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Role of surface functional groups in functionalized biochar for environmental remediation of antibiotics in single and competitive mode

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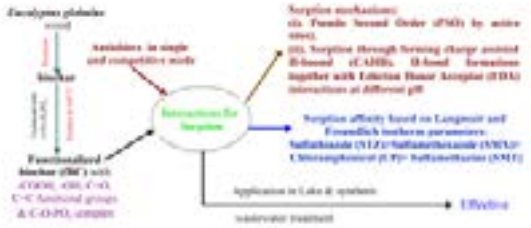
Functionalized biochar (fBC) was prepared through pyrolysis of woody biomass and functionalized using *o*H_3PO_4 acid. Characterizations of fBC were carried out using Fourier Transmittance Infrared spectroscopy (FTIR), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), ζ potential measurement, and scanning electron spectroscopy (SEM) with energy dispersive spectroscopy (EDS) analysis. FTIR result revealed that fBC contained –OH, -CH, C=O, C=C and –COOH functional groups, whereas Raman spectra clearly indicated the development of highly disordered structure (e.g. C-O, D band) along with graphitic structure (C=C i.e. G band) with increased intensity ratio (ID/IG). XPS result also confirmed that the present of C=C (at 284.8 eV), C-O (at 286.3 eV), C=O (at 287.8 eV), and -COOH (at 289.0 eV). ζ potential value was found to be at pH ~2.5. SEM showed development of microspore structure onto fBC surface. EDS data suggested that fBC mostly contained carbon (~75%), oxygen (~10%), nitrogen and phosphorous. The application of fBC at different pH to remove emerging contaminants antibiotics such as sulfathiazole (STZ), sulfamethazine (SMT), sulfamethoxazole (SMX) and chloramphenicol (CP) antibiotics in both single and competitive mode from water was found very effective. Maximum sorption capacity was observed at the pH range of 4.0-5.0 for all antibiotics. Functional groups of fBC played a vital role for removing those antibiotics at different pH. H-bond formation, π-π electron donor acceptor and electrostatic interactions were the main sorption mechanisms at different pH. The application of prepared fBC for treatment of antibiotics from different water and wastewater was successful. Therefore, fBC is a potent sorbent for removing antibiotics from water.

Image



Recent Publications

1. Mohammad Boshir Ahmed, Hao Ngo, Md. Abu Hasan Johir and Kireesan Sornalingam (2018) Sorptive removal of phenolic endocrine disruptors by functionalized biochar: competitive interaction mechanism, removal efficacy and application in wastewater. Chem. Eng. J. 335:801-811.
2. Ahmed M B, Zhou J L, Ngo H H, Guo W, Johir M A H, Sornalingam K and Sahedur Rahman M (2017) Chloramphenicol interaction with functionalized biochar in water: sorptive mechanism, molecular imprinting effect and repeatable application. Sci Total Environ. 609:885-895.
3. Mohammad Boshir Ahmed, John L Zhou, Huu Hao Ngo, Wenshan Guo, Md. Abu Hasan Johir and Dalel Belhaj (2017) Competitive sorption affinity of sulfonamides and chloramphenicol antibiotics toward functionalized biochar for water and wastewater treatment. Bioresour. Technol. 238:306-312.
4. Mohammad Boshir Ahmed, John L Zhou, Huu Hao Ngo, Wenshan Guo, Md. Abu Hasan Johir and Kireesan Sornalingam (2017) Single and competitive sorption properties and mechanism of functionalized biochar for removing sulfonamide antibiotics from water. Chem. Eng. J. 311:348-358.

Biography

Mohammad B Ahmed is a final year PhD student at University of Technology Sydney (UTS), Australia. He is also serving as Technical Assistant at Environmental Engineering Research Laboratories. Before that, he has completed his graduation and post-graduation from Department of Applied Chemistry and Chemical Technology from University of Rajshahi, Bangladesh. He has published more than 20 papers (including 12 as first author) in reputed journals. He has received several awards including publication awards and award for finalist in NSW Young Water Profession of the Year 2017 awarded by UTS and Australian Water Association, respectively.

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