Biochar and sustainable environmental development towards adsorptive removal of pollutants: Modern advancements and future insight

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ABSTRACT

Globally, environmental pollutants, involving emerging contaminants, are a developing issue. The tremendous growth of industry and the continuous emission of untreated effluents are significant challenges that pollute the ecosystem. Efforts are being focused on finding eco-friendly, cost-effective strategies to remediate various pollutants. Feedstock consists of organic wastes comprising food waste, compost, animal dung, agricultural residues, and sludge. Traditional treatment methods (primary and secondary treatment processes) are ineffective at mitigating or removing pollutants. Therefore, an effective, inexpensive, environmentally friendly tertiary treatment technique is urgently required. Biochar (BC) has intriguing uses in ecological functioning, such as pollutant removal, carbon emissions mitigation, and wastewater treatment. Various types of adsorbents (BCs), such as pristine and engineered BC, are utilized for the separation or remediation of heavy metals (HMs), polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides from polluted areas to promote sustainable development. This paper provides critical insight into BC derived from various biomass feed stocks for the adsorptive removal of pollutants. This article also examines numerous research that offers alternatives for environmental conservation and management, as well as the modern advancements of BC for environmental protection. The potential of various agricultural waste products and their ability to absorb contaminants was discussed. The challenges and future insight of research on the surface-based removal of pollutants were also explored.

KEYWORDS

Biochar; Contaminants; Biochar hazard; Environmental sustainability; Future insight

ACKNOWLEDGMENTS

We gratefully acknowledge Universiti Malaysia Pahang's research grant (RDU2203102) for financially supporting this study. This research was also supported by a Postdoctoral Fellowship from Prince of Songkla University, Thailand.