

Thionin Reaction

Description: A large flask or beaker contains a purple solution. When half of the flask is covered and the other half is exposed to light, the half exposed to light becomes colorless while the other half remains purple.

Materials:

0.001 M thionin (fresh solution)	Aluminum foil
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	Large beaker
3 M H_2SO_4	Deionized water

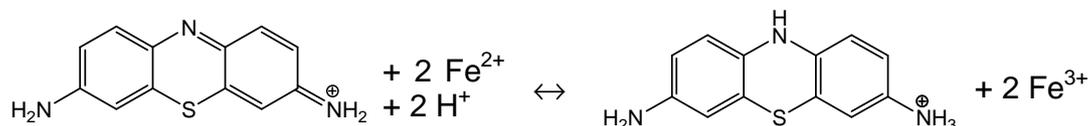
Procedure:

For larger lecture halls, project this demonstration using an overhead projector.

1. Prepare the following solution: 10 mL of 0.001 M thionin (prepared by dissolving 0.23 g thionin in 1000 mL water), 10 mL of 3 M H_2SO_4 , 2.0 g $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. Bring volume up to 500 mL with deionized water. It is important that the thionin solution is made fresh.
2. Dim the lights in the classroom and turn on the overhead projector light. Expose the solution to this light and the entire solution will change from purple to colorless. The purple color reappears when the solution is removed from the light.
3. Using several sheets of aluminum foil, cover half of the overhead projector screen and place the flask on the foil so that half of the solution is blocked from the overhead projector light. A distinct vertical division of the solution should be observed. The reaction can again be reversed by removing the solution from light.



Discussion: Thionin is a common staining agent used in various biological applications. In this reaction, thionin (shown below) is photochemically reduced by Fe^{2+} in acidic conditions. This reaction is reversible as demonstrated in the absence of light. The following chemical reaction illustrates the reactivity observed:



Safety: Wear proper protective equipment including gloves and safety glasses when preparing and performing this demonstration. Concentrated solutions of acids (>2 M) can irritate the skin and cause burns. When diluting concentrated acids, add acid to water to avoid spattering.

Disposal: Any leftover solutions should be discarded in an appropriate waste container.

References:

Lamb, C. B.; *et. al. J. Chem. Educ.* **1967**, *44*, A145.

Video:

<http://www.youtube.com/watch?v=HbKK2F7PGVs>