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Peatmoss Derived Biochar as an Effective Sorbent for Removing VOCs in Groundwaters

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Extended Abstract

Peatmoss derived biochars were produced at the pyrolytic temperatures of 300, 500, and 700 °C and were tested for the effectiveness of VOCs removal in waters. As the pyrolytic temperature increases, the carbon content were increased from 66% to 84% and hydrogen and oxygen contents were decreased from 4% to 1% and 19% to 4%, respectively. The surface areas of the biochars were 2 m^2/g at the pyrolysis temperature of 300 °C, and were increased to 200 and 300 m^2/g at 500 and 700 °C. FT-IR analysis showed that functional groups such as hydroxyl, nitro, and carboxyl groups were present at biochar produced at 300 °C, however, the functional groups were removed in the biochars produced at higher temperatures.

Sorption kinetics and equilibrium experiments were conducted with 6 selected VOCs, such as benzene (BZN), toluene (TOL), ethylbenzene (EBZ), p-xylene (pXYL), trichloroethylene (TCE), and tetrachloroethylene (PCE), which are the most common VOCs found in contaminated groundwater of South Korea. Sorption equilibrium was attained within 6 hrs with first order kinetic rate constants of 0.5 hr^{-1} for the VOCs tested. Biochar produced at 500 °C showed the highest sorption capacity for all VOCs, although biochars produced at 300 and 700 °C showed similar sorption capacity.

The biochars produced at 500 °C were tested on actual TCE contaminated groundwater and showed an excellent removal efficiencies both in batch and column experiments.

References

[1] M. Ahmad, A. U. Rajapaksha, J. E. Lim, M. Zhang, N. Bolan, D. Mohan, M. Vithanage, S. S. Lee, and Y. S. Ok, "Biochar as a sorbent for contaminant management in soil and water: a review," *Chemosphere*, vol. 99, pp. 19-33, 2014.

[2] S. Babel, T. A. Kurniawan, "Low-cost adsorbents for heavy metals uptake from contaminated water: a review," *Journal of Hazardous Materials*, vol. 97, pp. 219-43, 2003.

[3] L. Beesley, E. Moreno-Jimenez, J. L. Gomez-Eyles, E. Harris, B. Robinson, T. Sizmur, "A review of biochars' potential role in the remediation, revegetation and restoration of contaminated soils," *Environmental Pollution*, vol. 159, pp. 3269-82, 2011.

[4] J. S. Cha, S. H. Park, S. C. Jung, C. Ryu, J. K. Jeon, M. C. Shin, Y. K. Park, "Production and utilization of biochar: A review," *Journal of Industrial and Engineering Chemistry*, vol. 40, pp. 1-15, 2016

[5] S. Wang, C. Zhao, R. Shan, Y. Wang, H. Yuan, "A novel peat biochar supported catalyst for the transesterification reaction," *Energy Conversion and Management*, vol. 139, p. 89, 2017.