

Introduction

Surfactants

- surfactants are compounds that lower surface tension
- they have hydrophilic (water-loving) heads and hydrophobic (water-hating) tails

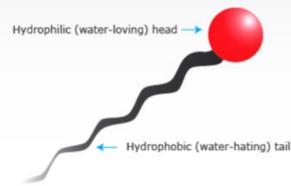


Figure 1. A picture of a surfactant with a label indicating its hydrophobic tail and hydrophilic head from the University of Waikato, 2019, Surfactants, p. 1. Copyright 2012 by sciencelearn.org

- these surfactants behave differently when they are in different conditions and can be seen to be in the micelle or vesicle structure



Figure 2. A picture of a micelle by Roy A. Black and Matthew C. Blosser, 2019, Surfactants, p. 4. Copyright 2016 by Roy and Matthew

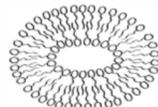


Figure 3. A picture of a vesicle by Roy A. Black and Matthew C. Blosser, 2019, Surfactants, p. 4. Copyright 2016 by Roy and Matthew

Proteins

- proteins are compounds that are made up of large molecules which are composed from one or more chains of amino acids

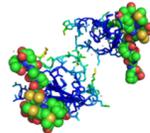


Figure 4. A picture of a protein from the Frontiers in Chemistry team, 2019, Protein Chemistry, p. 1. Copyright 2015 by frontiersin.org

Trans and Cis forms

- these are different forms that a surfactant called azoTAB changes from and to in response to different types of light (UV and Visible)



Figure 5. A picture of the different forms of azoTAB (a surfactant) with arrows showing the direction of change with differing light, 2019, Proteins, p. 3. Copyright 2019

Skills Learned

Chemical Laboratory Skills

- this is the first time that I've worked in a chemical laboratory, so there was a lot to learn, including lab safety along with the materials in the lab and how they are used
- lab safety training was given on the first day of SHINE and helped me understand what different symbols meant and indicated, allowing me to know what was safe and what to stay aware of in the lab

MatLab

- MatLab is a coding language that was introduced to me through the SHINE program, and allowed me to experience a new form of programming that proved to be especially useful when calculating results

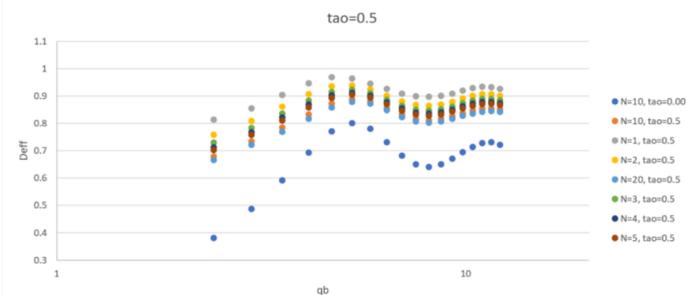


Figure 6. My MatLab graph. This graph explores when the number of bonds(N) is a parameter and tao(the ratio of the Radius to the bond length) and the bond length are constant. The diffusion coefficient(Deff) changes at different length scales(qb). PC: Daniel Chung

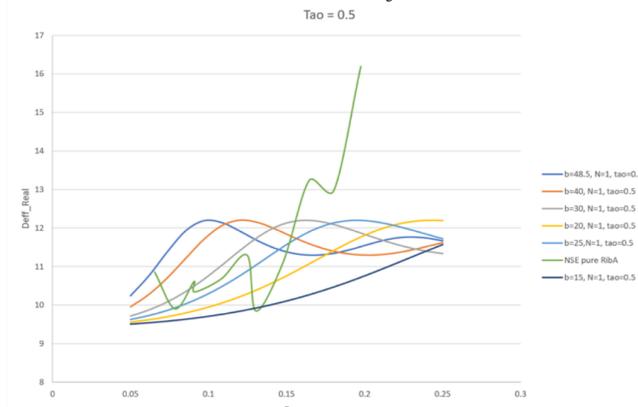


Figure 7. My MatLab graph. This graph explores when the bond lengths are the parameters and tao(the ratio of the Radius to the bond length) and the number of bonds(N) are constant. The diffusion coefficient(Deff) changes at different length scales(b). PC: Daniel Chung

Skills Learned (Cont.)

Researching Skills

- research has never been tougher before as in school you can gain the answer from a simple google search and get a pretty good idea from Wikipedia or other online sources
- in this course, the research was rigorous as I had to think more critically than I ever have before with tools such as the USC library website and its vast amount of scholarly articles available
- I've grown to like this new research as it provides more a challenge than typical school work and also gives a chance to see something that can be applied to something outside of the lab, and impact the world in a meaningful way

Objective & Impact

- through photoisomerization it can be seen that the surfactant can fold and unfold when reacting to light

- a protein's purpose is determined by the shape of the protein, meaning that different shapes lead to different functionalities

- azoTAB is a specific surfactant used in order to help enhance the protein's function because it helps shape the protein. By using light, we can change the behavior of the azoTAB in order to use it to our advantage

- this can be used in modern day as research has shown that for many neurodegenerative diseases such as Alzheimer's and Parkinson's are associated with an incorrect folding shape of the protein

- with more research and with the ability to manipulate the folding of proteins, people would be one step closer to discovering the cure to neurodegenerative diseases

Relativity to my STEM Coursework

Biology and Chemistry

- the research was mainly focused on concepts from both biology and chemistry and so the background knowledge from both my chemistry and biology classes helped me keep with the flow of information

Computer Science

- besides the research, we also used a program called MatLab to do various calculations, so background knowledge of concepts that I learned from my computer science classes in AP Java and Honors Python helped me understand the coding more easily as the concepts behind the coding were not at all simple

Next Steps for Me

Through the experiences of the lab work and research that I did with understanding photo-responsive surfactants, I would like to continue to research and understand more about the scientific world. By experiencing what it is like to be a chemical engineer, I see the numerous applications that can benefit the scientific community.

Acknowledgements

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