

NOVEL FLUORESCENT COUMARIN-THIOPHENE-DERIVED SCHIFF BASES: SYNTHESIS, EFFECTS OF SUBSTITUENTS, PHOTOPHYSICAL PROPERTIES, DFT CALCULATIONS, AND BIOLOGICAL ACTIVITIES

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Introduction & Objectives:

Schiff bases are an active class possessing a wide spectrum of biological activity^{1,2}. Besides their vast use in the sensing field, coumarins are known for having many pharmaceutical activities, for instance antioxidant³, anticoagulant⁴, antibacterial⁵, antifungal⁶ and anticancer⁷. Thiophene is also known as an anti-inflammatory agent and used in the treatment of Alzheimer's disease⁸.

The purpose of this study is to investigate the photophysical characteristics of some Schiff bases, prepared from the reaction of coumarin-thiophene hybrid molecules and salicylaldehydes, in various homogeneous media by using the absorption and fluorescence spectroscopic techniques. The deprotonation behavior of each of the compounds **2a-i** as well as their cytotoxicity, *in vitro* antimicrobial activity, the DNA Interaction with the compounds, and the determination of BamHI and HindIII restriction enzyme digestion have also been investigated.

Methodology (Material and methods):

Compounds **2a-i** were obtained by imine formation reaction between the coumarin-thiophene hybrid molecules **1a-c** and salicylaldehyde or *o*-vanillin or 4-methoxy salicylaldehyde to afford **2a-i** in good yields of 76–86% (Scheme 1).

The compounds **2a-i** were tested for their inhibitory activities against five Gram-positive bacteria and six Gram-negative, and three types of fungi.

Results and Discussion:

The novel series of coumarin-thiophene Schiff bases have been prepared in good yields. In the calculation studies, it was shown that the bathochromic shift in absorption spectra of all the molecules is the results of increase in (ICT).

The cytotoxicities of the Schiff base compounds **2a-i** were tested against normal L929 fibroblasts and a549 human lung cancer (small cell). For the fibroblast cell, results are significant just for **2a** and **2b**. An increase in the concentrations of the compounds caused a decrease in the compounds. However, for the other samples (**2c-i**) increasing in the concentrations of the compounds caused an increase in the all of dying cells in comparison with the control cells. For the cancer cells, an increase in the concentrations of the compounds caused an increase in all the dying cells in comparison with the control cells.

Among the Schiff bases, **2c**, **f**, and **i** showed mild antimicrobial activity against *S. typhimurium* and *B. subtilis*, but none of them exhibited any antifungal effect on the tested concentration.

Finally, on the interactions of Plasmid DNA with the compounds, an enzymatic inhibition was observed and this demonstrates that, the inhibition of the enzymatic digestion is due to



compounds binding with DNA. Each of the Schiff base compounds was evaluated with TGA analysis and have been found to be thermostable up to at least 335 °C, which means that all of them are applicable as optical dyes.

Conclusion :

With respect to the cytotoxicities of the compounds, most of dye samples (**2c–i**) caused an increase in all the dying cells, as the concentrations of the compounds increased, in comparison with the control cells.

Only three of the Schiff bases showed mild antimicrobial activity against *S. typhimurium* and *B. subtilis*, but none of them exhibited any antifungal effect on the tested concentration.

On the interactions of Plasmid DNA with the compounds, the inhibition of the enzymatic digestion is due to compounds binding with DNA.

Keywords: Coumarin-thiophene, Schiff bases, Photophysical properties, Cytotoxicity, Antimicrobial activity, Plasmid DNA interactions.

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