SUSTAINABLE MATERIALS FOR THE REMOVAL OF ANTIBIOTICS IN WATER

[1]ABUDU, L.S., [2]HAMED R. SADABAD, [3]ARNSCHEIDT J, [4]TRETSIAKOVA-MCNALLY S, [5]O'HAGAN B, [6]ADEYEMI D.K, [7]OLUSEYI T, [8]ADAMS L.A, [9]COLEMAN H.M

[1], [6]Department of Pharmaceutical Chemistry, University of Lagos, Nigeria
[2,3]School of Geography and Environmental Sciences, Ulster University
[4]Belfast School of Architecture and Built Environment, Ulster University
[5]School of Biomedical Sciences, Ulster University
[7,8]Department of Chemistry, University of Lagos, Nigeria
[1,9]School of Pharmacy and Pharmaceutical Science, Ulster University
E-mail: [9]h.coleman@ulster.ac.uk

The presence of antibiotic residues in the environment has led to the spread of antibiotic resistance, which has posed a lot of threats to human health. The major sources of these pollutants are effluent from both industrial and domestic wastewater treatment plants,agricultural run-off and untreated sewage into the waterbodies[1]. The continued increase in the world population has led to a continuous increase in the demand for food and this has led to the generation of more agricultural waste[2]. This study focuses on the use of a waste product - sawdust (*Swietenia mahagoni) for* the removal of antibiotics (vancomycin) from water. Vancomycin is an antibiotic that has been classifies as high risk from the World Health Organisation as priority pathogens like *Enterococcus faecium* are becoming resistant[3].

The sawdust was sourced from mahogany trees (Lagos, Nigeria). The sawdust was washed, dried, and ground to particles with sizes ranging from 38-850 μm before undergoing a pre-treatment with 30% w/v sulfuric acid. Adsorption experiments were conducted with vancomycin hydrochloride dissolved in water with a concentration of 10 ug/ml and its level was measured using HPLC fitted with a photodiode array detector.

The materials were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). SEM images showed that the materials were rod-like in shape with an average particle size of 8.003 ± 5.610 μm, and4.124 ± 1.209 μm for both the untreated and treated sawdust respectively. The zeta potential values of both the untreated and treated mahogany sawdust particles were -14 ± 1.2 mV and -20.4 ± 2.12mV respectively, indicating that the surface charges for both adsorbents are negative. The increase in the zeta potential after pre-treatment with sulphuric acid, is due to the breakage of some intermolecular bonds and leads to the presence of more negatively charged functional groups on the surface. Adsorption studies show that both untreated and treated mahogany sawdust can reduce the concentration of vancomycin in water by more than 40% and within 5 minutes of contact between the adsorbent and the antibiotic. The optimal contact time was found to be 30 minutes for the untreated sawdust, and there was a decrease in the uptake as the adsorbent dosage increases from 0.1 g to 1g per 25ml. Adsorption studies showed the waste material was effective for the adsorption of vancomycin from water and that the treated sawdust was more efficient.

REFERENCES

[1] Akinsanmi, Oluwashina, et al. "Tackling Antimicrobial Resistance: Adsorption of meropenem and ciprofloxacin on lignocellulosic substrate from sawdust." European Wastewater Management Conference. 2019.
[2] Muhammad, Syaifullah, et al. "Insights into Agricultural-Waste-Based Nano-Activated Carbon Fabrication and Modifications for Wastewater Treatment Application." Agriculture 12.10 (2022): 1737.
[3] WHO, Global Priority List of Antibiotic-resistant bacteria to guide research, discovery and development of new antibiotics, 25th February 2019.

★★★