Objectives

This proposal's objective was to model how the ratio between the sensitizer and annihilator affects the intensity of light produced for a variety of sensitizer-annihilator pairings. The long-term goal is to create a database that can help researchers find what ratios to use in their experiment for their desired final light intensity. Researchers benefit from knowing how a change in the optimal ratio affects final light intensity. The work done here benefits future research in TTA-UC by providing more understanding of the relationship between sensitizers, annihilators, and light intensity. The outcome of this work was a general trend and formula that researchers can refer to when looking for a specific ratio to use for their pairing.

Obj. 1: Tested at least 5 unique ratios for the system and collected light intensity

Obj. 2: Modeled the data collected on a graph and found trends and a formula

Obj. 3: Using the created graph, confirmed by experimenting whether a random ratio matches light intensity predicted

Hypothesis

Hyp. 1: As the annihilator increases in relation to the sensitizer in a TTA-UC system, the peak light intensity will increase as well, until it reaches its peak and rapidly drops off due to self-quenching.

Methodology

Role of Student vs. Mentor

In this project, I completed all steps of the methodology to create and test the TTA-UC samples. Dr. Shupei Yu taught me to use the various instruments required before starting data

collection for the project. I started this project in November and ended the first week of February, spending around 2-4 hours in the lab each week.

Equipment and Materials

The materials used include 0.3 mg/mL PdTPBP (sensitizer), 12.5 mM Perylene (annihilator), tetrahydrofuran, and argon. The equipment used includes a cuvette, micropipettes, rubber stopper, needles to degas, spectrofluorometer and 650 nm laser, and acetone to clean the cuvette.

Degassing

Degassing was used to replace air in the vial with argon, a stable gas. An exit needle and inlet needle were inserted through the rubber stopper and into the cuvette. Then, argon was allowed to bubble into the cuvette for 5 minutes.

Statistical Tests

ANOVA test

An ANOVA test was used to ensure statistical difference between each ratio trial of TTA-UC sample. The p-value received was 3.8*10^(-46).

Paired t-test

Additionally, a paired t-test was used to ensure statistical similarity between two trials of the same TTA-UC ratio (1:100). The p-value received was 5.83*10^(-20).

Regression Analysis

A regression analysis was used to find a relationship between the ratio and light intensity emitted. The function found was (R^2=).