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Novel Metal Complexes Based Anti-Cancer and Anti-Microbial Agents: Synthesis, Characterization, Molecular Docking and Pharmacological Activities

Sami A. AL-HARBI

Chemistry Department, University College in Al-Jamoum, Umm Al-Qura University, 21955, Makkah, Saudi Arabia

SUMMARY. **Cyanoacetic acid{1-[4-(3,4-dihydro-2H-quinoline-1-sulfonyl)phenyl]ethylidene} hydrazide Schiff base ligand (H_2L) has been synthesized by using 1-[4-(3,4-dihydro-*2H*-quinoline-1-sulfonyl)phenyl]ethanone (QSE) and cyanoacetohydrazide. The H_2L ligand was reacted with monodentate Fe(III), Cu(II), Co(II), Ni(II), and Ag(I) metal ions to produce complexes. The H_2L ligand and its metal complexes were characterized via elemental analysis, spectral data (FTIR, UV-visible,^{1}H NMR, mass), molar conductance, magnetic moment, TGA, and ESR measurements. The novel prepared (H_2L) ligand behaves as monobasic and coordinates to the metal ion in 1:1 stoichiometry via the azomethine nitrogen and enolic oxygen atom. The *in vitro* antimicrobial activities of ligand and their complexes were tested. Complex 1 showed good activity against *Klebsiella pneumoniae* as Gram-negative bacteria. Compound 2 showed a highly activity against *Mycobacterium tuberculosis*. In addition, in vitro cytotoxic activities of all the synthesized compounds were evaluated on MCF-7, HTC-116, and HEPG-2 cell lines. Complex 4 exhibited a significant inhibition against MCF-7 and HTC-116 cell lines, H_2L exhibited a significant inhibition against HEPG-2 cell line, and complex 1 exhibited a significant inhibition against MCF-7, HTC-116, and HEPG-2 cell lines compared to MTX as a reference drug. Docking studies involving MOE (Molecular Operating Environment) were carried out to find the potential binding affinities between the ligand and the DHFR enzyme. Complex 2 showed more interaction with DHFR, which leads to inhibition of this enzyme.**

RESUMEN. Se ha sintetizado un ligando de base de Schiff (H_2L) ácido cianoacético{1-[4- (3,4-dihidro-2H-quinolin-1- sulfonil)fenil] etilideno}, usando 2H-quinolina-1-sulfonil) fenil] etanona (QSE) y cianoacetohidrazida. El ligando de H_2L se hizo reaccionar con iones metálicos monodentados Fe (III), Cu (II), Co (II), Ni (II) y Ag (I) para producir complejos. El ligando H_2L y sus complejos metálicos se caracterizaron mediante análisis elemental, datos espectrales (FTIR, UV-visible, RMN 1H, masa), conductancia molar, momento magnético, TGA y medidas ESR. El ligando preparado (H_2L) se comporta como monobásico y se coordina con el ion metálico en estequiometría 1: 1 a través del nitrógeno de azometina y el átomo de oxígeno enólico. Se analizaron las actividades antimicrobianas *in vitro* del ligando y sus complejos. El complejo 1 mostró una buena actividad contra *Klebsiella pneumoniae* como bacterias Gram-negativas. El compuesto 2 mostró una alta actividad contra *Mycobacterium tuberculosis*. Además, se evaluaron las actividades citotóxicas in vitro de todos los compuestos sintetizados en las líneas celulares MCF-7, HTC-116 y HEPG-2. El complejo 4 mostró una inhibición significativa frente a las líneas celulares MCF-7 y HTC-116, el H_2L exhibió una inhibición significativa frente a la línea celular HEPG-2 y el complejo 1 exhibió una inhibición significativa contra células MCF-7, HTC-116 y HEPG-2 comparado con el MTX como fármaco de referencia. Se realizaron estudios de acoplamiento con MOE (Molecular Operating Environment) para encontrar las posibles afinidades de unión entre el ligando y la enzima DHFR. El complejo 2 mostró más interacción con DHFR, lo que conduce a la inhibición de esta enzima.

KEY WORDS: anti-cancer and anti-microbial agents, metal complexes, molecular docking, pharmacological activities, synthesis.

* Authors to whom correspondence should be addressed. *E-mail:* sadharbi@uqu.edu.sa

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