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### Master Thesis Defense

Entitled

*TIME-RESOLVED PHOTOLUMINESCENCE OF 6-TIENYL-LUMAZINE FLUOROPHORE IN CELLULOSE  
ACETATE NANOFIBERS FOR DETECTION OF MERCURY IONS*

by

Noura Ali Humaid Alshamsi

Faculty Advisor

Dr. Na'il Saleh Ibrahim, Department of Chemistry

College of Science

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Abstract

Time-resolved photoluminescence measurements were used to characterize the photophysical properties of 6-thienyllumazine (TLm) fluorophores in cellulose acetate nanofibers (NFs) in the presence and absence of mercuric acetate salts. In solution, excited-state proton transfer (ESPT) from TLm to water molecules was observed at pH from 2 to 12. The insertion of thienyl group into lumazine (Lm) introduces *cis* and *trans* conformers while keeping the same tautomerization structures. Global and target analysis were employed to resolve the true emission spectra of all prototropic, tautomeric, and rotameric species for TLm in water. However, in NFs solid film no ESPT from TLm to a nearby water molecule was observed. The addition of NFs increases the excited-state lifetime of TLm in the solid state because of combined polarity/confinement effects. The solid-state fluorescence of TLm (in NFs) was quenched by mercuric acetate through different mechanisms—dynamic and static—depending on the applied pressure—atmospheric and vacuum, respectively. The new solid-state sensor is simple, ecofriendly, and instantly fabricated. 20  $\mu\text{mol}$  TLm-loaded NFs detects mercuric ions in the range from 0.2  $\mu\text{mol}$  to 2  $\mu\text{mol}$ . The formation of non-fluorescent ground-state complex between TLm molecules and mercuric ions inside the pores of NFs was achieved under vacuum condition.

**Keywords:** Lumazine, nanofibers, time-resolved photoluminescence, ESPT, fluorescence quenching.