A Spectroscopic Study of Photoswitching and Non-Photoswitching Azobenzene Derivatives in the Formation of Dynamic Aggregates

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Rationale

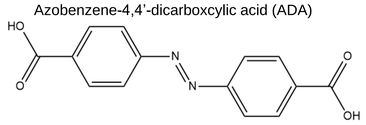
- Molecular photoswitching aggregates are being widely used by many fields, for things ranging from molecular machines to photo pharmacology to control the activity of drugs.
- As such it would be highly beneficial if more dynamic aggregates where made available.
- Azobenzene is a very well known photoswitch and has the capabilities to aggregate with itself and derivatives of itself.
- This gives a plethora of various options towards the development of new dynamic aggregates.

Methodology

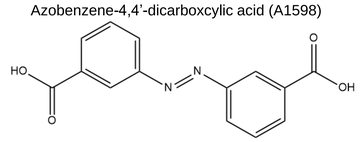
- Each component azobenzene molecule was tested for their relevant photoswitching and self-aggregation properties.
    - This is done using UV-Vis Spectrometry, CD Spectrometry, and a particle analyzer
- Using this data component molecules where paired with one another to create our aggregates.
- These aggregates where then tested in similar fashions for their ability to aggregate in ordered structures and photoswitch while maintaining that established ordered structure.

Molecules Assessed

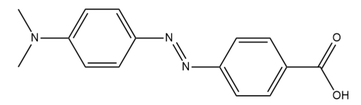
Azobenzene-4,4'-dicarboxcylic acid (ADA)



Azobenzene-4,4'-dicarboxcylic acid (A1598)



4-dimethylaminoazobenzene-4'-carboxcylic acid (M0423)



Results

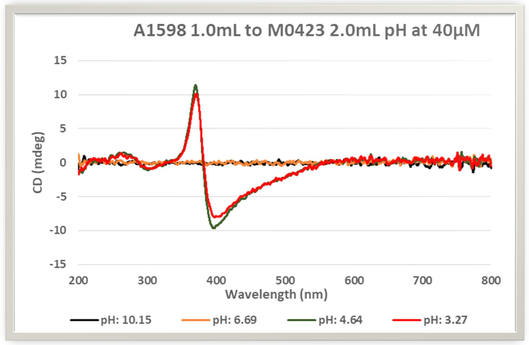


Figure 1: Example of test of Varying pH levels done using CD Spectrometry and a mixing ratio of 1mL of A1598 and 2mL of M0423 both at a concentration of 40µM

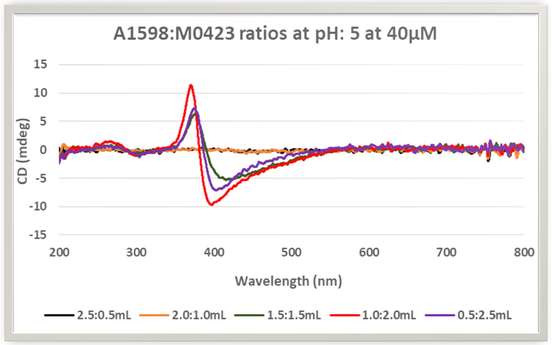


Figure 3: Example of test of differing ratios of A1598:M0423 at experimental ideal pH of 5 using CD Spectrometry

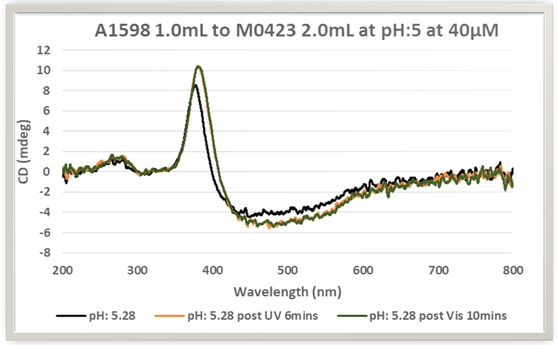


Figure 5: Photoswitching results of 1mL A1598 and 2mL M0423 at the experimentally determined ideal pH of 5 showing a locking of the photoswitching capabilities of the aggregate

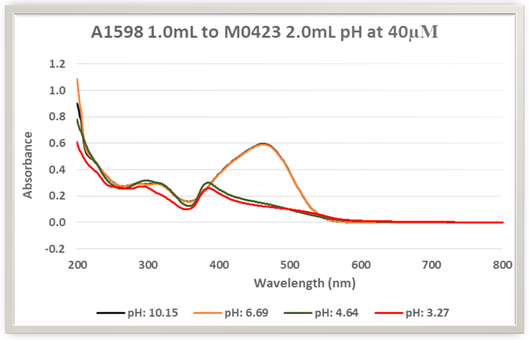


Figure 2: Example of test of Varying pH levels done using UV-Vis Spectrometry at the same mixing ratio in Figure 1

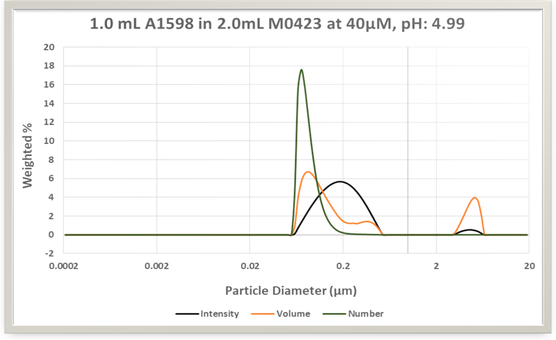


Figure 4: Particle analyzer data of A1598:M0423 showing the relative weighted percentages of intensity, volume, and number.

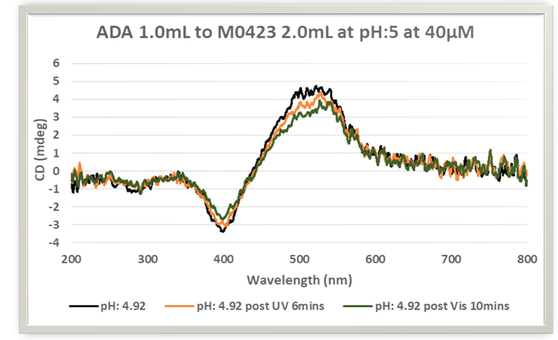


Figure 6: Photoswitching results of 1mL ADA and 2mL M0423 at the experimentally determined ideal pH of 5.

Conclusions

- The properties of the azobenzene derivatives while in aggregation depend on a variety of factors. These factors include their pH, the rate at which they are brought to pH, and time spent aggregating.
- Tests showed that, while A1598 shows ideal aggregation with M0423 at a ratio of 1:2 respectively and a pH of 5 by the fact of having a very large CD signal, it also locks at that pH. This prevents it from photoswitching back and forth.