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Selective sequestration of perfluorinated compounds using activated biochar decorated carbon backbone N-rich polymers

YEONJI YEA

Kyungpook National university

Presenting Author: dpduswl@naver.com

Selective sequestration of perfluorinated compounds using activated biochar decorated carbon backbone N-rich polymers

Yeon ji Yea, Gyuri Kim, Chang Min Park*

Department of Environment Engineering, Kyungpook National University, Daegu 41566, Republic of Korea.

Presenting author: Tel: +82-10-2582-9534, E-mail: dpduswl@naver.com

* Corresponding author. Tel: +82-10-3594-8210, E-mail: cmpark@knu.ac.kr

Poly- and per-fluorinated compounds (PFCs) are globally used for several applications including lubricants, cleaning agents, and fire retardants and an emerging concern owing to the persistent and ubiquitous characteristics in the environment. PFCs are highly toxic in nature and can cause serious health problems such as immune system disorder and cancer. Thus, it is imperative to develop remediation technology for PFCs removal from aqueous environments. In this study, activated biochar (AB) decorated polyaniline (PANI) hybrid composites (AB@*x*%PANI, x=0, 25, 50, 75, and 100% of PANI) were fabricated *via* in-situ chemical oxidation and co-precipitation with calcination. The synthesized AB@*x*%PANI hybrid composites were characterized by X-ray diffraction, Fourier transform-infrared spectroscopy, nuclear magnetic resonance, X-ray photoelectron spectroscopy, thermogravimetric analysis, field emission-scanning electron microscopy, and high-resolution transmission electron microscopy. The results demonstrated that AB@75%PANI showed the highest adsorption capacities toward perfluorooctanoate (PFOA), perfluorooctanesulfonate (PFOS), and perfluorohexane sulfonate (PFHxS) in ultrapure water, surface water, and wastewater effluents than its parent compounds of AB and PANI. The adsorption kinetics and isotherms indicated that adsorption behaviors of PFOA, PFOS, and PFHxS over AB@75%PANI followed a pseudo-second-order and Langmuir isotherm models, respectively.

The co-existing heavy metals could improve the removal efficiency by serving as bridge ions to form inner-sphere AB@75%PANI-Me^{2+}-PFOA/PFOS/PFHxS surface complexes. The findings of this work provide significant insights to sequestrate PFOA, PFOS, and PFHxS from the aqueous environment and open a gateway for practical applications.

Keywords : PFCc, Activated biochar , Polyaniline, Adsorption