Organic Synthesis and Characterization

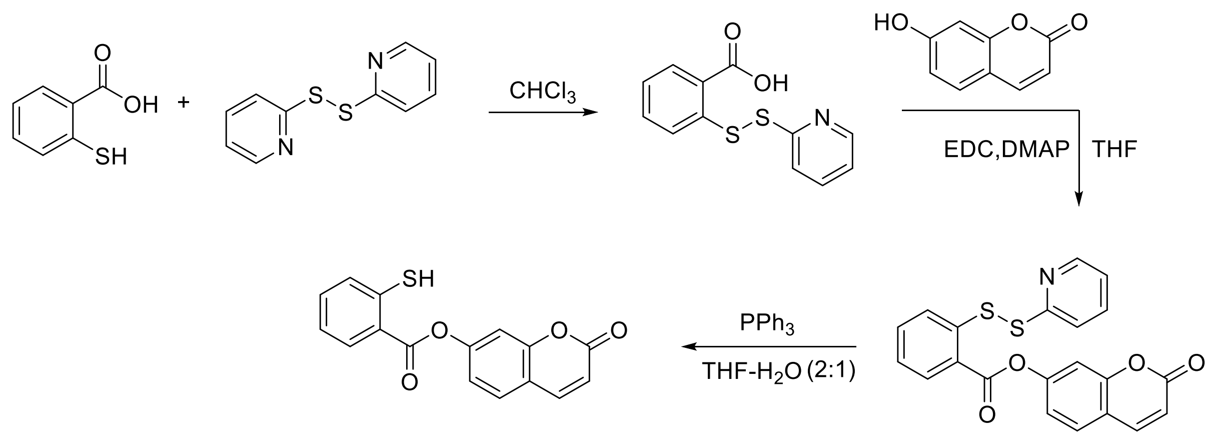
Introduction

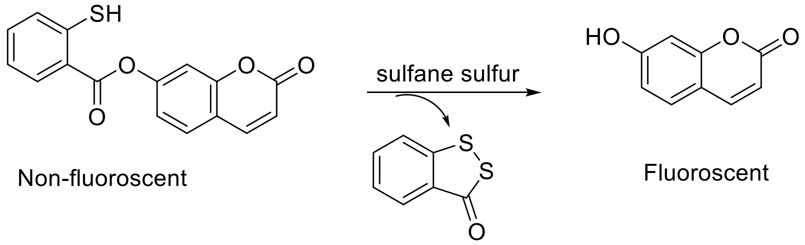
Organic chemistry requires a strong integration of theoretical understanding and laboratory skills to successfully synthesize, purify, and analyze compounds. This report outlines the key learning outcomes from my recent lab project on the **Enantioselective Synthesis of Gamma Butyrolactones**, where I gained experience in the synthesis of organic compounds, applied various chromatography techniques, and characterized compounds using advanced analytical methods. This hands-on experience has deepened my comprehension of organic chemistry principles and enhanced my technical laboratory skills.

Learning Outcomes

Experimental Skills in Organic Synthesis and Synthetic Schemes

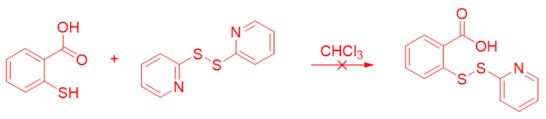
Throughout the project, I developed foundational experimental skills in organic synthesis. Handling sensitive reactions taught me the importance of precision in reagent manipulation and control of reaction parameters such as temperature and solvent systems. An essential component of this process was learning how to design efficient and feasible synthetic schemes. Using tools like **SciFinder** for literature reviews and reaction condition analysis, I was able to efficiently plan my synthetic routes. Additionally, **ChemDraw** software allowed me to accurately depict chemical structures and reaction mechanisms, which facilitated the execution of complex syntheses. Together, these tools enhanced my ability to design and optimize synthetic pathways for target molecules, improving my experimental efficiency.





Application of Chromatography Techniques

In the purification and analysis stages, I employed several chromatography techniques. **Gas Chromatography (GC)** was essential for separating and analyzing volatile organic compounds, helping to ensure the purity of the synthesized products. **High-Performance Liquid Chromatography (HPLC)** was used for the separation of complex mixtures, allowing for precise quantification of the components. **Ion Chromatography (IC)** was valuable for detecting and analyzing ionic species, while **Gel Permeation Chromatography (GPC)** enabled the analysis of polymers and large molecules based on size exclusion. Each chromatography method provided specific insights into the chemical nature of the synthesized products, contributing to both purification and quality control.

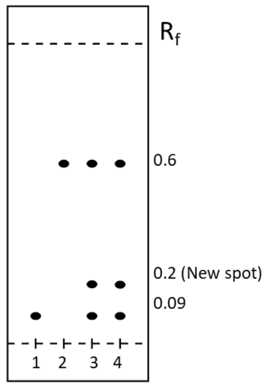


1- Thiosalicylic acid

2- Aldrithiol

3- Co spot

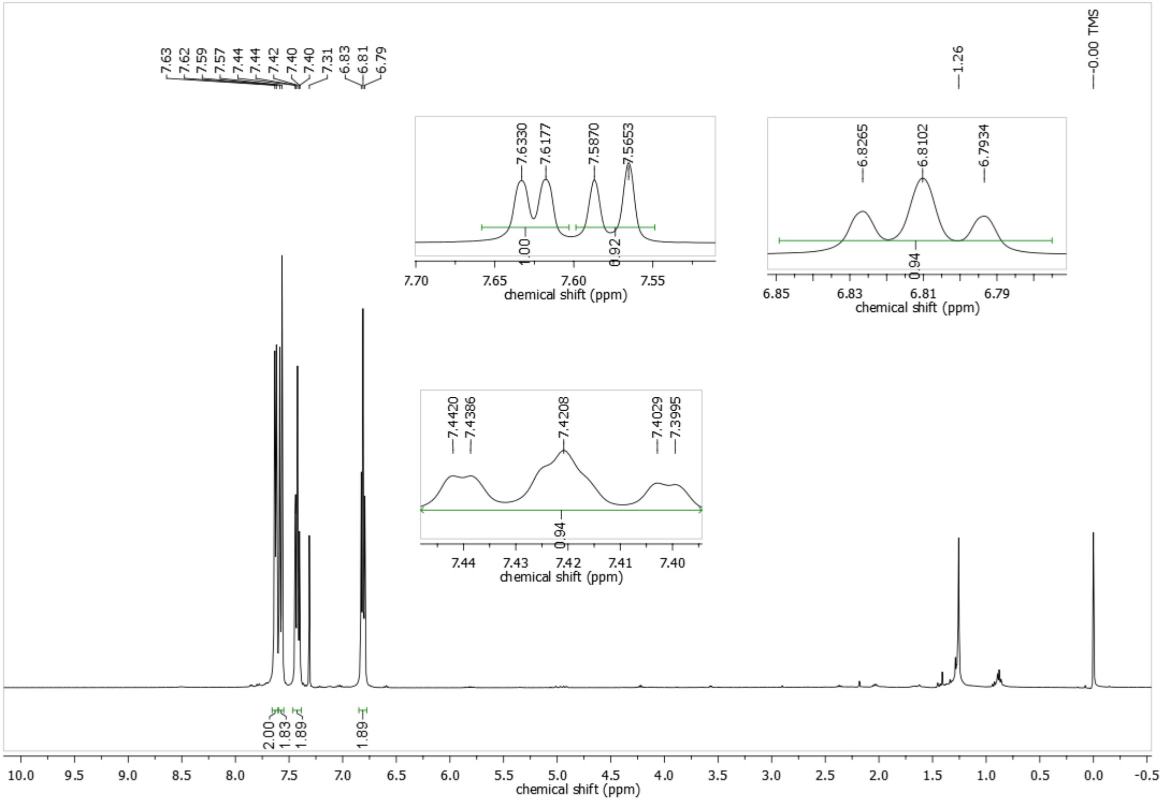
4- Reaction mixture



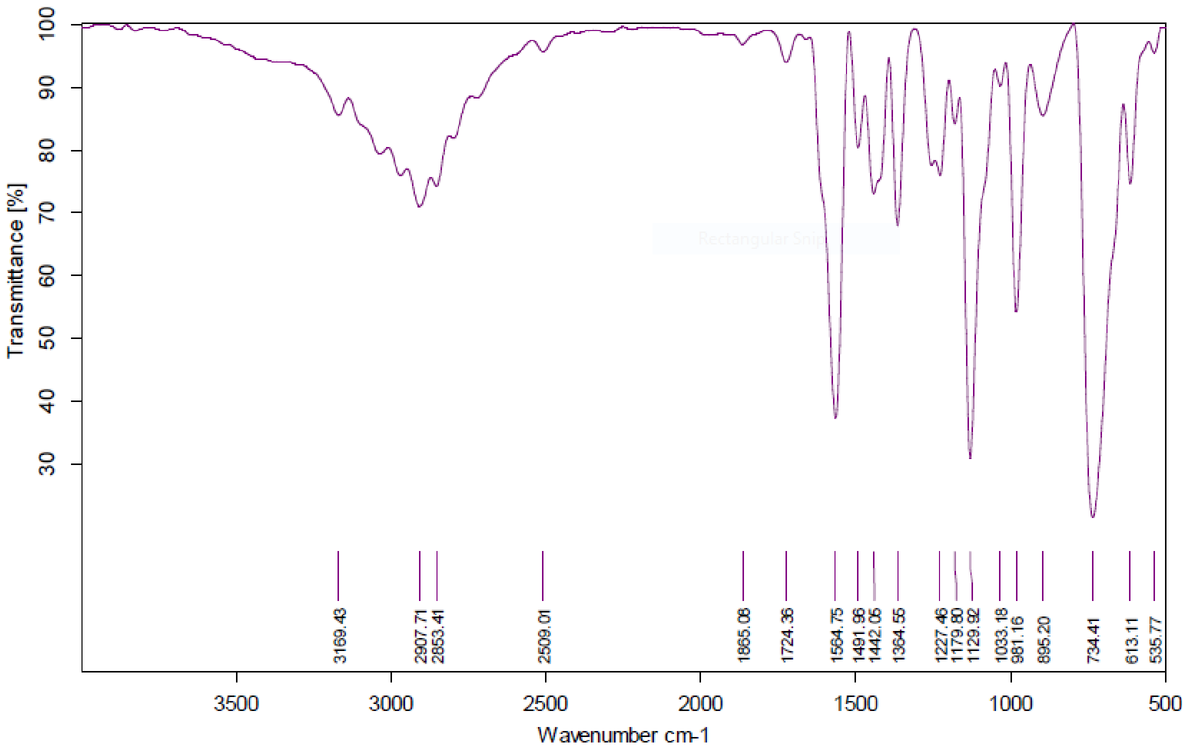
Solvent: 10% MeOH:$CHCl_3$
(Run twice)

Characterization of Organic Compounds Using Advanced Analytical Methods

Characterizing the synthesized compounds was a critical part of the project, allowing for the validation of molecular structures and compositions. I gained proficiency in **Nuclear Magnetic Resonance (NMR) spectroscopy**, using **Mnova software** to interpret the data. NMR spectroscopy was crucial for determining the molecular framework and confirming stereochemistry in my synthesized compounds. **Infrared (IR) spectroscopy** was employed to analyze functional groups and confirm the presence of specific bonds. Finally, **Mass Spectrometry** provided molecular weight data, helping confirm the molecular formula of the synthesized products. The combination of these techniques offered a detailed and accurate characterization of the synthesized organic molecules.



7.63
7.62
7.59
7.57
7.44
7.44
7.42
7.40
7.40
7.31
6.83
6.81
6.79
1.26
0.00 TMS
7.6330
7.6177
7.5870
7.5653
1.00
0.92
chemical shift (ppm)
6.8265
6.8102
6.7934
0.94
chemical shift (ppm)
7.4420
7.4386
7.4208
7.4029
7.3995
0.94
chemical shift (ppm)
2.00
1.83
1.89
1.89
chemical shift (ppm)



Transmittance [%]
3169.43
2907.71
2853.41
2509.01
1865.08
1724.36
1564.75
1491.96
1442.05
1364.55
1227.46
1179.80
1129.92
1033.18
981.16
895.20
734.41
613.11
535.77
Wavenumber cm-1

Conclusion

This project provided significant practical experience in the synthesis and characterization of organic compounds. I developed essential skills in designing synthetic routes, handling sensitive reactions, and applying various chromatography techniques for purification. Furthermore, I gained a thorough understanding of how to use advanced spectroscopic techniques such as NMR, IR, and mass spectrometry for characterizing and verifying the identity of compounds. These experiences have greatly enhanced my technical expertise, preparing me for further research challenges and applications in organic chemistry. This project not only improved my practical laboratory skills but also underscored the value of integrating theoretical concepts with experimental practice in scientific research.