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Research Topic: Synthesis, Characterization and Applications of Cashew Nut Shell Liquid derived Coordination Polymers

Abstract

The aim of our work is to utilize *Col* to design CPs based on *Col* and assess its biological and other possible applications.

The thesis has been divided into five chapters as follows:

- Chapter 1, includes general introduction and literature review on CNSL and its constituent *Col*, with special emphasis on CPs and characterization techniques of CPs.
- Chapter 2, includes one-pot synthesis of Cardanol-Formaldehyde (ColF) and aromatic diisocyanate (Toluene diisocyanate) based coordination polyurethane [M(II)-ColF-ArPU] films/coatings via following "Green" chemistry principles. The effect of electronic configuration of metal ions, *i.e.,* half-filled, partially-filled and full-filled 'd' orbitals and the use of aromatic diisocyanate on the development and finally properties of coordination PU films was studied. The physico-mechanical properties were analyzed by standard methods. The thermal stability and morphology were also investigated. It was overall found that the introduction of metal in the polymer resulted in improved mechanical, thermal properties and enhanced antimicrobial activity compared to virgin polymer, and hence can find application as mechanically robust, thermally stable and antibacterial free-standing thin films as well as coatings.
- Chapter 3, includes 'in-situ' synthesis of aliphatic diisocyanate (Hexamethylene diisocyanate) based coordination polyurethane films/coatings via sustainable route. The effect of use of aliphatic diisocyanate and electronic configuration of metal ions, *i.e.,* half-filled, partially-

filled and full-filled ‘d’ orbitals on the structure, geometry and properties of coordination PU films was studied. The thermal stability alongwith flame retardant behavior was analyzed with the aid of TGA-DTG and DSC technique. The morphology was analyzed with the help of SEM-EDX, TEM and XRD technique. A comparative study with the previous chapter (Chapter 1), i.e., M(II)-ColF-ArPU was also done. It was observed that the developed metal incorporated films, M(II)-ColF-AliPU, were thermally stable with good mechanical properties but comparatively less than M(II)-ColF-ArPU based films. The antibacterial studies were also conducted to found their application as antibacterial films/coatings and thus Mn(II)-ColF-AliPU and Co(II)-ColF-AliPU based films showed promising results.

- Chapter 4, dealt with *in-situ* synthesis of ColF and aromatic amine (Furfurylamine) based coordination polybenzoxazine [M(II)-ColF-ArBz] films by the use of fully bio-based resources via following green chemistry principles. The high-temperature baked polymeric films were developed whose mode of formation was established by ATR technique. It was overall found that the introduction of metal in the polymer resulted in improved thermal stability and antimicrobial activity compared to virgin polymer, and hence can find application as thermally stable (moderate) and antibacterial free-standing thin films.
- Chapter 5, includes *in-situ* synthesis of ColF and aliphatic amine (Hexamethylene tetramine) based coordination polybenzoxazine [M(II)-ColF-AliBz] films via following cleaner and environment friendly approach. It was overall found that the introduction of metal in the polymer resulted in improved thermal stability, better mechanical strength and antimicrobial activity compared to virgin polymer, and hence can find application as thermally stable and antibacterial free-standing thin films.

Present chapter also describes the suggestion of future plan.