Multi-Spectroscopic Optimization of Cobalt(II) meso-Tetra(4-sulfonatophenyl) Porphine Under Variable pH, Concentration, and Temperature

Wright, Sarah (School: Oxon Hill High School)

This project investigates the multi-spectroscopic characterization of Cobalt(II) meso-Tetra(4-sulfonatophenyl)Porphine (CoTPPS) and its metal-free counterpart, TPPS, under varying concentration, pH, and temperature conditions. Ultraviolet–Visible (UV–Vis) spectroscopy and fluorescence spectroscopy using the StellarNet system (SN-FL) were used to study the effects of concentration (0.375–2.2 uM), pH (4, 5, 6, 10), and temperature (40–90°C) on electronic absorption and emission. Raman spectroscopy (Raman) and Fourier Transform Infrared spectroscopy (FTIR) examined concentration and pH effects only, without temperature variation, to assess vibrational behavior and structural changes. Results show that CoTPPS is more sensitive to environmental factors than TPPS, with pH strongly influencing vibrational modes, concentration affecting both electronic and vibrational signals, and temperature primarily modulating electronic transitions. These findings clarify how cobalt coordination impacts molecular properties and provide guidance for optimizing porphyrins for sensing, photochemistry, and catalysis applications.

Awards Won: