Characterization and sodium cations sorption capacity of chemically modified biochars produced from agricultural and forestry wastes.

Autorzy

Agnieszka Medyńska-Juraszek

Maria Luisa Álvarez

Andrzej Białowiec

Maria Jerzykiewicz

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Streszczenie

Excessive amounts of sodium cations (Na+) in water is an important limiting factor to reuse poor quality water in agriculture or industry, and recently, much attention has been paid to developing cost-effective and easily available water desalination technology that is not limited to natural resources. Biochar seems to be a promising solution for reducing high loads of inorganic contaminant from water and soil solution, and due to the high availability of biomass in agriculture and forestry, its production for these purposes may become beneficial. In the present research, wheat straw, sunflower husk, and pine-chip biochars produced at 250, 450 and 550 C under simple torrefaction/pyrolysis conditions were chemically modified with ethanol or HCl to determine the effect of these activations on Na sorption capacity from aqueous solution. Biochar sorption property measurements, such as specific surface area, cation exchange capacity, content of base cations in exchangeable forms, and structural changes of biochar surface, were performed by FTIR and EPR spectrometry to study the effect of material chemical activation. The sorption capacity of biochars and activated carbons was investigated by performing batch sorption experiments, and adsorption isotherms were tested with Langmuir's and Freundlich's models. The results showed that biochar activation had significant effects on the sorption characteristics of Na+, increasing its capacity (even 10-folds) and inducing the mechanism of ion exchange between biochar and saline solution, especially when ethanol activation was applied. The findings of this study show that biochar produced through torrefaction with ethanol activation requires lower energy demand and carbon footprint and, therefore, is a promising method for studying material applications for environmental and industrial purposes.

Słowa kluczowe

biochar, modification, sodium, sorbent, saline water, soil

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