

Development of Fluorogenic Styrene Probes for Cell Imaging

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Abstract

Cell visualization through cell labeling has previously been an effective way to learn about the cell and cell biology. Small-molecule fluorescent dyes are used for cell imaging, especially the RNA. This method of binding fluorescent dyes to the cell is less expensive compared to other methods such as oligonucleotide-based probes or protein-based reporters. Although using RNA dyes are less expensive, it is still not practical due to qualities such as prone to scattering and having low photostability. Styrene dyes however, will be more stable and give more fluorescence, increasing the application of using RNA dyes. With this improved fluorescent dye, visualizing RNA will be easier and can lead to further research and understanding of RNA biology.

Objectives

By using fluorogenic styrene dyes and binding them to RNA and DNA, it makes it easier for cell imaging and visualization of the cell. Our objective is to create 2 new styrene dyes that will give off the most amount of light emission under fluorescent wavelengths (250-700 nm), and then binding it to the cell for cell imaging.

Purification Methods

There are different methods of purifying and extracting the products after the reaction:

- If there are no waste chemicals then filtration is used. Filtration uses a funnel with filter paper to separate the liquid and solid.
- If there are unwanted chemical waste in the product, then Thin Layer Chromatography (TLC) and Column Chromatography should be used. Column chromatography uses the polarity of the chemicals to separate the product and waste.

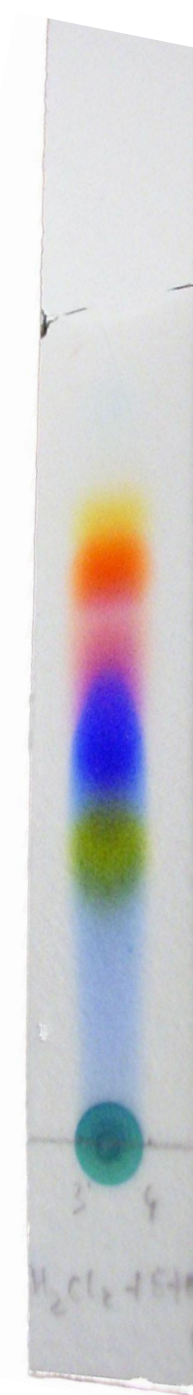


Figure 1. This is an example of TLC, which can be used to test the formation of the product before column chromatography.

Procedure

1. Preparations of Chemicals

Researching and measuring the amount of chemicals needed for the reaction.

2. Chemical Reaction

Mix the reactants in a flask with a stir bar, connect to a reflux condenser, remove oxygen if needed, and set it in oil on a hot plate. Wait for chemical reaction.

3. Purification

Extract the products:

- With extraction and separation if product mixed with solvent.
- With filtration if there are no waste product.

4. Light Absorption and Emission

Test the light absorption and emission of the product with control, DNA, and RNA mixed samples.

5. Cell Imaging

Bind product to cells and use for cell imaging.

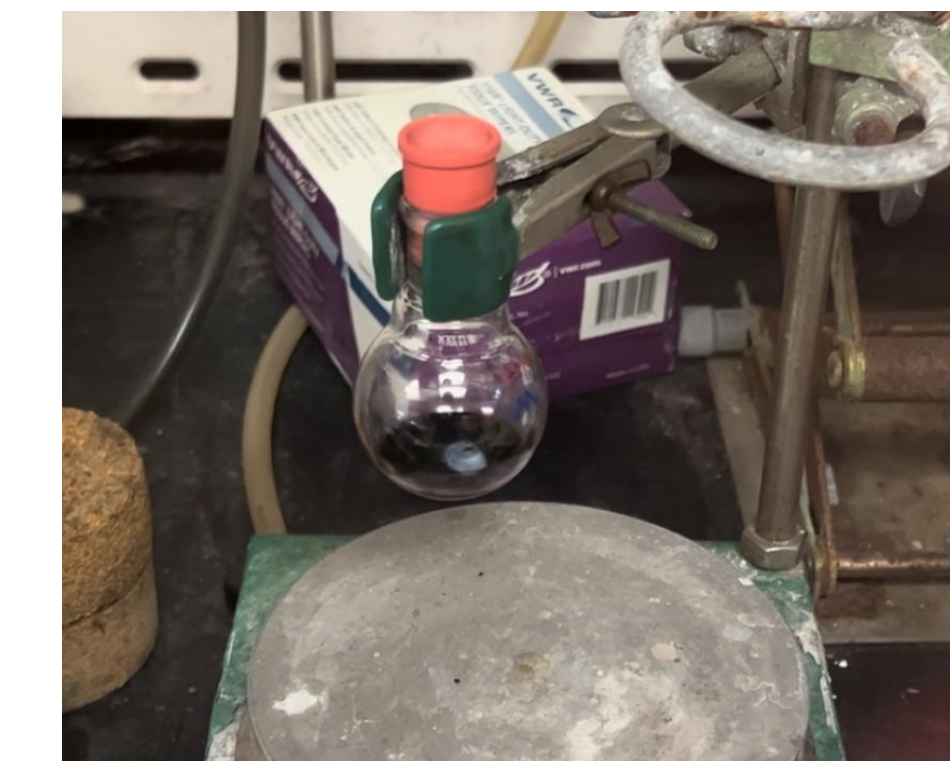


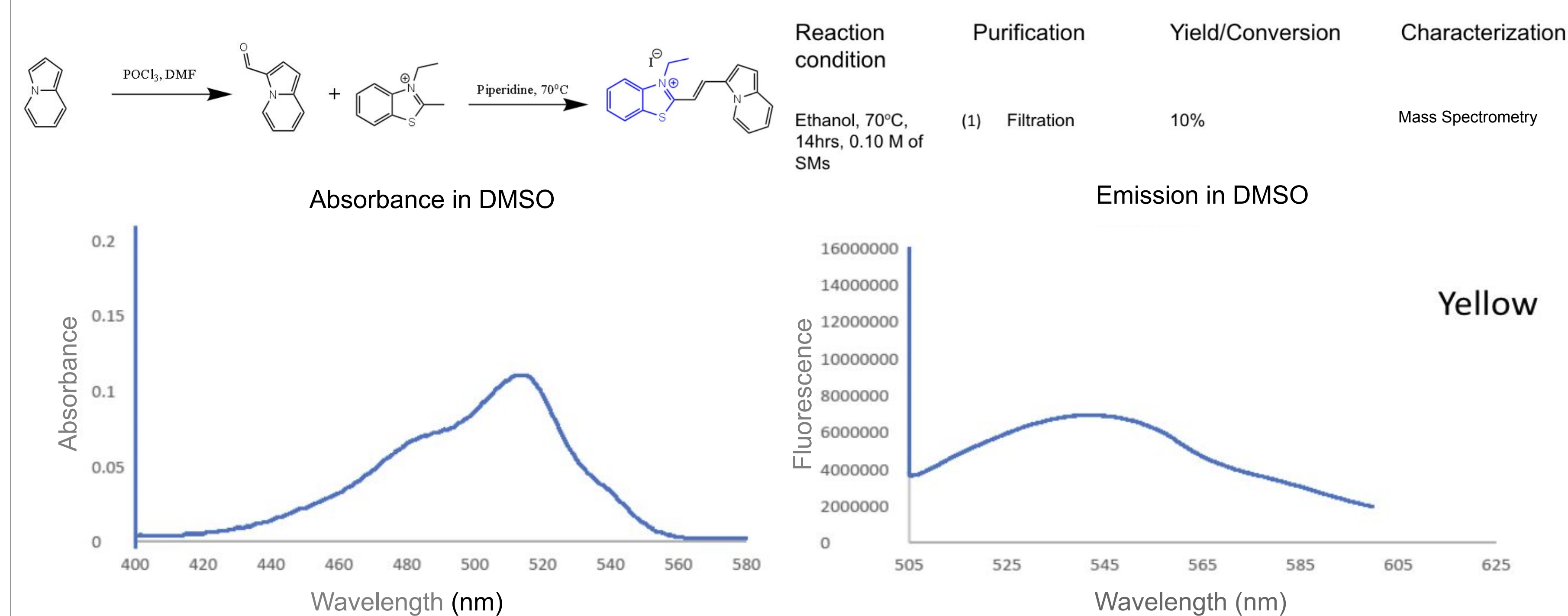
Figure 2. Chemical reaction with a stir bar



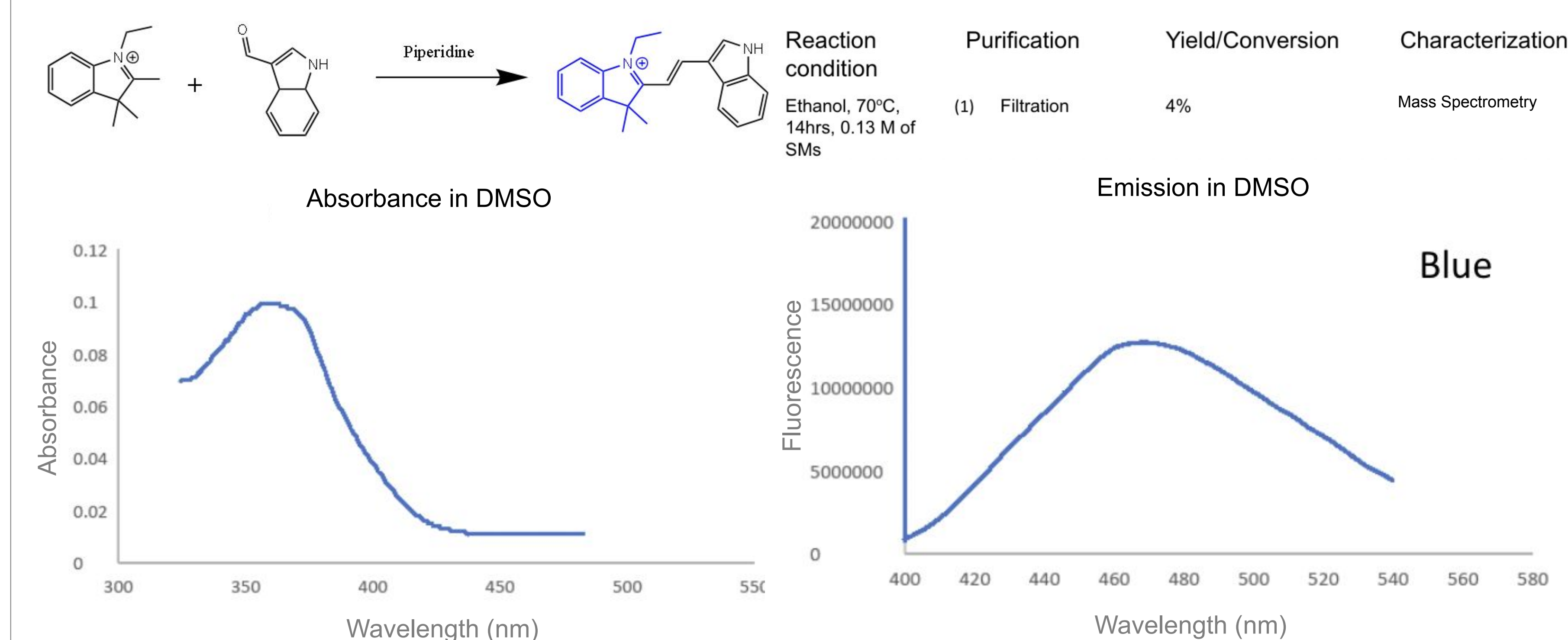
Figure 3. Styrene dyes under visible light (Left) and under ultraviolet light (Right)

Data and Analysis

Reaction 1

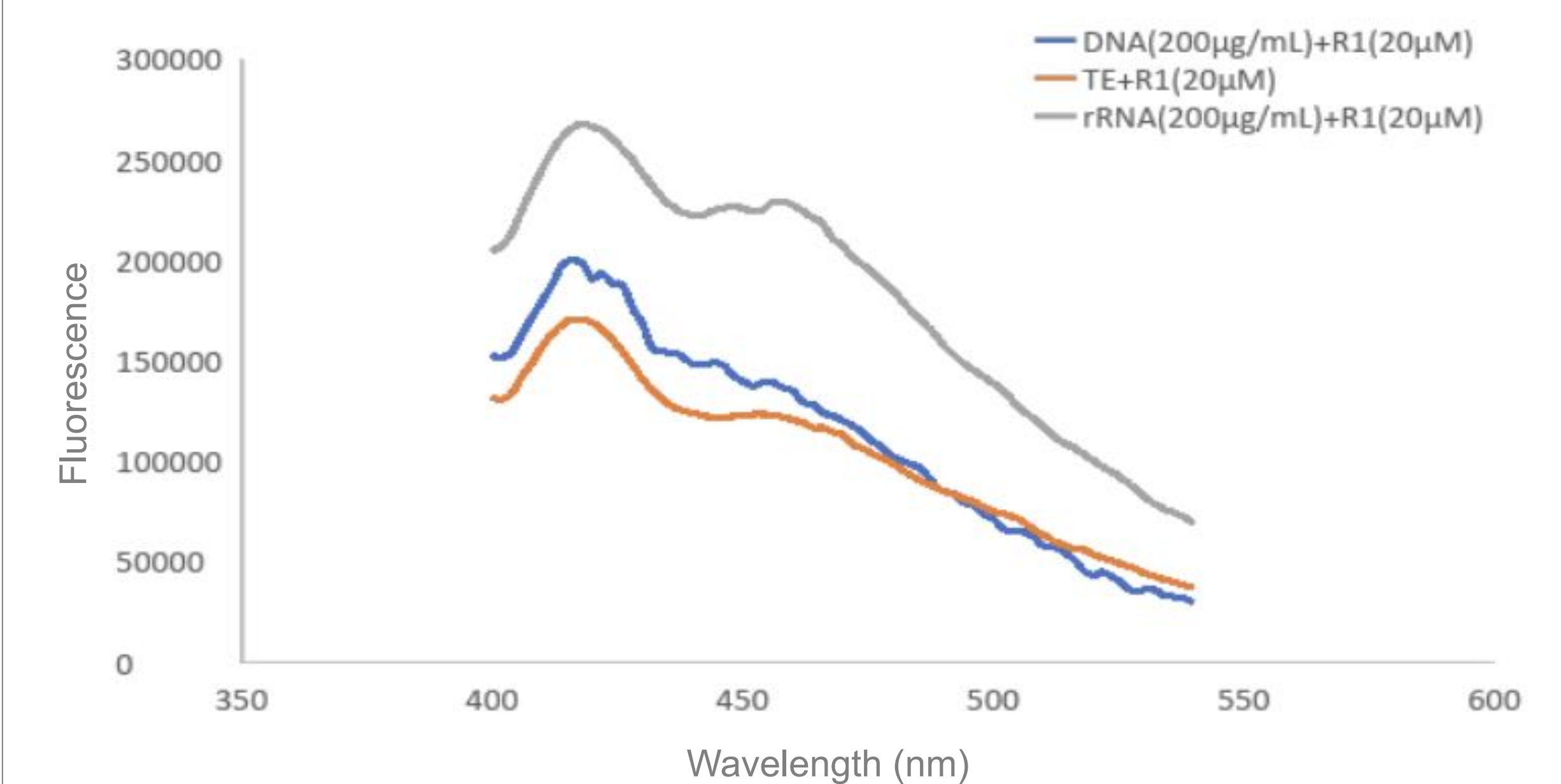


Reaction 2

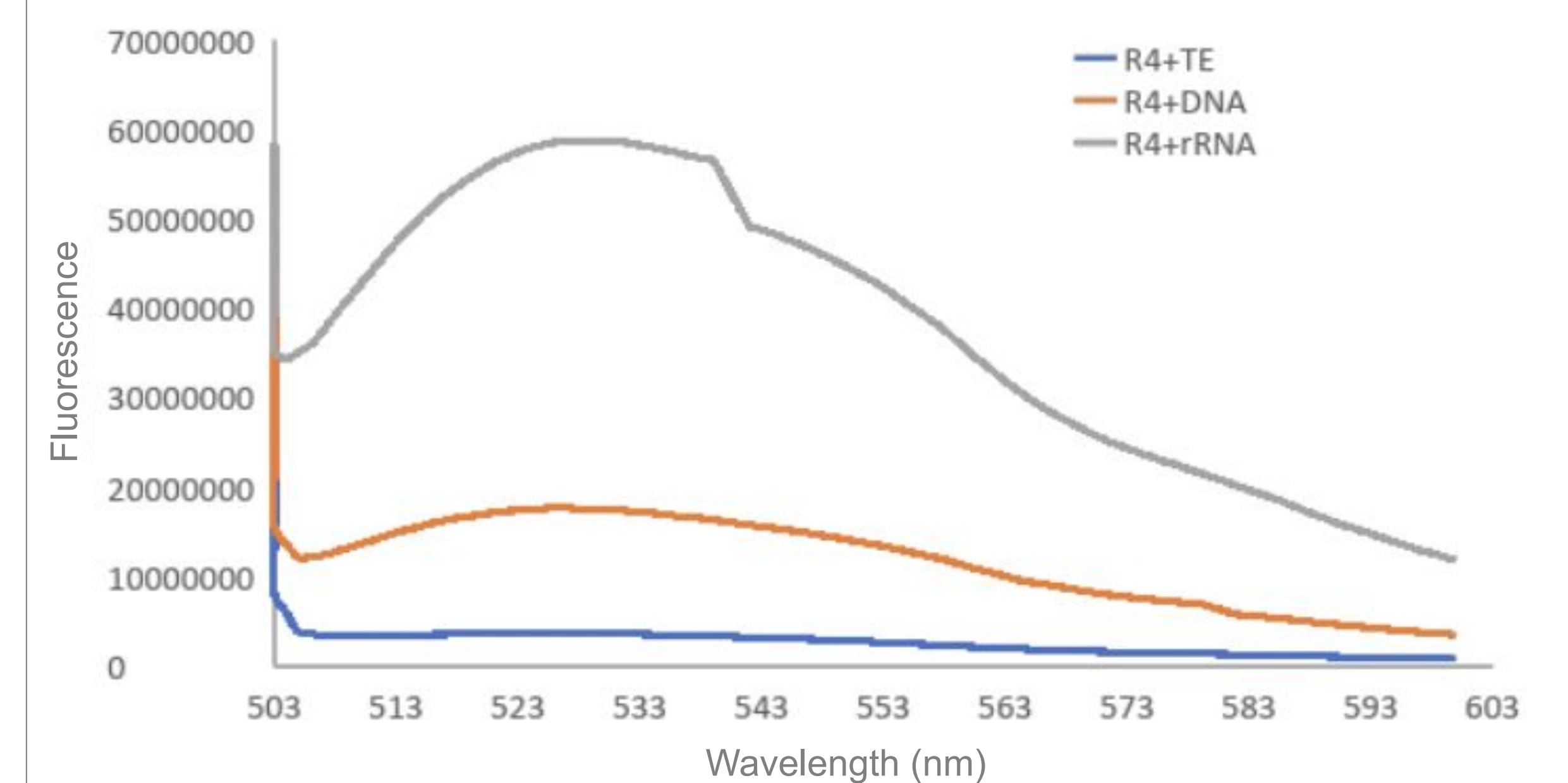


Results

Fluorescence of Dye 1



Fluorescence of Dye 2



Summary

In the data, styrene dyes that bound with DNA and RNA has improved fluorescence level compared to the control sample. RNA still has more fluorescence compared to DNA in both tests, which accomplishes the original objective of creating a RNA dye. This makes cellular RNA imaging more accessible and is an improvement over the previous RNA dyes, which expands the application of the usage of RNA dyes in future research of cellular RNA biology.

CONTACT US

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