Degradation of Methylene Blue in a Photocatalytic Reactor

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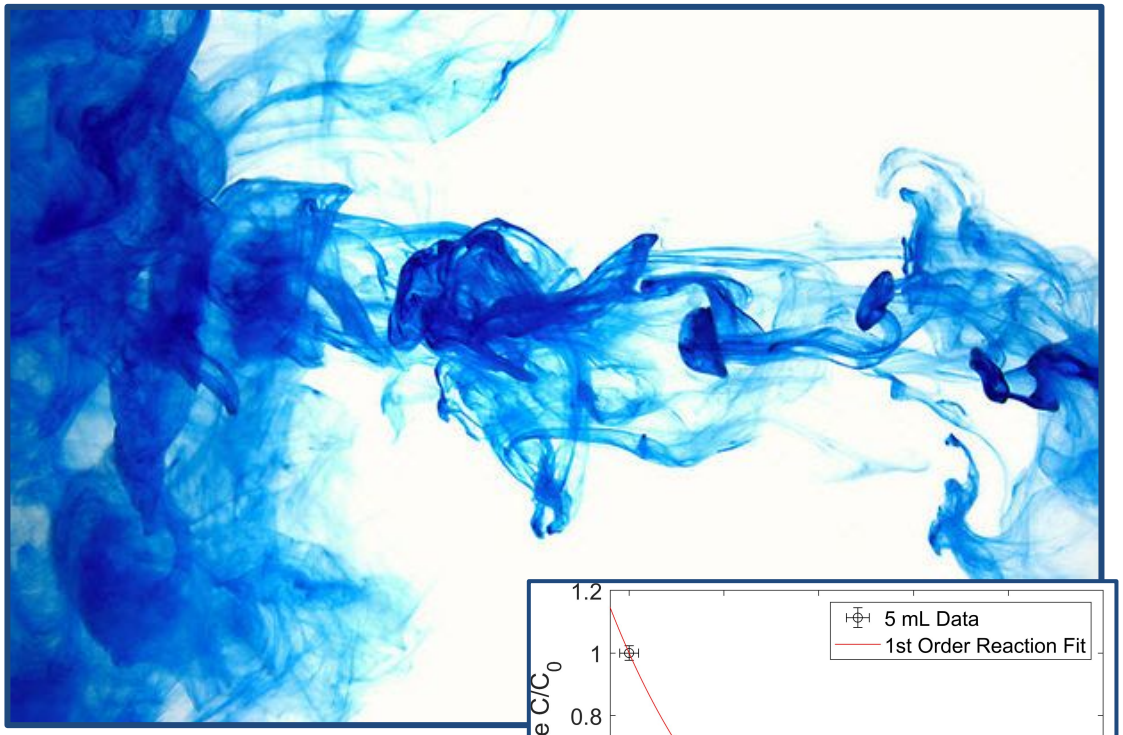
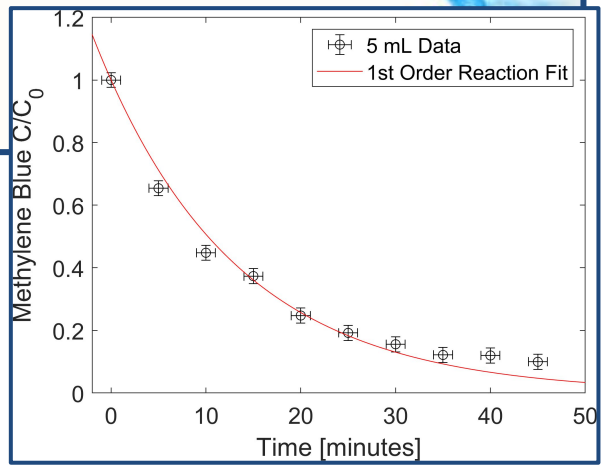


Source: Project Lyme



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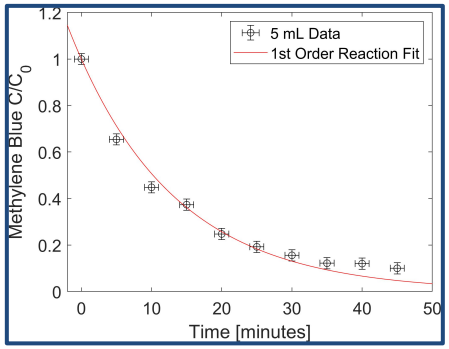
Methylene is used as a medication and a dye but can be environmentally polluting as a waste product.

Source: BenGreenField Life

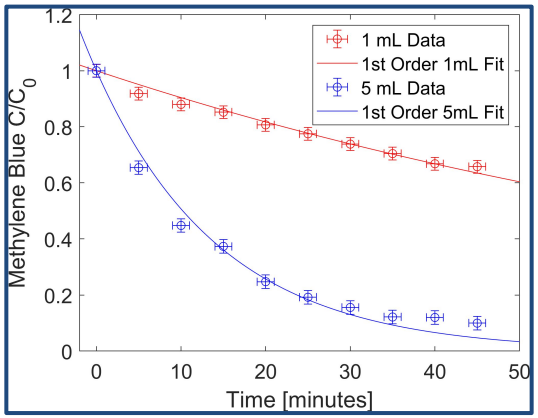
This presentation focuses on how different concentrations of hydrogen peroxide effects the degradation of methylene blue in a photocatalytic reactor.

$$C_A = C_{A0} e^{-(k_1+k_2)t}$$

Expected Reaction Rates



Fitting to experimental data



Comparisons and Analysis

According to the literature, the reaction rates for both reactions are both first order.

$$r_A = \frac{dC_A}{dt} = -k_1 C_A - k_2 C_A$$

$$\frac{1}{C_A} dC_A = (-k_1 - k_2) dt$$

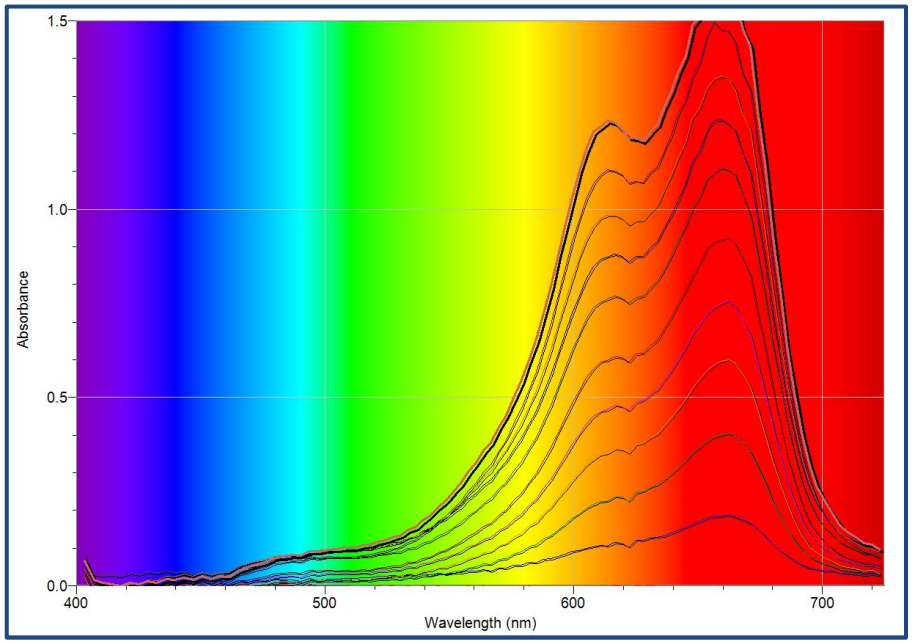
$$ln(C_A) - ln(C_{A0}) = -(k_1 + k_2)t$$

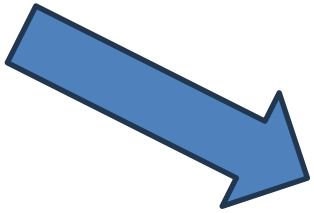
A = Methylene Blue
k1 = TiO2 rxn constant
k2 = H2O2 rxn constant

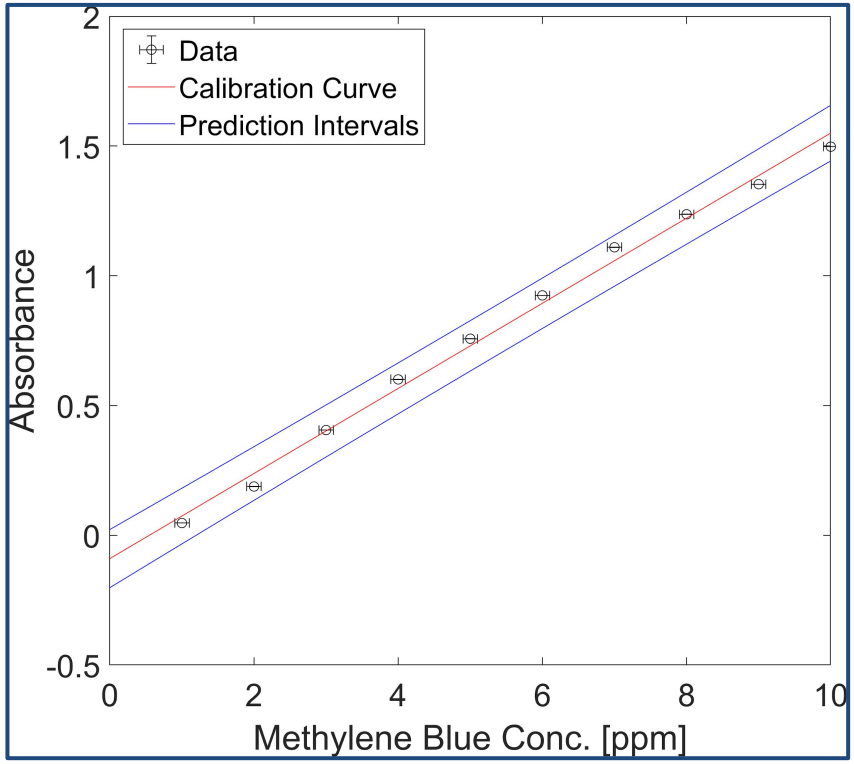
$$C_A = C_{A0} e^{-(k_1 + k_2)t}$$

$$C_A = C_{A0} e^{-kt}$$

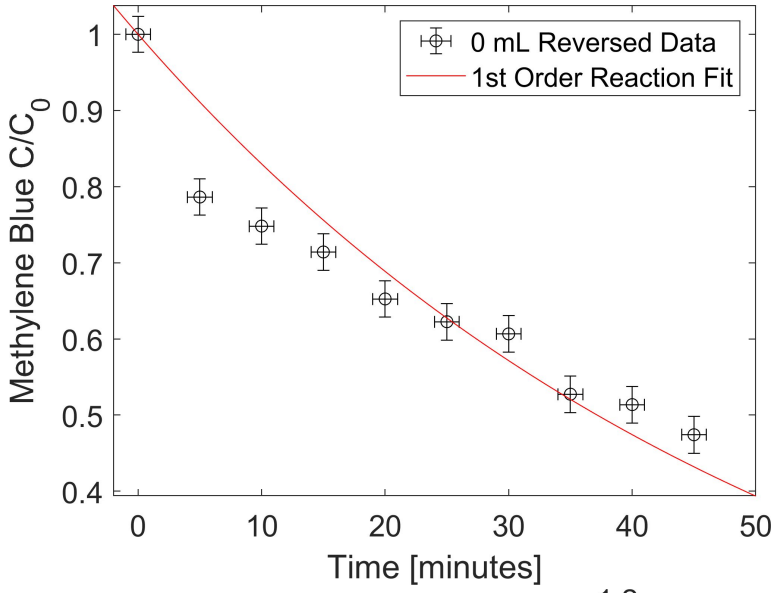
Using known concentrations of methylene blue, a calibration curve was created for the spectrophotometer

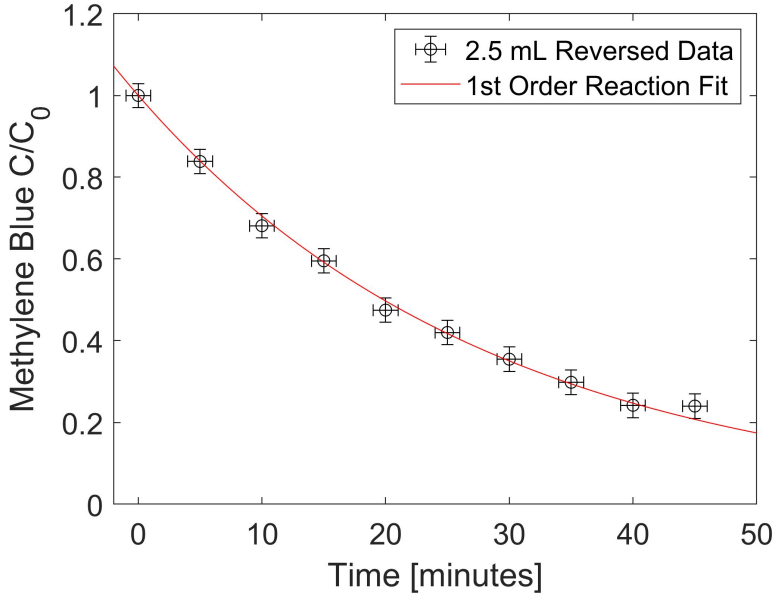


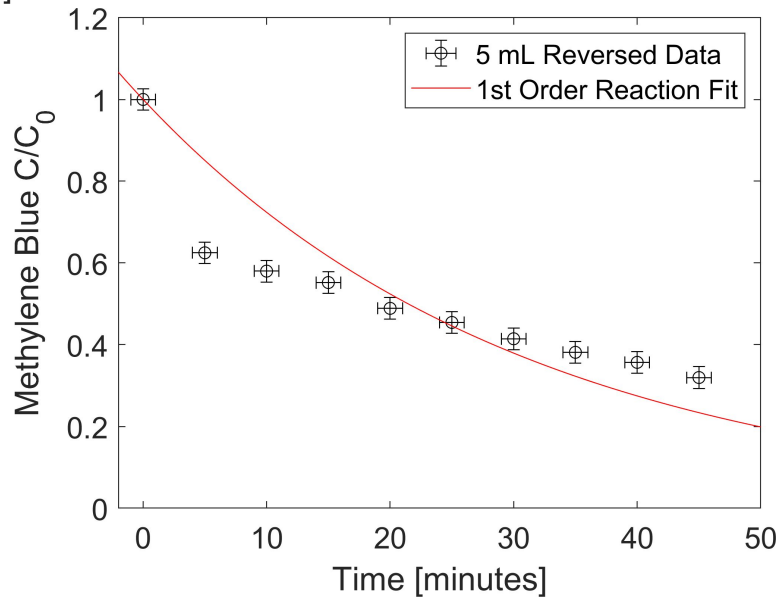




We fit this equation to the experimental data.

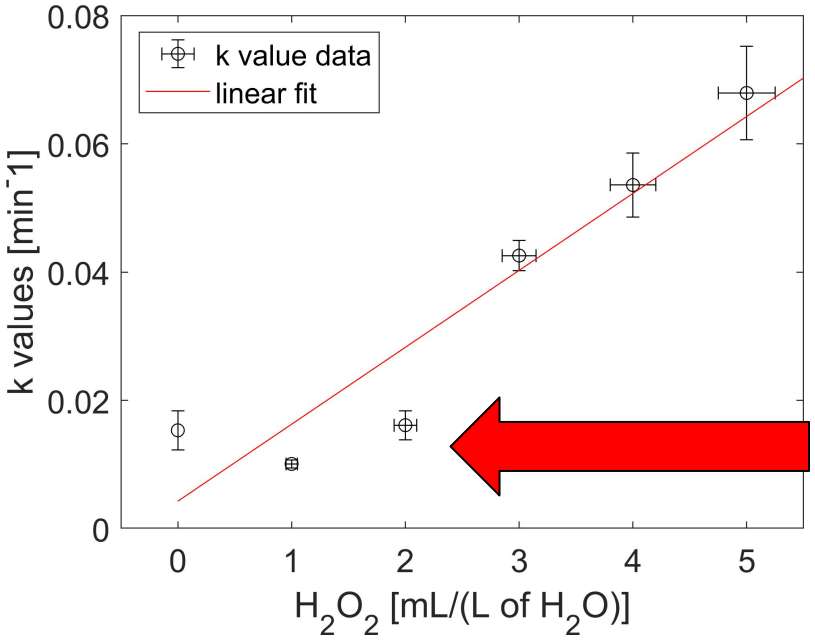






Reverse pumped data

The k values tend to increase as the amount of hydrogen peroxide increases.



Errors?

K-values

	Direct	Reverse
0 mL	0.0153	0.0187
2 mL		
2.5 mL		
3 mL		
5 mL	0.0679	0.0323

Questions?

Works Cited

- https://projectlyme.org/methylene-blue/
- https://bengreenfieldlife.com/article/the-ultimate-guide-to-methylene-blue/
- Marziyeh Salehi, Hassan Hashemipour, Mohammad Mirzaee, Experimental Study of Influencing Factors and Kinetics in Catalytic Removal of Methylene Blue with TiO2 Nanopowder, American Journal of Environmental Engineering, Vol. 2 No. 1, 2012, pp. 1-7. doi: 10.5923/j.ajee.20120201.01.
- Salem IA, El-Maazawi MS. Kinetics and mechanism of color removal of methylene blue with hydrogen peroxide catalyzed by some supported alumina surfaces. Chemosphere. 2000 Oct;41(8):1173-80. doi: 10.1016/s0045-6535(00)00009-6. PMID: 10901243.