

Measuring Kinetics Of Hydroxyl Radical Production By Photoactive Titanium Dioxide Nanoparticles In Natural Systems

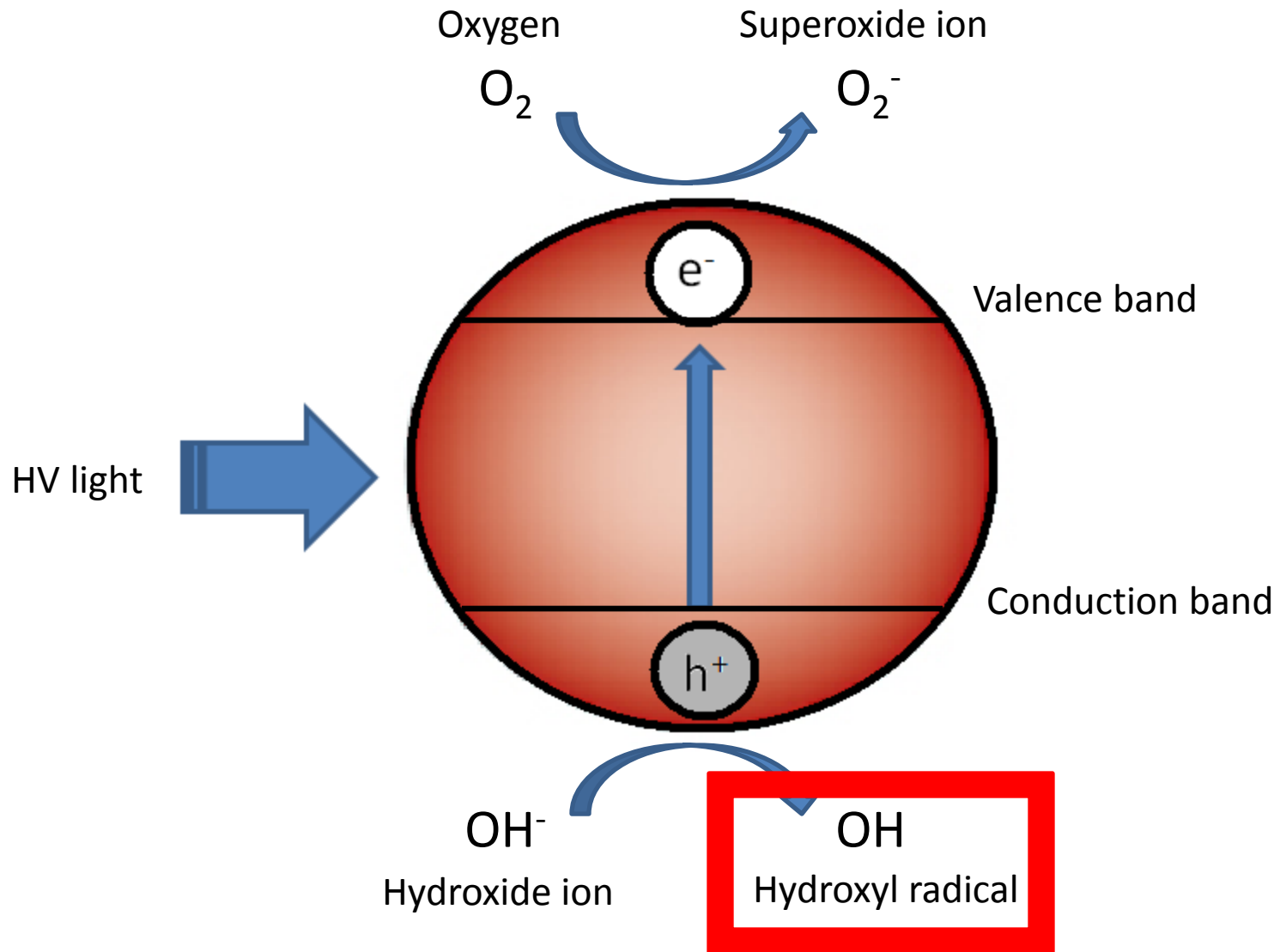
Aarone Perez
Chemistry, Oxnard College

Mentor: Samuel Bennett

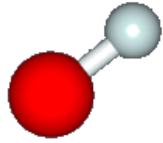
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*Bren School of Environmental Science &
Management*



Nanoparticle Introduction



Research Goals

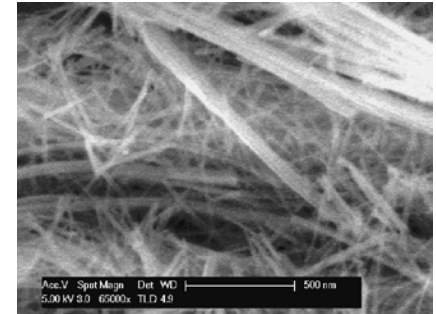
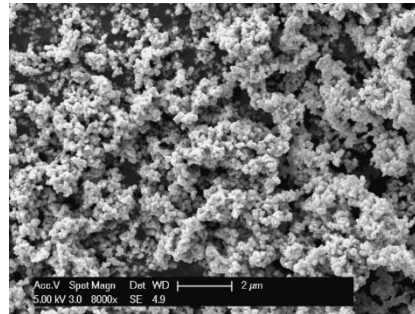
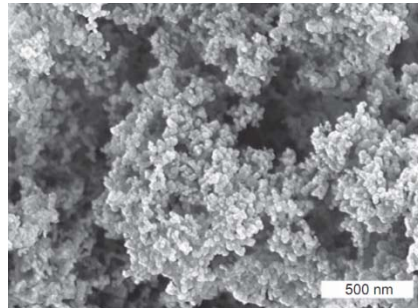


Hydroxyl radical

At what rate are they produced?

➤ Morphology

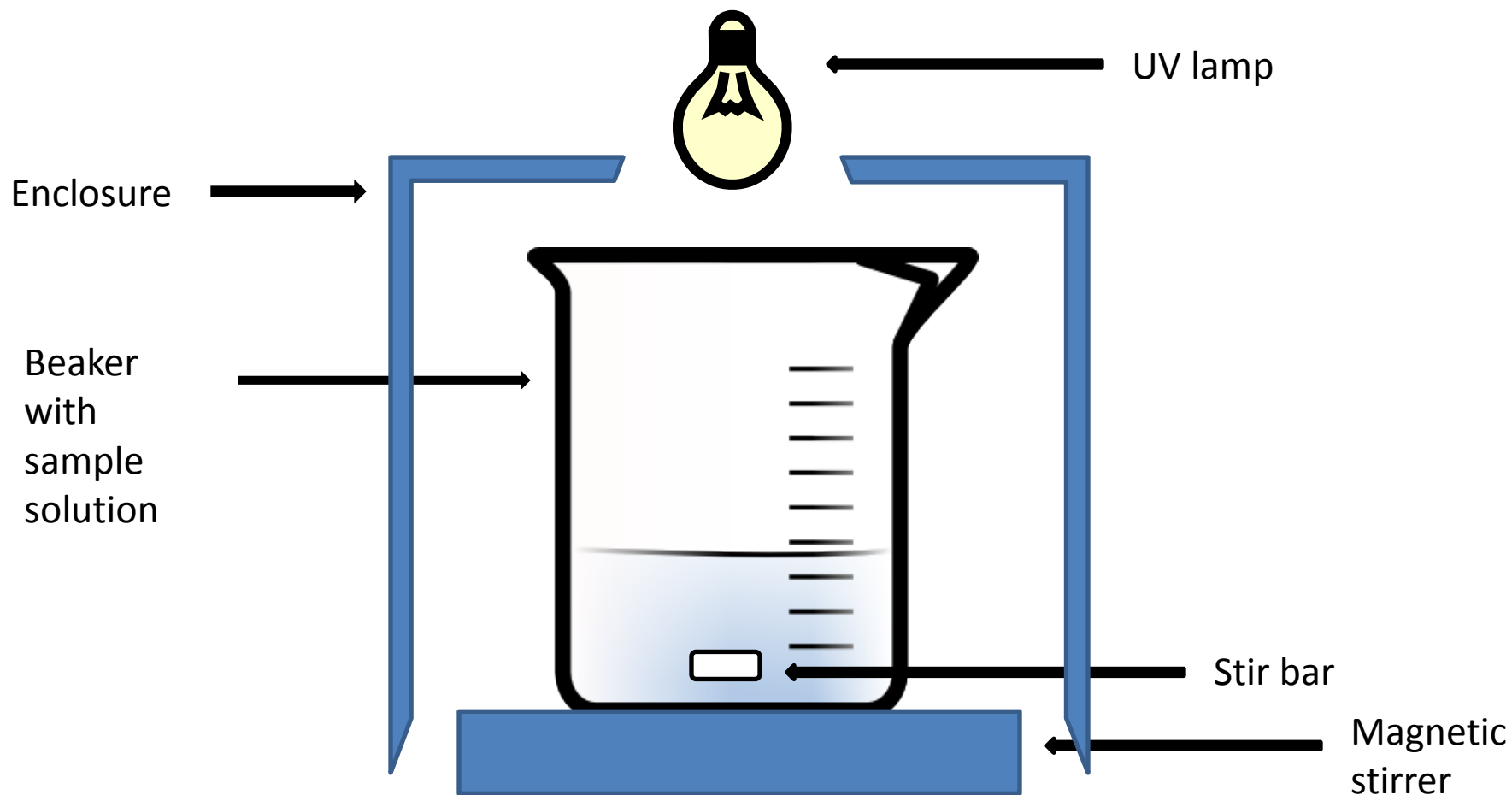
2



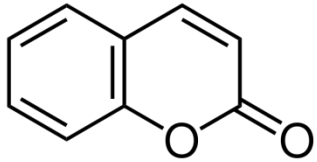
Conditions:

- Concentration
- Ionic strength
- pH

Experimental Method

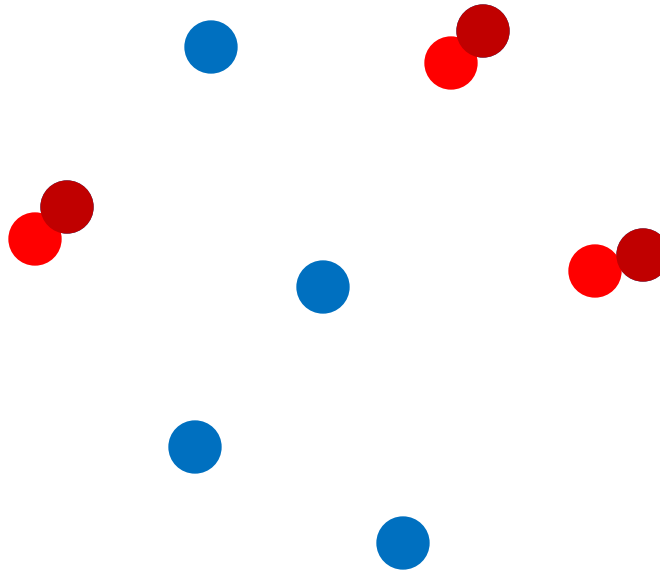


Experimental Method



Coumarin

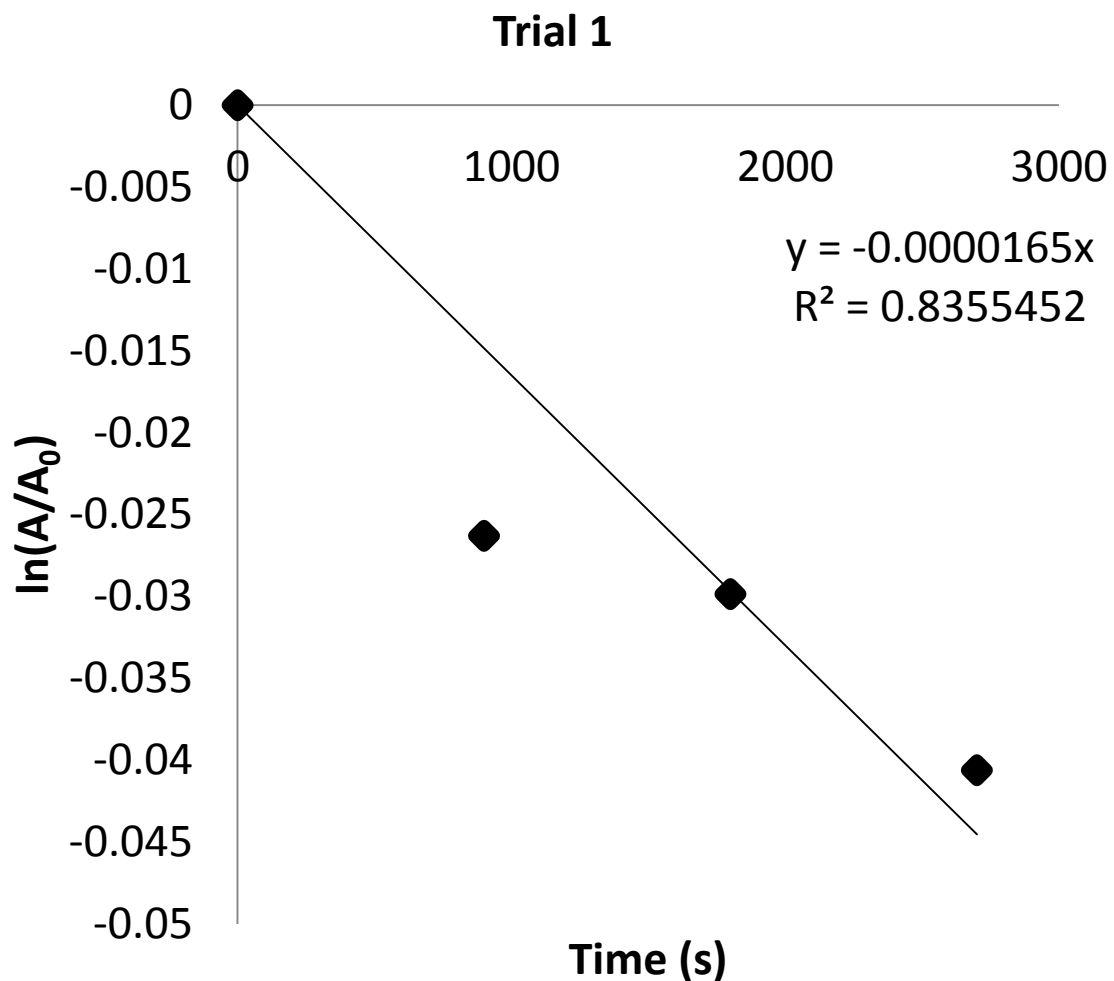
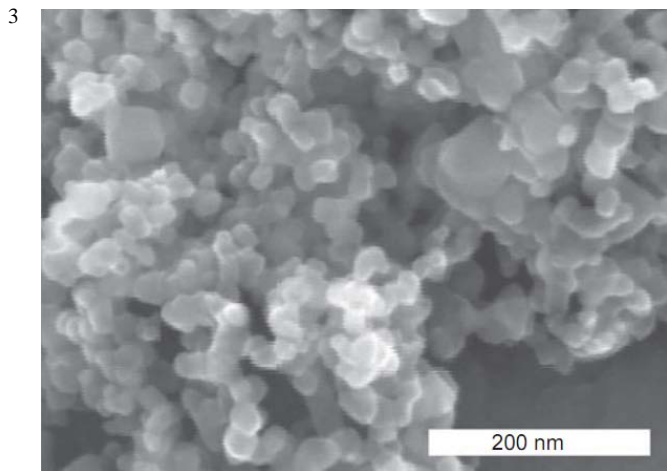
Changing coumarin absorption used to measure rate constant k



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

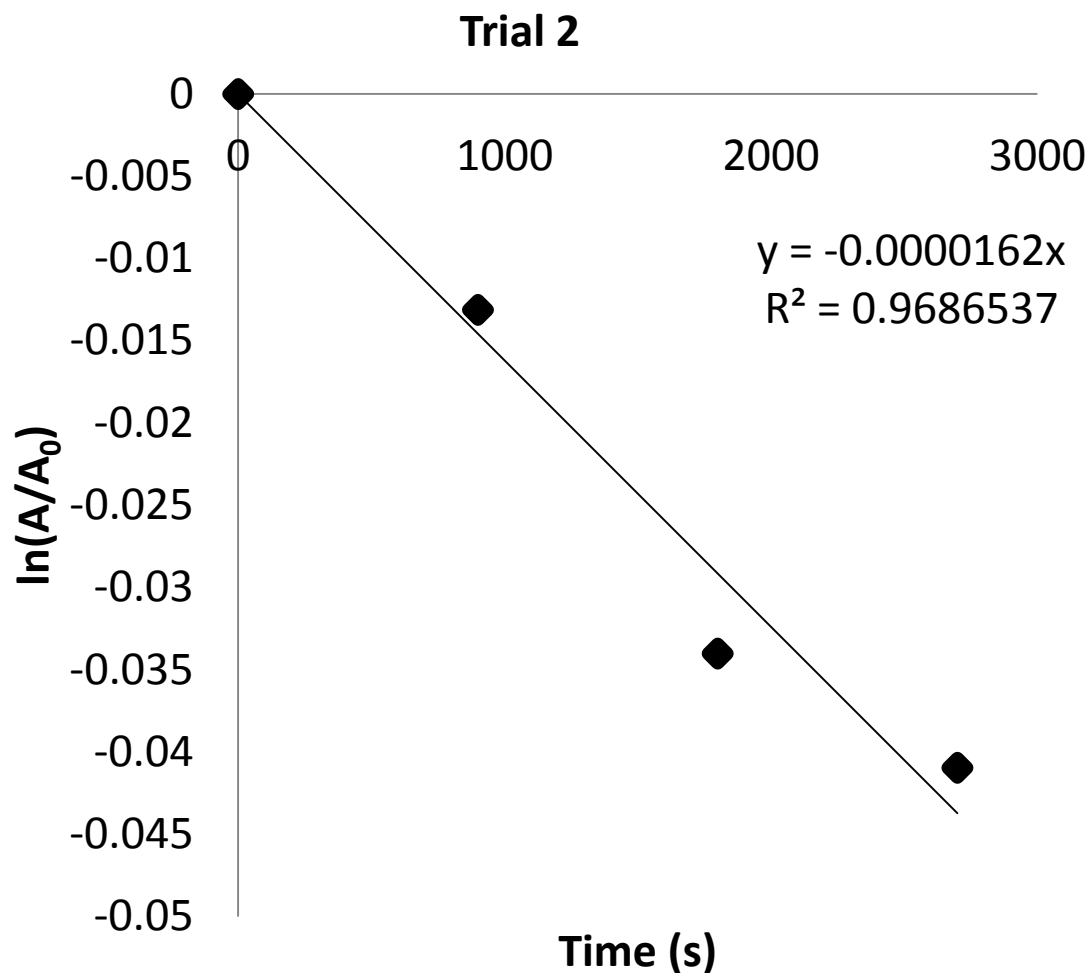
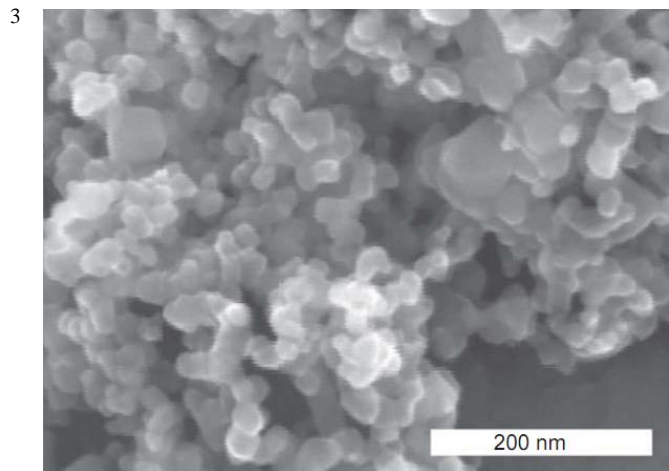
10 mg⁻¹ TiO₂ (P25)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

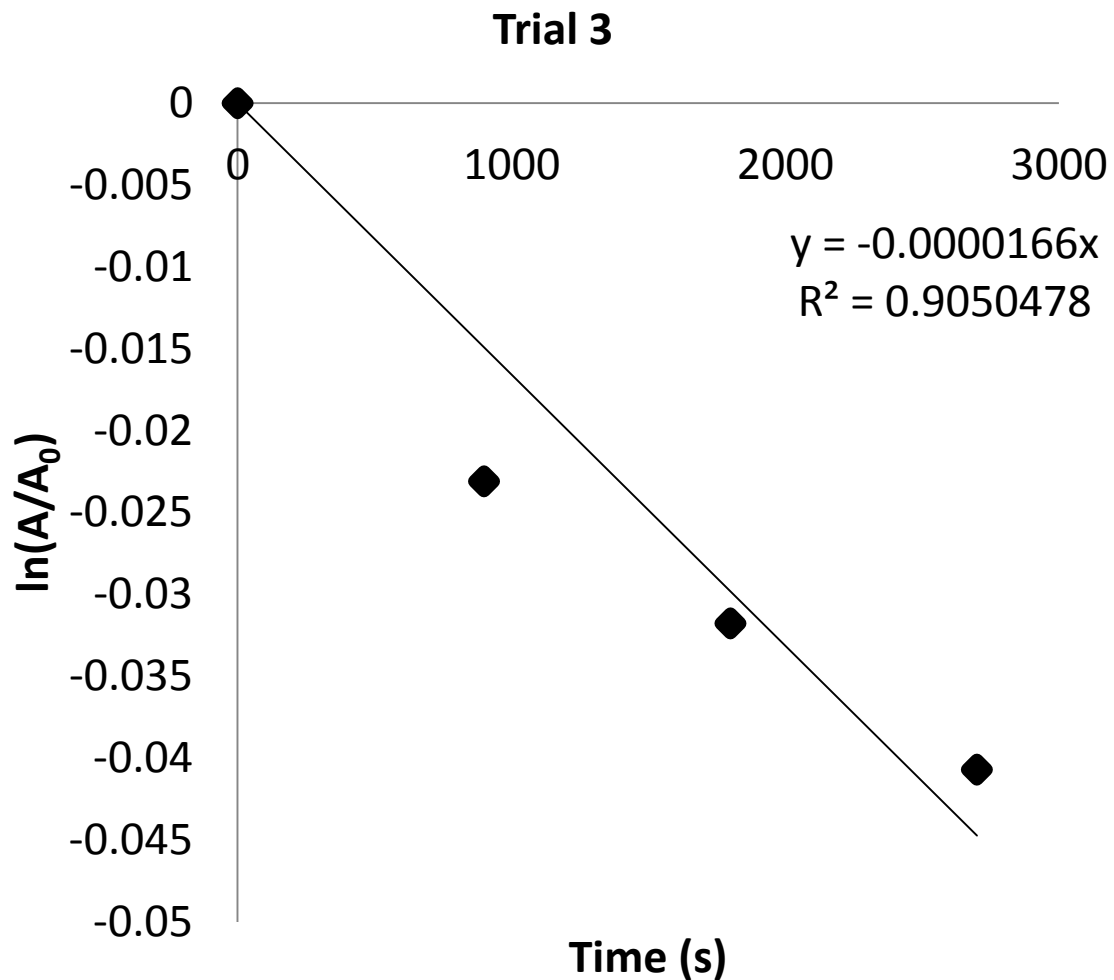
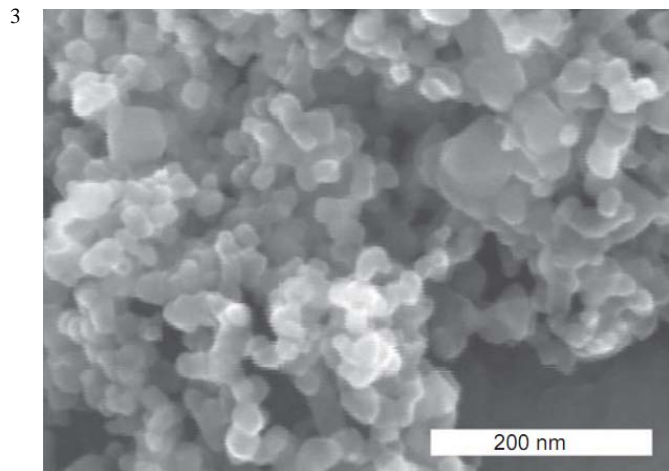
10 mg⁻¹ TiO₂ (P25)



Experimental Rates

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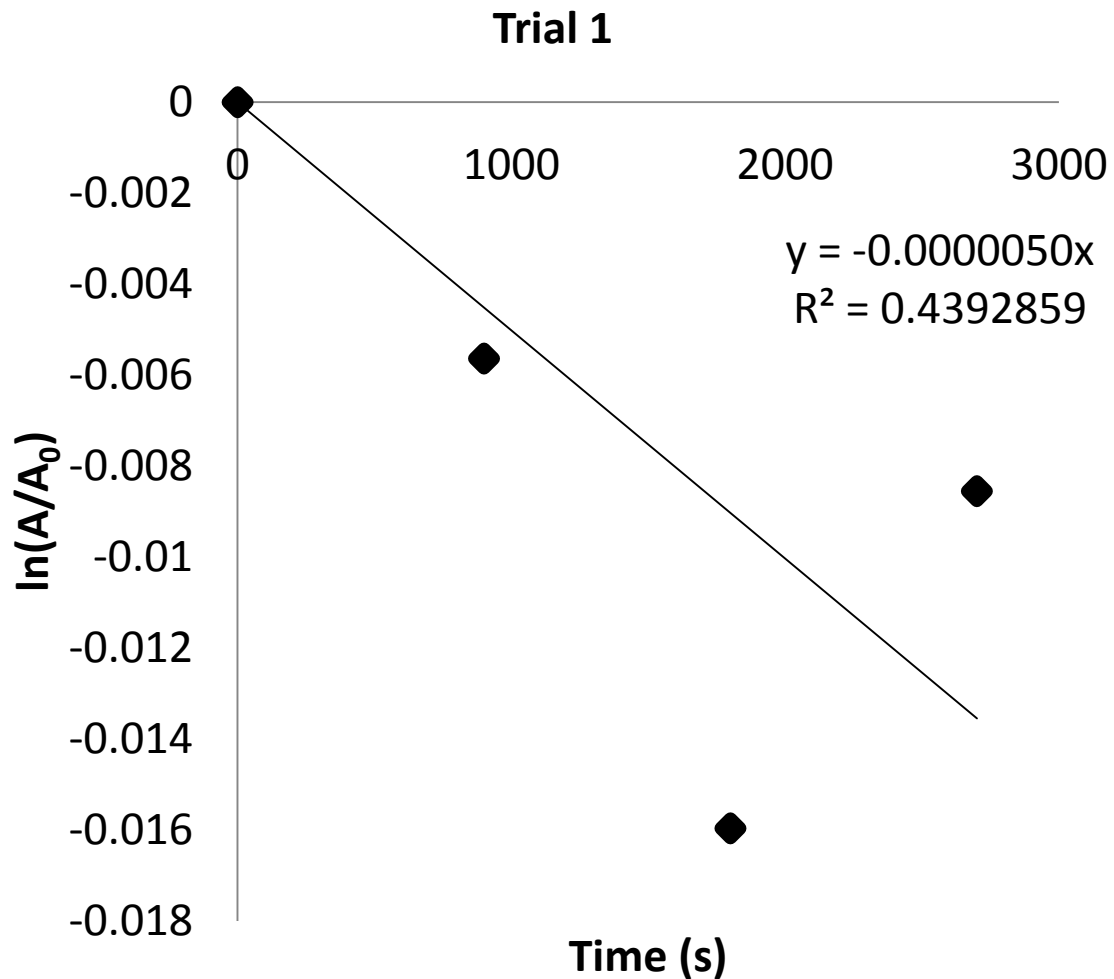
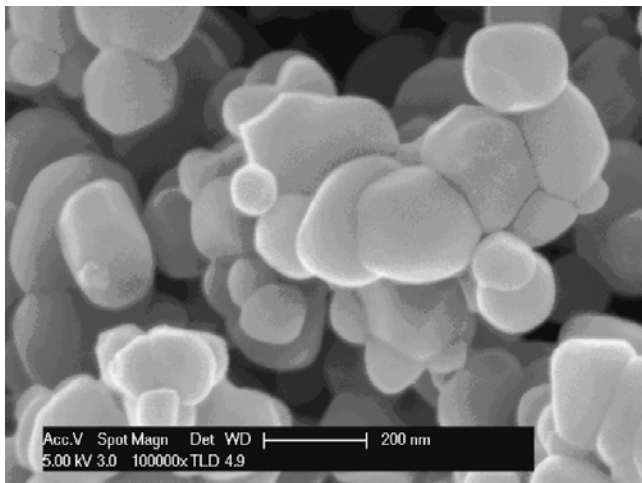
10 mg⁻¹ TiO₂ (P25)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

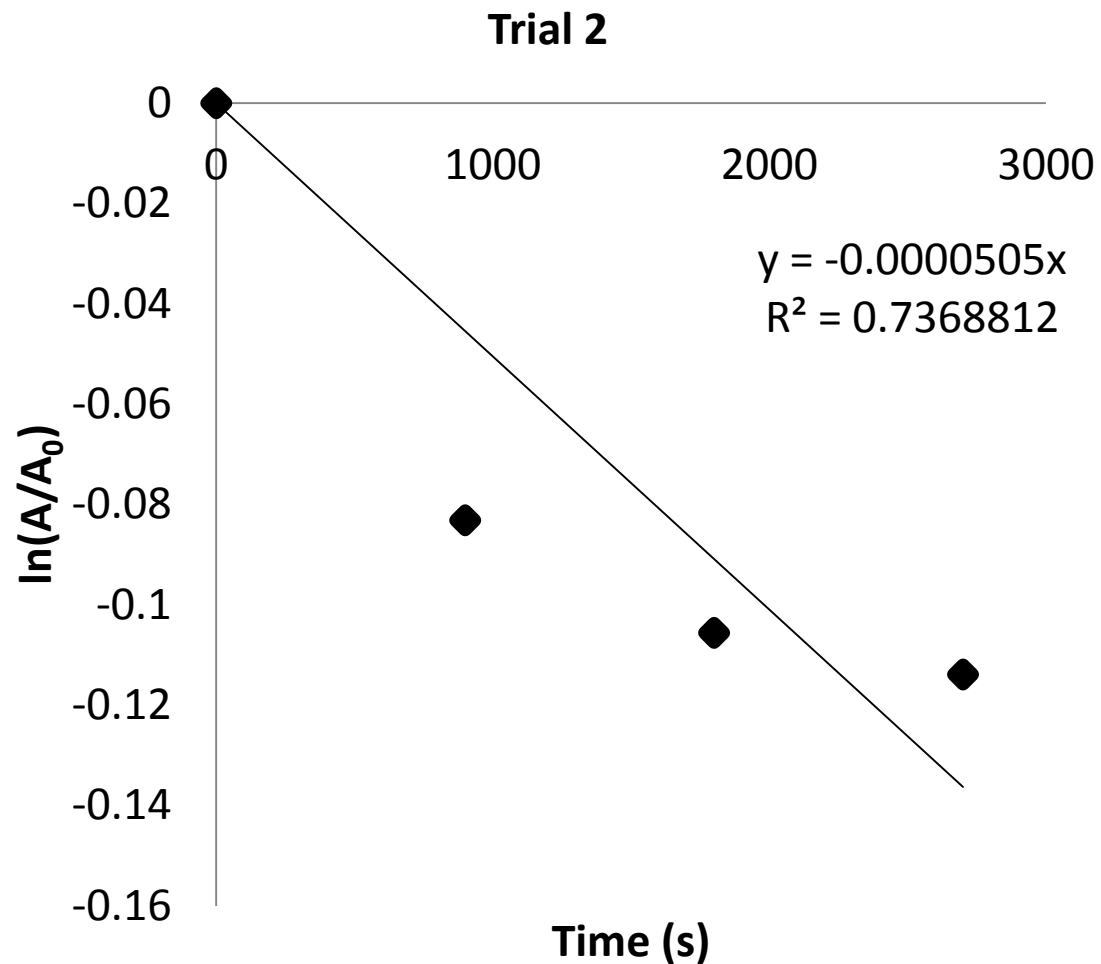
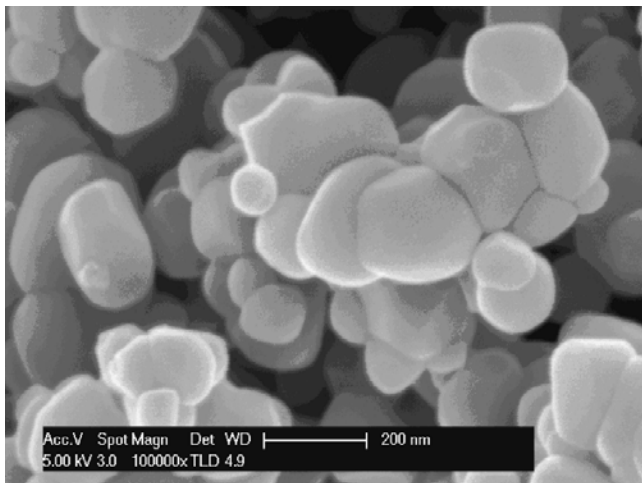
10 mg⁻¹ TiO₂ (TM3)



Experimental Rates

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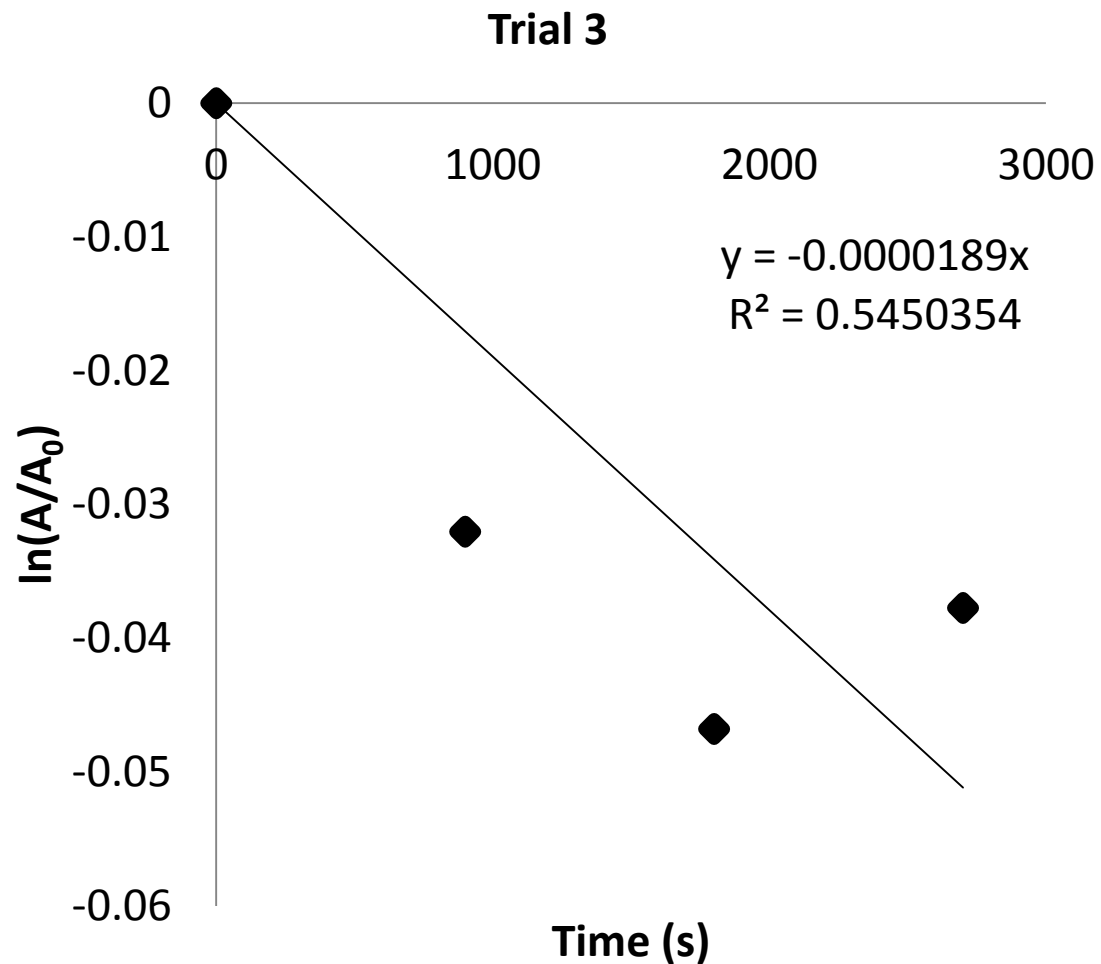
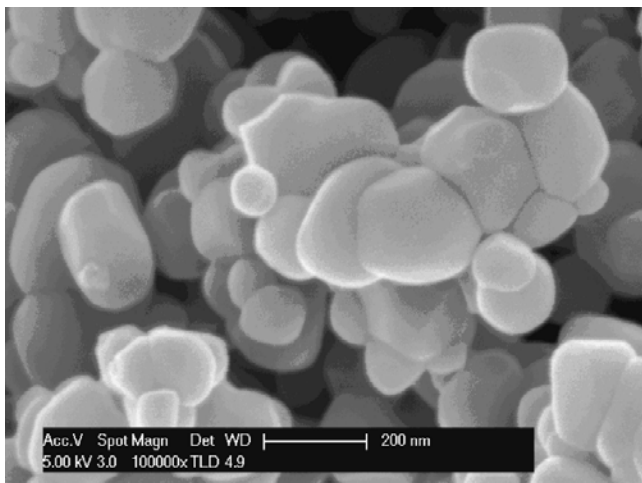
10 mg⁻¹ TiO₂ (TM3)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

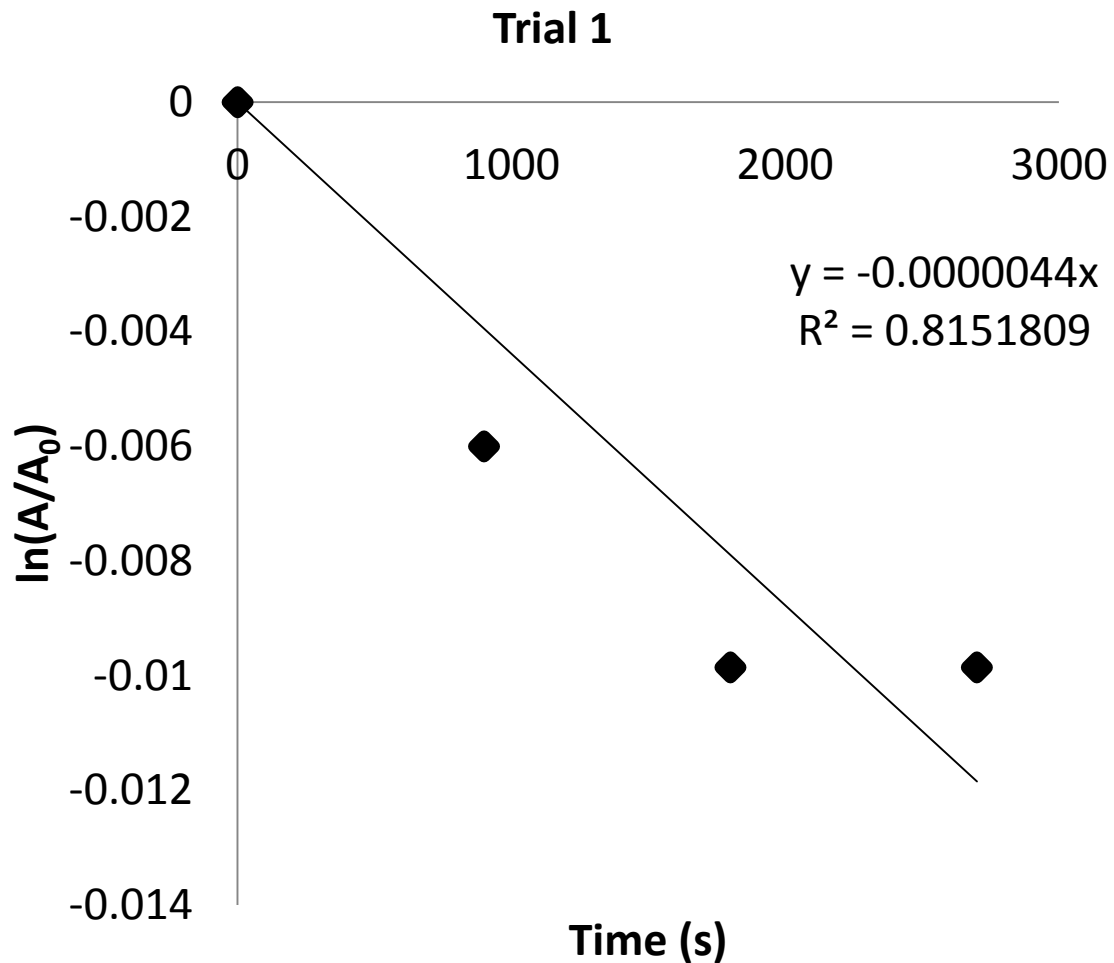
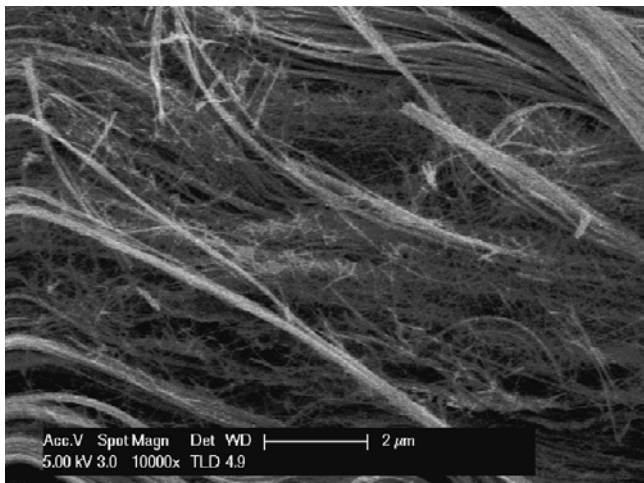
10 mg⁻¹ TiO₂ (TM3)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

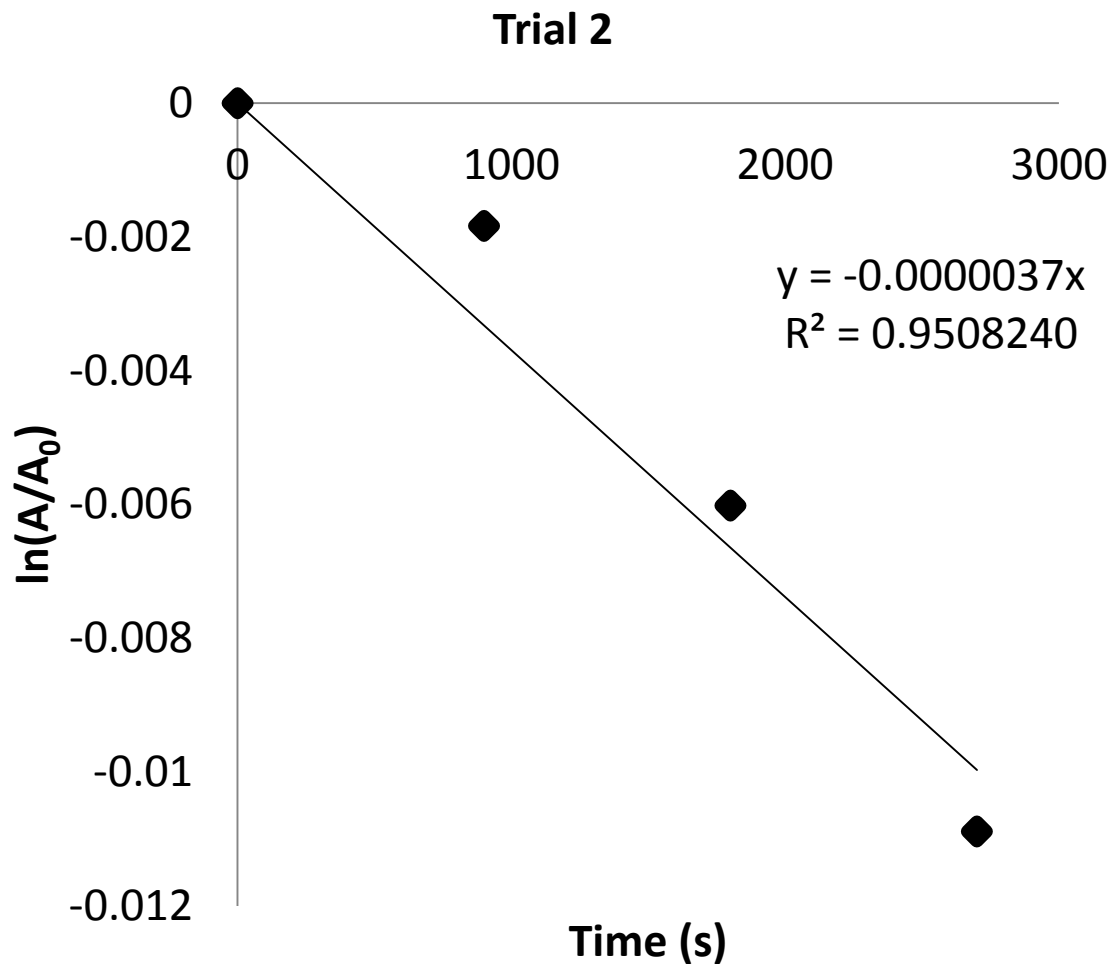
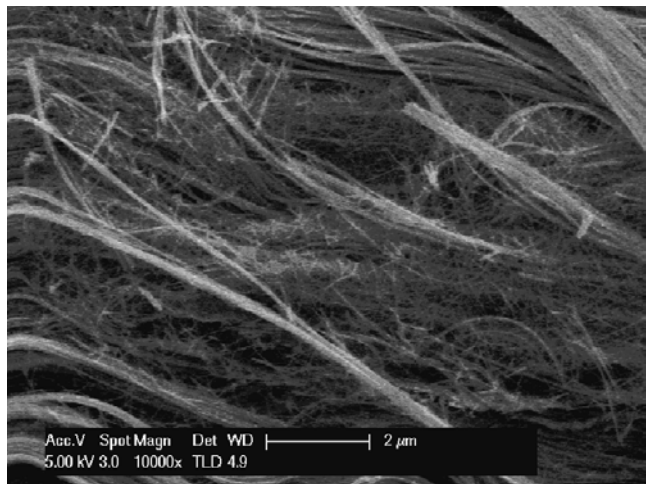
10 mg⁻¹ TiO₂ (TM4)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

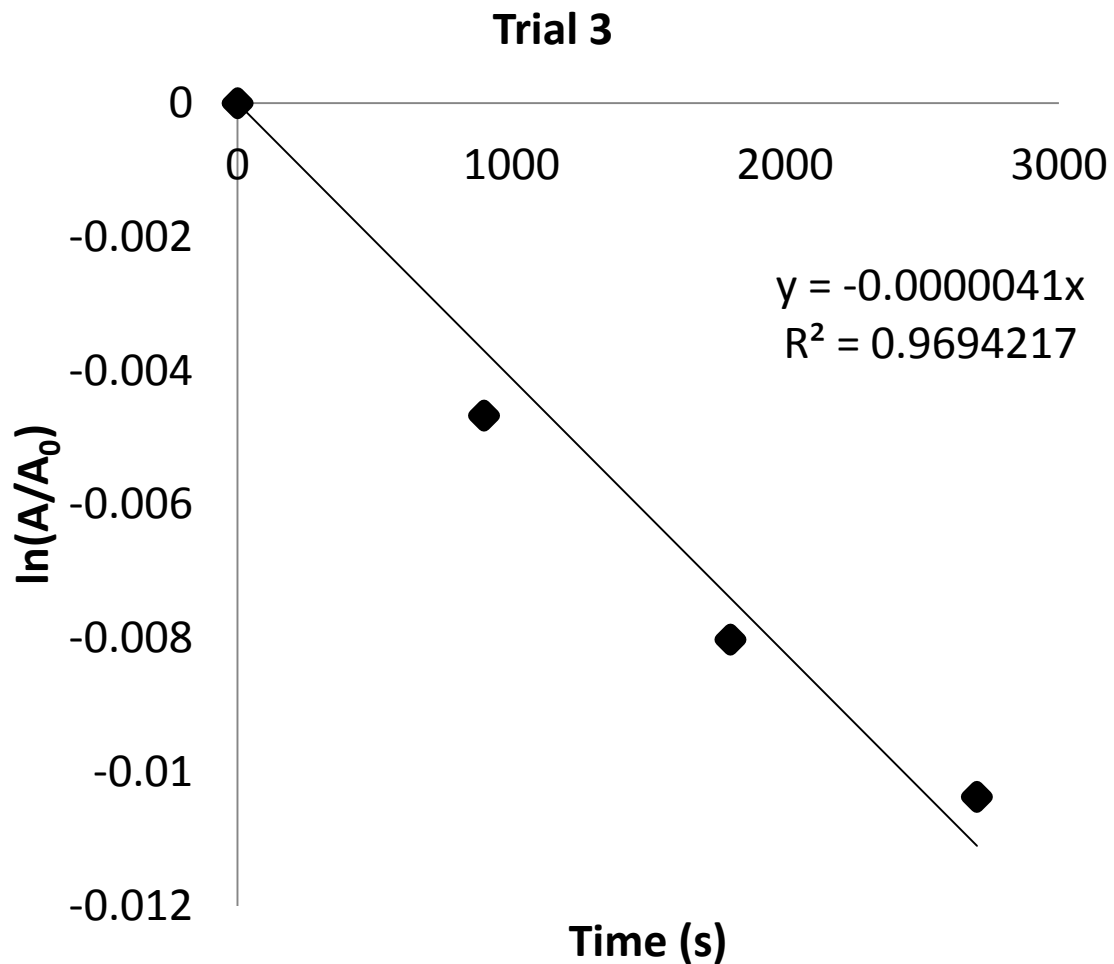
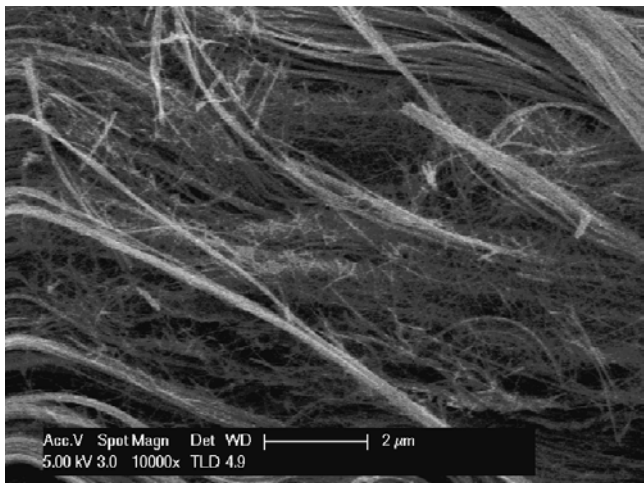
10 mg⁻¹ TiO₂ (TM4)



Experimental Rates

$$\ln [A] = -kt + \ln [A]_0$$

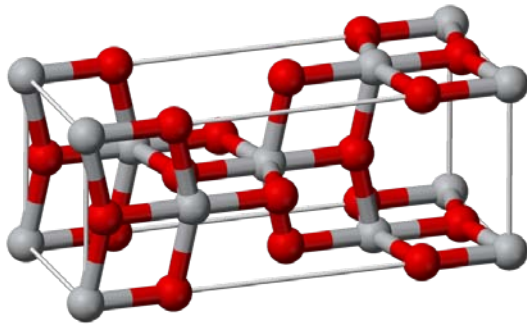
10 mg⁻¹ TiO₂ (TM4)



Experimental Rates

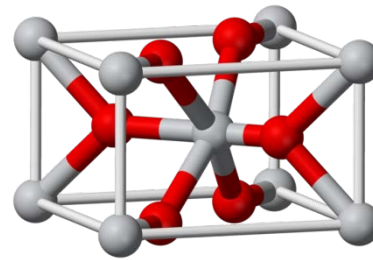
TiO ₂ Concentration & Morphology	Average Rate Constant	Error
10 mg ⁻¹ TiO ₂ P25	1.643 x 10 ⁻⁵ s ⁻¹	1.202 x 10 ⁻⁷ (0.73%)
10 mg ⁻¹ TiO ₂ TM3	2.48 x 10 ⁻⁵ s ⁻¹	1.35 x 10 ⁻⁵ (54.44%)
10 mg ⁻¹ TiO ₂ TM4	4.07 x 10 ⁻⁶ s ⁻¹	2.03 x 10 ⁻⁷ (4.99%)

Anatase



<http://en.wikipedia.org/wiki/File:Anatase-unit-cell-3D-balls.png>

Rutile



<http://en.wikipedia.org/wiki/File:Rutile-unit-cell-3D-balls.png>

$$\ln [A] = -kt + \ln [A]_0$$

$$A = c \varepsilon L$$

$$\frac{c}{c_0} = \frac{A - A_{\infty}}{A_0 - A_{\infty}}$$

$$\ln \frac{A - A_{\infty}}{A_0 - A_{\infty}} = -kt$$