Preface

Wastewater that contains antibiotics and artificial dyes presents serious threats to the environment and public health, so it must be carefully treated before being released. Because of the growing volume produced by different sectors, the poisonous dye wastewater treatment procedures currently in use are insufficient, negatively affecting aquatic ecosystems and photosynthetic activity. Furthermore, even at low concentrations, the buildup of antibiotics in the environment has sparked worries because of their potential side effects, which include hypersensitivity, irregular digestion, and allergic reactions. Conventional techniques include advanced oxidation, ozonation, membrane filtration, reverse osmosis, electrochemical technologies, and biological treatments are frequently expensive and produce unwanted byproducts when used to remove antibiotics and dyes from wastewater. Adsorption is the recommended alternative because to its cost-effectiveness, simplicity of design, and ease of operation among the various options.

Polyaniline is a highly conductive polymer due to the presence of –NH– groups, making it widely used in industries such as batteries, electronics, solar cells, sensors, electromagnetic shielding, and anti-corrosion coatings. Its good physicochemical characteristics, mechanical flexibility, environmental stability, ease of synthesis, and monomer availability are all factors in its popularity. Because of its excellent interactions with different contaminants through its active amine and imine groups, polyaniline has been thoroughly researched as an adsorbent for wastewater treatment. Sand is a promising adsorbent material since it is widely available, stable, effective, and non-toxic. Nevertheless, its efficacy is diminished by its restricted functional groupings. Sand can be mixed with polyaniline to create an organic-inorganic hybrid material that has better mechanical, thermal, and chemical properties, thereby increasing its usefulness. This polyaniline-impregnated sand is a cost-effective adsorbent capable of withstanding extreme physicochemical conditions and offers reusability, making it economical for wastewater treatment applications Sugarcane bagasse (SCB), a byproduct of the sugarcane industry, is rich in cellulose, hemicellulose, lignin, and other compounds like wax. SCB has been utilized in producing various materials, including methane, cellulose, bioethanol, hemicellulose, and composites. Cellulose, a glucose polymer, constitutes about 40–50% of SCB, while the rest is made up of wax, lignin, and hemicellulose. Various studies have been conducted to extract these components from SCB. However, there is no existing literature on the use of novel polyaniline/sand composite materials and natural sugarcane bagasse as adsorbents for dye and antibiotic removal. The research presented in the thesis, divided into five chapters, provides a detailed investigation into these composite materials for the removal of dyes and antibiotic.

Chapter I This chapter contains a general introduction of water pollution, pollutants, synthetic dyes, classification of dyes, applications of dyes, antibiotics, drawbacks of antibiotic, methods of the removal of pollutants/adsorbate, nature of adsorbate, adsorbents, adsorption, types of adsorptions, factor affecting on adsorption, adsorption isotherms and kinetics.

Chapter II Described the literature review on Polyaniline based composite, Polyaniline/sand, Natural adsorbents (sugarcane bagasse) composite used for dyes and antibiotic removal.

Chapter III The detailed synthesis, characterization, and application of Novel Ganga-sand encapsulated polyaniline granules for effective remediation of textile and pharmaceutical wastewater.

Chapter IV This chapter represent the Low-cost chemically treated sugarcane bagasse for removal of cationic, anionic, and neutral dyes from aqueous solution.

Chapter V Describes the summary of the present research work with its future scope.

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