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Abstract / Introduction
NMR spectroscopy plays an integral role in the teaching of organic chemistry. With the integration of conceptual understanding and problem solving, deciphering spectrums of an unknown chemical structure can provide many necessary challenges. The Diels-Alder reaction ([4π + 2π] cycloaddition reaction) is one of the most important reactions in synthetic organic chemistry as it allows for the formation of two C-C bonds and displays good regio- and stereoselectivity. The kinetics of the reaction between maleic anhydride and anthracene and two of its derivatives (9-methylanthracene & 9-anthracencarboxaldehyde) were the main focus of this experiment.

Figure 1: Reaction between maleic anhydride and anthracene.

Methods
A 1 M solution was created of each reactant with chloroform-D as the solvent. Solutions were filtered prior to the acquisition of the spectra. The representative peak of the internal standard revealed itself at the position farthest downfield. An initial scan was necessary as soon as the two solutions mixed together. Additional scans were performed as time allowed with special attention paid to the rate of the reaction. For example, the reaction with 9-methylanthracene is quite rapid so more frequent scans were required. The other two required approximately 1-2 scans per day. The results from our reactions compare favorably to the literature.

Results / Discussion
The differences in reactions rates were very obvious from observation and data collection. The addition of the methyl group significantly increased the rate, while the aldehyde significantly decreased the rate. Unfortunately, due to length of the reaction with the aldehyde substituent, not enough data was collected to be useable for this experiment. We are currently in the process of writing a lab to be performed by the Organic Chemistry II class in the spring.

References

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