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**Preparation, characterization, and adsorption mechanism of cogon grass-derived cellulose nanofibers/graphene nanoplatelets aerogels for diclofenac sodium removal from water**

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**Abstract**
The presence of diclofenac sodium (DCF) residues in water streams poses significant risks to aquatic ecosystems and human health. The ecotoxicity of pharmaceutical contaminants can be mitigated by developing advanced materials to supplement conventional wastewater treatment methods. This study aims to prepare and characterize the physicochemical properties of cogon grass-based cellulose nanofibers/graphene nanoplatelets (CNF/GnP) aerogels for the removal of DCF residues from aqueous solutions. CNF was successfully isolated from cogon grass through a series of processes, including bleaching, alkaline treatment, and TEMPO-mediated oxidation, followed by mechanical disintegration. Fourier Transform Infrared Spectroscopy (FTIR) revealed the composition of CNF and indicated the presence of physical crosslinking with GnP. Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) confirmed CNF diameters ranging from 1.1 to 5.3 nm. Thermogravimetric analysis (TGA) demonstrated an increase in thermal stability from raw cellulose (269.94 °C) to CNF aerogel (296.96 °C) and CNF/GnP aerogel (309.45 °C). Both CNF aerogel and CNF/GnP aerogel were applied for the adsorption of DCF. The adsorption capacity and removal efficiency of CNF/GnP aerogel (219.3 mg/g and 95.47 %) were comparable to those of CNF aerogel (204.2 mg/g and 88.81 %) under optimal conditions: pH 4, 0.045 g adsorbent dosage, and an initial DCF concentration of 10 mg/L, indicating that the CNF matrix plays a significant role in the adsorption process. The adsorption behaviour followed the Langmuir isotherm and pseudo-second-order kinetic models. This study demonstrates the potential of CNF aerogel and CNF/GnP aerogel as sustainable adsorbents for DCF removal, contributing to the development of green technologies in alignment with Sustainable Development Goals. © 2024 Elsevier B.V.

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Aerogel; Cellulose; Cellulose nanofibers; Diclofenac sodium; Graphene; Graphene nanoplatelets; Nanocellulose

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