Synthesis, Characterization and Application of PEGylated Bimetallic Oxide Snail Shell Based Adsorbent for Remediation of Methylene Blue Polluted Wastewater

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Certification

This is to certify that Abisoye Abidemi, ADARAMAJA with matriculation number LCU/PG/002217 carried out this research work titled "Synthesis, Characterization and Application of PEGylated Bimetallic Oxide Snail Shell-based Adsorbent for Remediation of Methylene Blue Polluted Wastewater" in the Department of Chemical Science, Faculty of Applied Sciences, Lead City University, Ibadan, Oyo State, for the award of Master Degree in Industrial Chemistry and that this has not been previously submitted.

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Dr. A. O. Bamisaye **Date**

(Supervisor)

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Dr. O. M. Ighodaro **Date**

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Dedication

The entire thesis is a thank-you to Almighty God and my loving parents, Mr. and Mrs. Adaramaja, for their unfailing love and guidance throughout my life.

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Even though the above-mentioned institutions and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any found in the work.

Abstract

Dyes polluted waste water has been shown to be catastrophic and lethargic to the environment; flora and fauna, resulting to an imbalance in the eco-system. This study focuses on the synthesis of bimetallic oxide and PEGylated biomass based adsorbent for effective uptake of methylene blue (MB) dye from waste water. The snail shell-based sorbents were synthesized through wet impregnation followed by calcination, which were characterized using FTIR, XRD, SEM and EDX. The batch adsorption experiment of methylene blue was carried out by varying the operating parameters such as contact time, temperature, pH, adsorbent dose, and initial adsorbate concentration. The optimum pH for this study was found at pH 3 with dosage of 10 mg, at 25 °C uptake of MB at 93.5% (CaO), 94.19% (Al_2O_3/Fe_2O_3-CaO) and 91.91% (PEGylated Al_2O_3/Fe_2O_3-CaO). SEM images of the catalysts showed well-organized rod-like and cubic aggregates, while XRD showed a highly crystalline bio-sorbent material. The EDX confirms an effective impregnation of the biomass material with the metal oxide while FTIR spectra showed the presence of O-H, N-H, C=O and C-O moiety available for the efficient adsorption of MB. Langmuir-Freundlich isotherm model best described the adsorption data for all the catalysts: CaO with R^2 value=0.994 and Q_{max}= 349.37mg/g. Al_2O_3/Fe_2O_3-CaO; with R^2 value = 0.986 and Q_{max} = 218.5 mg/g and PEGylated Al_2O_3/Fe_2O_3-CaO; with R^2 value = 0.984 and Q_{max} = 1570 mg/g The study is best fitted into Brouers Sotolongo sractals kinetics at a recorded R^2 = 0.991 and Q_{max}= 78.91 mg/g (CaO). R^2 = 0.995 and Q_{max} = 52.10 mg/g (Al_2O_3/Fe_2O_3-CaO), and R^2= 0.992 and Q_{max} =27.69 me/g (PEGylated Al_2O_3/Fe_2O_3-CaO). This study revealed that snail shell based adsorbent could be regarded as a promising biosorbent for the remediation of methylene Blue polluted wastewater.

Keywords: Waste water, Methylene blue, Catalysts, Biomass based adsorbent.

Word Count: 284

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List of Acronyms

Abbreviation	Meaning
AC	Activated Carbon
AOP	Advanced Oxidation Process
MB	Methylene Blue
MIP	Molecular Imprinted Polymers
MOF	Metal Organic Framework
nm	Nano Meter
PEG	Polyethylene Glycol
pH	Potential Of Hydrogen
PPM	Parts Per Million
REDOX	Reduction-Oxidation
SS	Snail Shell

UV	Ultraviolet
Zpc	Point Of Charge