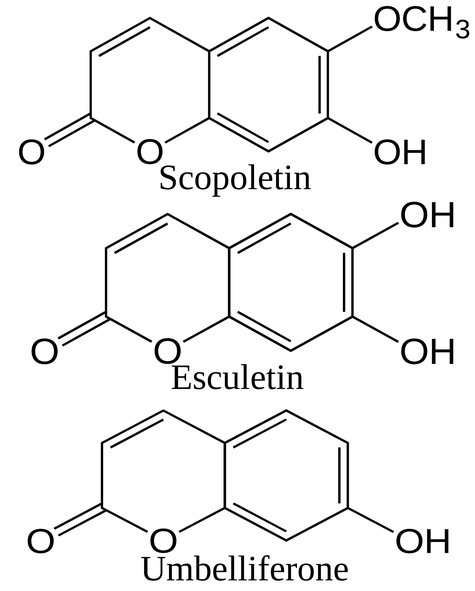
Lifetime data from MSU.
(Lifetime is calculated by taking the reciprocal of the slope of the linear line.)





	Low pH	High pH	Ethanol
Scopoletin	4.55 ns	4.15 ns	2.96 ns
Esculetin	Not Sure	1.65 ns	1.19 ns
Umbelliferone	5.20 ns	5.01 ns	Data not collected

Lifetime of three coumarins in different solvents based on FWHM measurements at Calvin College.



Conclusions

- Our simple system of measuring lifetime works
- pH dependence of fluorescent properties
- Confirm scopoletin is in sycamore extracts
- More complicated fluorescence process in low pH scopoletin

Future Work

- Computer modeling of fluorescence process
- Extend our study to other coumarins

Acknowledgements

- Calvin Chemistry and Biochemistry Department
- Rollin M. Gerstacker Foundation