DETERMINATION OF PHYSICO-CHEMICAL PARAMETERS AND REMOVAL OF BIS(2-ETHYLHEXYL) PHTHALATE FROM WASTEWATER USING *PROSOPIS JULIFLORA* BIOCHAR/CARBON NANOTUBES COMPOSITE ADSORBENT

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented, to the best of my knowledge, for examination or award of master's degree in any institution.

Signature..... Date.....14/10/2024.....

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Recommendation

This thesis has been examined, passed and submitted with our approval as the university supervisors.

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DEDICATION

I dedicate this work to my entire family comprising of Mr. and Mrs. Mutua, Sabina, Simon, Asunta, Patrick, Edward, Nathan, Francis and Lydia.

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ABSTRACT

Phthalates, such as BEHP, are endocrine-disrupting compounds commonly used as plasticizers. Their presence in wastewater, often from industrial and household effluents,

poses health risks including congenital anomalies, cancer, and chronic toxicity. The high cancer prevalence in Meru County has been linked to toxicants in effluent released into Kathita River, used for domestic purposes and irrigation. This is attributed to the inefficiency of the lagoon wastewater treatment technology in removing chemicals like BEHP. This study evaluates the physico-chemical properties and BEHP levels in wastewater from Meru Sewage Treatment Plant and explores the adsorption of BEHP using a Prosopis juliflora biochar/carbon nanotubes composite adsorbent. The temperature, pH, conductivity, turbidity, TDS, TSS, BOD and COD of the wastewater were determined using the standard APHA methods for wastewater, the concentrations of heavy metals using AAS while those of BEHP using HPLC. The following mean values were reported after data analysis: BEHP 0.055mg/L, Cu ND, Pb 0.042mg/L, Cd 0.0019 mg/L, COD 65.99 mg/L, TSS 29.3mg/L, TDS 639.17mg/L, turbidity 117.9FTU, conductivity 1079.9µS, pH 7.3, temperature 26^{o}C and BOD_5 65.9 mg/L; for dry season. Only pH and COD exceeded WHO limits for wastewater discharge into environment. The wet season parameter mean values were: COD 359.7mg/L, TSS 198.3mg/L, TDS 2094.2mg/L, turbidity 105FTU, conductivity 1244µS, pH 8, temperature 26℃, BEHP 0.0429mg/L, Cu 0.47mg/L, Pb 0.037mg/L, Cd 0.056mg/L and BOD_5 71.2mg/L. The temperature, TDS, BOD, Cu and Pb met WHO limit while conductivity, turbidity, TSS, COD and Cd exceeded. The composite adsorbent was characterized using FTIR and powder XRD. The dominant functional groups of the composite were C=O, CO_2, OH-, Si-OH, C=N, MgO, $CaCO_3$, and SiO_2. The composite adsorbent was very efficient in the adsorption of BEHP with up to 96% removal in the samples at determined optimum adsorption parameters of; pH 5, temperature 24 ℃, 15 minutes contact time and an adsorbent dose of 200 mg. The isotherm studies showed that the adsorption process was in agreement with the Freundlich isotherms with R^2 value of 0.90469 while the kinetic studies revealed that BEHP adsorption followed pseudo second order model with R^2 of 0.994. It was concluded that the application of biochar/CNTs composite adsorbent for the removal of BEHP from the wastewater is relatively cheaper and eco-friendly and should be applied for treatment of wastewater for irrigation and domestic use to improve water quality and minimize health risks associated with BEHP.