

spectrum of product in  $\text{CDCl}_3$  evidenced the formation of the dimer of 1,4-dichlorobenzene, 4,4'-dichlorobiphenyl. In summary, dimerization of 1,4-dichlorobenzene was carried out using Ullmann coupling. Reaction condition optimization and characterization of trimer, tetramer

and other oligomers of 1,4-dichlorobenzene are currently underway.

**Keywords:** [n]Cycloparaphenylenes, Ullmann coupling, 1,4-dichlorobenzene, 4,4'-dichlorobiphenyl

Abstract No: SB 3

## Synthesis and characterization of platinum complexes with ethylenediamine and diethylenetriamine sulphonamide ligands towards biological applications

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Diethylenetriamine and ethylenediamine are renowned tridentate and bidentate chelating ligands, and have been utilized to synthesize sulfonamide derivatized platinum complexes. The sulphonamide ligands were synthesized with the use of sulfonyl chlorides and the relevant amine in dioxane, while the platinum complexes were formulated by treating *cis*-[Pt(DMSO)<sub>2</sub>Cl<sub>2</sub>] with the synthesized ligand. Synthesis of novel platinum-ethylenediamine sulphonamide complexes (C1=[PtCl<sub>2</sub>(N(SO<sub>2</sub>biphenyl)ethylenediamine)], C2=[PtCl<sub>2</sub>(N(SO<sub>2</sub>azobenzene)ethylenediamine)]) was accomplished using synthesized ethylenediamine sulphonamide ligands, (L1=N(SO<sub>2</sub>biphenyl)ethylenediamine, L2=N(SO<sub>2</sub>azobenzene)ethylenediamine) while that of novel platinum-diethylenetriamine sulphonamide complexes (C3=[PtCl<sub>2</sub>(N(SO<sub>2</sub>azobenzene)diethylenetriamine)], C4=[PtCl<sub>2</sub>(N(SO<sub>2</sub>quinoline)diethylenetriamine)]) was carried out with the use of synthesized diethylenetriamine sulphonamide ligands (L3=N(SO<sub>2</sub>azobenzene)diethylenetriamine, L4=N(SO<sub>2</sub>quinoline)diethylenetriamine). In this study, amphiphilic ligand systems were considered as an ideal approach to enhance uptake of coordination complexes by target cells. This was executed by employing the hydrophilicity of ethylenediamine and diethylenetriamine and the lipophilicity of the aromatic bulky sulphonamide fragment bound to its terminal amine group. The ligands and complexes were synthesized

in good yield (66%-96%) and characterization of these synthesized compounds was conducted using UV-Visible spectroscopy, FTIR spectroscopy and NMR spectroscopy. UV-Visible spectra of the ligands indicate clear changes from starting material along with the presence of intra-ligand  $\pi \rightarrow \pi^*$  and  $n \rightarrow \pi^*$  transitions, giving rise to absorption peaks around 200-600 nm. Shifts of these peaks can be observed in the UV-Visible spectra of the complexes. The strong S-N band signifying the formation of the sulphonamide bond, was detected in the FTIR spectra of the ligand and was found to shift to higher wavenumbers in the ethylenediamine complexes as well as in the diethylenetriamine complexes. The shift could possibly be due to the donation of the nitrogen lone pair to form the platinum coordination complex. The peaks relevant to stretching vibration frequency of -NH<sub>2</sub> were found in the 3300-3500 cm<sup>-1</sup> region of the FTIR spectra of the ethylenediamine ligands and could be seen shifting to lower wavenumbers in the complex due to coordination with platinum. <sup>1</sup>H NMR spectra were acquired for the ligands and complexes, where the noteworthy regions include the aromatic protons found in the range of 6.76-9.00 ppm and the methylene protons of the amine group in the ethylenediamine and diethylenetriamine backbone of the ligands, appearing at 2.80-3.00 ppm. Complexes display slightly higher fluorescence intensities in comparison to that of the ligands. Structural data was obtained from single crystal X-ray diffraction of L2 and C1 which validated

the formation of the ligand and complex and provided distinct evidence of the deprotonation of the amine group in ethylenediamine upon coordination to metal in complex C1. Results of the *in silico* analysis of physico-chemical and pharmacokinetic parameters as well as drug-likeness of the ethylenediamine sulphonamide ligands show that they obey Lipinski's rule of five along with having lead-likeness. Swiss TargetPrediction was used

to identify several probable biological targets, suggesting that the novel compounds may act as lead compounds for novel anti-cancer drugs.

**Keywords:** platinum, ethylenediamine, diethylenetriamine

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## Invasive plant-derived biochar for sorptive removal of hexavalent chromium in aqueous media

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Due to increased industrialization and urbanization, chromium (Cr) has been commonly used and released to the environment in a variety of industrial activities. Two primarily available valence states of chromium in the environment are trivalent chromium (Cr III) and hexavalent chromium (Cr VI). Cr(VI) is more soluble in water, causing health hazards to human beings and animals by all exposure routes. The rapid spread of invasive plants poses a severe threat to natural ecosystems. The present study aimed to investigate the effectiveness of biochars derived from the local invasive plant 'Giant Mimosa' (*Mimosa pigra*) in removing hexavalent chromium from contaminated water. In this study, plant species *Mimosa pigra* was subjected to slow pyrolysis at 350 °C within a 2-hour residence time to produce pristine *Mimosa pigra* biochar (MPBC). The physicochemical properties of MPBC were characterized by BET, SEM, XRD and FTIR analysis. The pH at point of zero charge (pHpzc) of MPBC was obtained as pH 7.874 by surface titrations at different NaNO<sub>3</sub> ionic strengths. Cr(VI) adsorption was studied as a function of pH with three different background electrolyte strengths. The highest

Cr(VI) removal from solution occurred at pH 3 with an adsorption capacity of 3.10 mg g<sup>-1</sup>, and adsorption decreased when the pH increased from 3 to 10. Results also indicated that the removal of Cr(VI) by the MPBC modified biochar depended on solution pH, and a low pH value was favorable for the Cr(VI) removal with all three ionic strengths. The results herein revealed that the *Mimosa pigra* derived biochar prepared in this study has a promising application in sorption and detoxification of Cr(VI) from an aqueous solution. Future studies will be carried out to investigate the sorption kinetic behaviors of MPBC and sorption parameters will also be calculated through batch isotherm experiments. Furthermore, pilot-scale testing will be conducted to investigate the applicability of the laboratory-tested material in the actual environment. The effectiveness of organo-functionalized biochars derived from *M. pigra* in removing hexavalent chromium from contaminated water will be assessed in future studies.

**Keywords:** Adsorption, Remediation, Invasive plants, *Mimosa pigra*