

Introduction

In Professor Ted Lee's lab, they use light-responsive surfactants to improve human health and combat neurological diseases, as well as using surfactants to control enzyme activity with light illumination.

Surfactants

- Stands for "surface active agent"
- Reduce surface tension of a liquid
- Compound – polar head and non-polar tail
- Hydrophilic heads bond together, hydrophilic tails bunch together
- Can be responsive to temperature, pH, or light

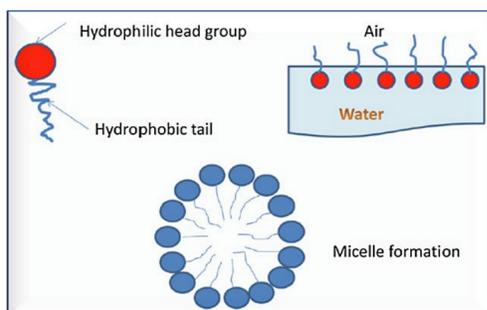


Fig. 1. Illustration of a micelle formed from surfactants
Source: Wiley Online Library

Enzymes

- Catalyst for living organisms, responsible for cell metabolism
- Made of one or more amino acids bound together
- Subject to temperature and pH changes
- Only interacts with substrates to cause a reaction
- Less energy needed for a reaction

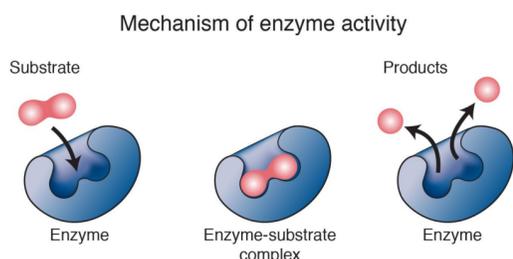


Fig. 2. This diagram demonstrates the process of enzymatic activity and the role of the substrate
Source: National Human Genome Research Institute

Results and Conclusion

The slope of the dots' lines indicates the activation rate of the surfactant azoTAB. Therefore, a steeper slope means a higher activation rate for that type of light. Looking at the results and the graphs, in the first graph, the concentration of azoTAB (the surfactant we worked with) dramatically increases when the light source was switched to UV light (the grey dots). Similarly, in the second graph, the blue and grey dots display a trend where the increase of concentration with the UV light is greater than the concentration increase when the surfactant is exposed to visible light.

In conclusion, light-responsive surfactants such as azoTAB will be easier to manipulate and control; enzymes can be controlled using surfactants, which could increase biofuel efficiency.

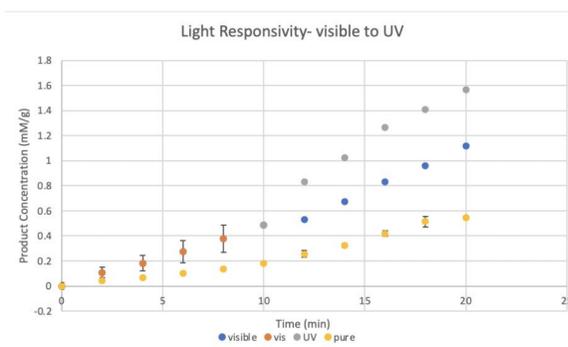


Fig. 3. The concentration of azoTAB exposed to different light over time (visible light to UV light)
PC: Ashley Saw

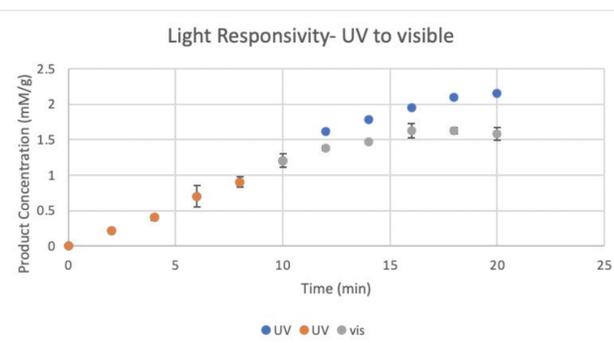


Fig. 4. The concentration of azoTAB exposed to different light over time
PC: Ashley Saw

Skills Learned

IMRAD and Scholarly Articles

During SHINE, I learned about how to use IMRAD (read the Introduction, Methods, Results, and Discussion) to understand a scholarly article, and that it's okay if I don't understand all the words in an article. Reading scholarly articles earlier on will prepare me for the articles that I have to read for college and beyond, and I'm glad I got to learn strategies in SHINE.

Excel

At first, I thought Excel was just a Microsoft version of Google Sheets, but after the first day about learning how to analyze data on Excel, I knew I was wrong. I learned how to use the Solver tool, how to use Excel to find certain data points and plot those points on a graph to find my final answer, as well as finding the average, slope, and standard deviation of datasets. Though it's only been a couple of weeks, I now feel more comfortable using Excel compared to when I first started.

Lab Safety

Although I was not able to come to USC and engage in the lab in person, I was still able to learn the basics in Lab Safety. There were a lot more tools and equipment than I initially thought there would be, and I hope I get to use them in the future in research. I learned how to identify different types of lab equipment and tools, how to dispose of lab waste properly, and the standard lab protocols.

Searching for Academic Journals

I have also learned and familiarized myself during SHINE is using a digital academic library finding sources that I could use in my research. I did not have to find additional sources for my lab, but I know it will be good practice for the future when I am doing research.

Next Steps & Advice for Future SHINE Students

I will definitely use my knowledge that I learned from this lab and apply it to the future STEM courses that I will be. Furthermore, this experience in SHINE has motivated me to pursue research next year and in college, and possibly beyond.

For future SHINE students, I recommend going to optional events and webinars that the SHINE staff team hosts, since a lot of them have been helpful!

My STEM Coursework

In both my biology and chemistry classes, we learned about proteins and enzymes, but never really dived deep into the processes of how proteins and enzymes react and surfactants. In the future, I look forward to applying these topics to my research and STEM classes in college. I have never done research before SHINE, so learning about new topics and applying my knowledge to the work that I'm doing is an amazing aspect of SHINE.

Acknowledgements

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