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Use of porous algal biochar in water treatment in the state of Ceará in Brazil

Thursday, 3 June 2021 14:40 (1 hour)

Growing world population and global warming impact the quality of water resources on a global scale. Eutrophication, the process of enrichment of water by nutrients, is considered one of the most common causes of water quality impairment. A direct outcome of eutrophication is an increase in the production of algae. In northeastern Brazil, a semi-arid climate region, cyanobacteria dominance and algae blooms are quite recurrent due to several factors, namely, high temperature, long photoperiods, and abundant nutrient availability. Water shortage and poor water quality are linked because contamination reduces the supply of water and increases the costs of treating water for use. Therefore, this poses a serious problem for a region with water scarcity and drought such as Ceará. In addition to the general deteriorating impact on the ecosystem, algae are associated with cyanobacteria which are known to produce toxic and/or noxious secondary metabolites that can render large quantities of water unsuitable for drinking. Cyanotoxins are primarily produced intracellularly and their release into the water makes the treatment process more costly, as well may pose a serious health hazard to animals and humans. Conventional methods of remediating persistent pollutants (agrochemicals, antibiotics, PAHs, PCBs, aromatic dyes, heavy metals, ammonia, nitrate, phosphate, sulfide, etc.) mainly employ methods that are costly and often generate large amounts of chemical residues (chemical precipitation, ion exchange, adsorption using activated carbon, and membrane separation processes), which have no economic value.

Biochar, a charcoal material, is an emerging material that has proven effective in environmental remediation and water treatment technologies. Biochar is produced using the thermal process of pyrolysis in which biomass feedstock is heated in absence of oxygen. As a result, an organic rich porous solid material is produced that alongside its use for environmental remediation can play a role in carbon sequestration and contribute to achieving net zero targets by reducing the emission of carbon dioxide. While efforts in manufacturing biochar have increased in the last decade, there is still a need for advancing the manufacturing processes (optimising the pyrolysis process) to improve biochar quality and quantity based on locally available feedstock. A key factor controlling the performance of biochar in environmental remediation applications is its multi-scale porous structure. To achieve a porous biochar an activation process (either chemical or physical) is required. In this study, we evaluate the use of drinking water treatment sludge as a feedstock for manufacturing porous biochar. We examine the possibility of applying the produced biochar to treat the contaminated water from which the algae were harvested. We use the algae from the Gavião water reservoir in the state of Ceará in Brazil.

The application of algal-biochar in water reservoirs in the state of Ceará will gradually control the occurrence of algae blooms. In the meantime, the use of algal-biochar in water treatment can contribute to creating a circular economy where the unwanted residue will be regarded as a feedstock for the production of biochar as a high-value product.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

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