Opinion

Organic pollutants in water and its remediation using biowaste activated carbon as greener adsorbent

Abstract

The occurrence of organic pollutants in water bodies has elevated in recent years causing serious damage to human health and aquatic ecosystems. Cost-effective, environmental friendly and renewable techniques therefore need to be employed for the treatment of wastewater before discharging into natural water bodies. Biomass material serves as a promising, ecofriendly, and economical resource for synthesis of versatile adsorbent such as activated carbon. Thus, the present manuscript gives a view about the removal of organic pollutant from wastewater by activated carbon synthesized from biomass.

Keywords: Organic pollutants, Biomass, Activated carbon

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Opinion

Water is a vital resource for sustaining life, however in present scenario the access to clean safe water around the world has become a burning concern especially in developing and emerging countries attributing to increase in population, climate change and environmental water pollution by sewages, industrial effluents, chemicals, domestic wastes, pesticides, pharmaceuticals and so on. These pollutants consist of organic, inorganic, biological and radioactive substances that make the water unfit for any use and poses a threat to human health, animals and plants as they are either toxic, carcinogenic or mutagenic.[1–3] According to report of World Water Development 2017, currently only 20% of wastewater produced globally receives proper treatment while majority of it is discharged without any form of treatment into the environment.[4] The occurrence of organic pollutants in wastewater have increased tremendously in modern years and has become a critical concern because of their toxicity, semi volatile nature, low water solubility, high bioaccumulation and non-biodegradability under normal environmental condition.[5–7] These types of organic pollutants such as phenolic compounds, polycyclic aromatic hydrocarbons (PAHs) and agricultural chemicals (organic pesticides and organic herbicides) have been considered as critical problems as it leads to aquatic system depletion, environmental degradation and also affect human health such as reproductive system disorders, endocrine disruption, obesity and cancer.[8,9] In this regard, water purification have now become the main critical issue world-wide for which strict legislation has been formulated by World Health Organization for organic compounds for Drinking-Water Quality.[10,11] Many ongoing studies in water purification remain a severe challenge to governments, scientists and industries, as lack of cost-effective water purification technology has aggravated the crisis of clean and safe water for the fast expanding population. Over the years, various methodologies to remediate these water threats have been developed, such as photocatalytic degradation,[12] advanced oxidation,[13] micellar enhanced ultra filtration,[14] combined photo-fenton and ultrasound, advanced oxidation, aerobic degradation, adsorption, filtration, ozonation, coagulation, flocculation, distillation, extraction, precipitationetc.[15] However, Adsorption has been found to be superior in terms of cost-effectiveness, simplicity of design and ease of operation and has always evolved as a front line remediation for water purification. Selective adsorption utilizing biological materials, mineral oxides, activated carbons, or polymer resins have been widely documented as a potential method for removal of pollutants from water recently.[16] Among all the adsorbents, activated carbon has been used extensively for remediation of various organic pollutants from wastewater.[17,18] A wide variety of activated carbon has been synthesized from different biowaste materials such as olive stones,[19] vermiculate plant,[20] bamboo dust, coconut shell, groundnut shell, rice husk and straw,[21] banana peel and pomegranate peel,[22,23] Apricot Stone,[24,25] rice husk,[26] corn cob,[27] etc. Activated carbon prepared from biomass apricot stone shells was found to remove of 2, 4-dinitrophenol with an adsorption capacity of 232 mg/g.[28] Monolayer adsorption of oxamyl with adsorption capacity of 147.05mg/g was also studied using apricot stone activated carbon.[24] Removal of phenol using ratten saw dust activated carbon and corn grain-based activated carbon was studied having adsorption capacity of 149.25mg/g and 256mg/g respectively also been reported.[29,30] India being the second most populated country also experiences fresh water scarcity above all other challenges and it is estimated that about 38,254 million litres per day of wastewater is generated especially in urban areas and only 21% of it is treated and the rest of the untreated water accounts for the pollution of water with different kind of contaminants in addition to pollution created by natural sources.[31–33] These issues could be addressed by converting the tons of biomass into wealth by production of cost-effective versatile adsorbent with high adsorption capacity, low energy requirement and high removal efficiency. As biomass is easily available, cheaper and renewable, there is a bigger scope of research forsynthesis of activated carbon as an adsorbent for removal of organic compounds from water.

Conclusion

In our view, more biomass material could be explored and utilize for preparation of inexpensive activated carbon over high cost commercial activated carbon which could further be used for efficient

removal of organic pollutants as well as other contaminants from polluted water. Moreover, activated carbon prepared from biowaste material will prove as an economical, renewable and greener source of adsorbent for wastewater treatment.

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Conflict of interest

None.

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