

Spent Coffee Ground Biochar

This technology offers a method to convert and upcycle spent coffee grounds into a biochar capable of removing contaminants from water. Compared to activated carbon, it significantly reduces the carbon footprint by not generating greenhouse gasses.

What is the Problem?

Carbonaceous media such as activated carbon possess high porosity, large surface area, and surface functional groups that facilitate removal of many contaminant classes via pore diffusion, surface complexation, and other weak interactions. As such, activated carbon is widely used adsorbent in water treatment. Activated carbon is generated by pyrolysis of carbon-rich source materials (e.g., coal, tar coconut husks, tar pitch) followed by chemical activation to achieve high reactivity for air and water purification. Unfortunately, activated carbon is expensive (\$1000/ton), high levels of chemical additives are needed to achieve activation, and its production contributes to greenhouse gas emissions (18 kg CO₂ eq/kg produced). Conversely, biochar is a low-cost pyrolyzed carbonaceous media that can offer similar benefits as activated carbon, and can be produced under more environmentally friendly conditions. Biochar biomass food waste sources can include wheat straw, rice hulls, wood, and switchgrass. The intended functions of the porous, carbonaceous biochar are to improve soil properties and fertility, and retain water and nutrients in soils as a soil amendment. Recent investigations suggest a capacity of biochar to remove nutrients, bacteria and pathogens, heavy metals, and organic compounds in water.

What is the Solution?

The solution is a method of converting and upcycling spent coffee grounds into a biochar capable of removing contaminants from water. The used coffee grounds are washed and pyrolyzed. The heating and pyrolysis conditions are controlled to increase the resulting biochar surface area and porosity. A benign industrial caustic agent (potassium hydroxide) is added during pyrolysis to further maximize these biochar properties that contribute to contaminant removal. Preliminary tests reveal that the modified spent coffee ground biochar can remove over 95% of harmful organic contaminants in water. Furthermore, negligible amounts of caffeine are leached from the biochar which further increases its safety in water treatment applications. The granular media is well-suited for filtration applications for urban stormwater and point-of-use filtration to increase contaminant removal.

What is the Competitive Advantage?

Technology ID

BDP 8713

Category

Cleantech/Water Technologies
Selection of Available
Technologies

Authors

Jessica Ray

Learn more



The benefit to activated carbon is that it is already well-suited for water purification and is currently used in home filters and municipal water treatment plants to remove dissolved organic carbon, select trace metals, and organic compounds in water. However, producing activated carbon generates greenhouse gasses and contributes to global climate change. This system is sustainable as it upcycles spent coffee grounds, significantly reducing the carbon footprint when compared to activated carbon.

Patent Information:

[WO2022093908A1](#)