Notification No. : 561/2024

Date of Award : 24/06/2024

Name of Scholar : Md. Sajid

Name of Supervisor : Dr. Saif Ali Chaudhry

Name of the Department : Chemistry

Topic of research : Synthesis, characterization and application of surface modified bimetallic sulphides nanomaterials for the removal of toxic pollutants from water through adsorption.

Findings

The thesis comprises of the six chapters. Chapter 1, titled "Introduction and Literature Review" provides a concise overview of water pollution, dye contamination, water treatment methods, the adsorption process, and includes a catalog of previously employed bimetallic sulphide nanomaterials for dye removal. Chapter 2, titled "Materials and Methodology" encompasses the production of nanomaterial, a comprehensive description of the methods employed, and an outline of the instrumentation utilized for analyzing the physicochemical attribute of the adsorbents. This chapter also delves into the experimental procedures and mathematical equations used to assess the adsorption characteristics of the nanomaterials towards pollutants. Chapter 3, titled "Synthesis, Characterization, and Application of the Ni-Co-S@Citric acid" highlights the synthesis of novel Citric acid functionalized-Nickel-Cobalt-Sulphide nanoparticles via simple co-precipitation method. The equilibrium sorption capacity of Ni-Co-S@Citric acid has been found 90.91 mg/g for Methylene blue, 232.55 mg/g for Crystal violet, 357.14 mg/g for Nile blue, 142.9 mg/g for Congo red, 1111 mg/g for As(III) and 2000 mg/g for As(V). Chapter 4, titled "Synthesis, Characterization, and Application of the Ni-Zn- S@Cyclodextrine" investigates the synthesis of a hybrid nanomaterial, denoted as Ni-Zn-S@Cyclodextrine, through a cost-effective and easy co-precipitation method, by combining Cyclodextrine and Ni-Zn-S inorganic components. The resulting nanomaterial has

been thoroughly characterized and applied for the adsorptive removal of Crystal violet and Congo red dyes from their solutions. Ni-Zn-S@Cyclodextrine exhibited a strong affinity for both the dyes, demonstrating a maximum adsorption capacity of 138.20 mgg^{-1} for Congo red and 129.95 mgg^{-1} for Crystal violet dyes at 303 K. Chapter 5, titled "Synthesis, Characterization, and Application of the Mn-Co-S@CTAB" explores the cost-effective and simple co-precipitation technique for the synthesis of bimetallic sulphide (Mn-Co-S@CTAB) nanomaterial, a hybrid of Manganese and Cobalt sulphide along with some surface modification through hexadecyltrimethylammonium bromide (CTAB). Congo Red (CR) and Malachite Green (MG) dye were adsorbed out of its solution using the produced nanomaterial, which has been studied. The Mn-Co-S@CTAB demonstrated strong attraction to the CR dye with adsorption capacity of 263.15 mg/g at 303 K, while an adsorption capacity of 163.93 mg/g was exhibited for MG dye. Chapter 6, titled "Synthesis, Characterization, and Application of the Ni-Zn-S@Date seeds powder" presents a comprehensive investigation into the development, characterization, and application of a novel hybrid nanocomposite, denoted as Ni-Zn-S@Date seed powder, for water treatment purposes. The synthesis of this innovative nanocomposite was accomplished through a facile co-precipitation method, and its preparation mechanism has been meticulously elucidated. the maximum adsorption capacity (Qmax) reached 208.33 mgg^{-1} and 121.95 mgg^{-1} for CR and NB dye, respectively.