SYNTHESIS, CHARACTERIZATION, ELECTROCHEMISTRY AND BIOLOGICAL PROPERTIES OF SCHIFF BASES AND THEIR METAL COMPLEXES

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For my parents, to whom I will always be indebted.

UNIVERSITI MALAYA

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ABSTRACT

A series of new indole hydrazone Schiff bases and their metal complexes have been synthesized, characterized and evaluated for anti-ulcerogenic activity.The Schiff bases derived from indole-3-acetic acid hydrazide and 2-hydroxyacetophenone and their zinc(II), nickel (II) and copper complexes were synthesized by condensation in ethanol. The IR, ^{1}H and ^{13}C NMR, UV Visible data indicate that the hydrazone ligands are coordinated to zinc metal. Indole hydrazones coordinated to zinc(II), nickel(II) and copper(II) metals as dimer ligands. The IR spectrum of the free ligand indicates that in solid state the ligand remains in the keto form. Recrystallization of ligand and complex 5-methyl-2-hydroxyacetophenone in DMSO obtained suitable crystals for x-ray analysis, indicating two ligands coordinated to the central metal atom. TGA Analysis were also performed showing degradation of the all metal complex to MO. The cyclic voltammetry of these zinc complexes exhibited irrevisible oxidation peaks. The electro-oxidation of zinc(II) complexes displayed a diffusion –controlled electron transfer reaction process.

For the biological testing, the ligands and their metal complexes except for 2-HapIH and $Ni_{5\text{-}CH3\text{-}2\text{-}HapIH}$ show better anti-ulcerogenic activity compared to cimetidine, the standard drug. The results show that substituted ligands inhibit gastric lesion more than the unsubstituted ligand and electron withdrawing substituent shows better inhibition compared to electron donating substituent. Metal complexes show better inhibition of gastric ulcer compared to their free ligands.

ABSTRAK

Satu siri baru Schiff base indole hidrazon dan kompleks logam telah disintesis, dicirikan dan aktiviti anti-mikrobialnya telah dikaji. Kompleks zink (II), nikel (II) dan kuprum (II) telah disediakan dalam etanol melalui kondensasi templat beberapa jenis hydrazida dengan keton. Data IR, ^{1}H and ^{13}C NMR, dan ultralembayung UV menunjukkan ligan bergabung dengan logam zink (II). Indole hidrazon bergabung dengan logam zink (II), nikel (II) dan kuprum (II) sebagai ligan dimer. Spektrum IR menunjukkan ligan berkeadaan pepejal dalam keadaan keto. Penghabluran semula ligan dan kompleks 5-metil-2-hydroxyacetophenone di dalam DMSO memberikan hablur bersesuaian untuk analisis x-ray di an menunjukkan ligan berada di tengah atom logam. Analisis TGA menunjukkan degradasi semua kompleks kepada MO. Voltammetri siklik kompleks menunjukkan puncak pengoksidaan tak berbalik. Pengoksidaan-elektro zink (II), nikel (II) dan kuprum (II) menunjukkan proses pembauran tindak balas satu electron.

Untuk ujian biologi, semua ligan dan kompleks kecuali 2- HapIH and $Ni_{5\text{-}CH3\text{-}2\text{-}HapIH}$ menunjukkan aktiviti anti-ulser yang lebih baik berbanding standard dadah, simitidin. Keputusan menunjukkan ligan tetukarganti menghalang pertumbuhan gastrik daripada ligan yang tidak mempunyai kumpulan tertukarganti. Elektron penderma menunjukkan halangan yang baik berbanding elektron penerima. Kompleks logam menunjukkan halangan yang paling baik berbanding ligan bebas.

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LIST OF ABBREVIATIONS

α	The electron transferred coefficient
A	The area of the surface electrode, cm^2
C^*_R	Initial concentration of sample, mol dm^{-3}
D	Diffusion Coefficient, cm^2s^{-1}
D_0	Diffusion coefficient at infinite temperature, cm^2s^{-1}
E_p	Peak potential, V
E^0	Formal standard potential, V
F	Faraday constant, 96485 C eqv^{-1}
R	Gas constant, 8.314 J mol^{-1} K^{-1}
I_p	Peak current, A
n_a	The number of electron transferred in rate determining step
n	The number of electron transferred
r	Radius, cm
T	Absolute temperature, K
%	Percentage
˚C	Degree Celsius
ml	Mililiter
mg	Miligram
mmol	Milimoles
g	Gram (s)
NMR	Nuclear Magnetic Resonance
IR	Infrared

UV- Vis	Ultraviolet/visible
CHNS	Carbon, Hydrogen, Nitrogen and Sulfur
TGA	Thermogravimetric Analysis
DMSO	Dimethylsulfoxide