CARBONIZATION OF TREE OF HEAVEN FOR BIOCHAR PRODUCTION: A PROMISING UTILIZATION OF INVASIVE SPECIES FOR PESTICIDE ADSORPTION

Danilo ERDELJAN[1], Jelena PLATIŠA[1], Aleksandra JANOŠEVIĆ LEŽAIĆ[2], Snežana USKOKOVIĆ-MARKOVIĆ[2], Maja MILOJEVIĆ-RAKIĆ[1*], Danica BAJUK-BOGDANOVIĆ[1]

[1]*University of Belgrade-Faculty of Physical Chemistry, Belgrade, Serbia*
[2]*University of Belgrade-Faculty of Pharmacy, Belgrade, Serbia*
maja@ffh.bg.ac.rs

The increasing presence of pesticides in soil and water systems has raised concerns about their adverse effects on ecosystems and human health. To address this issue, biochar has emerged as a sustainable solution due to its high adsorption capacity [1]. This study focuses on utilizing tree of heaven (Ailanthus altissima) biomass as a feedstock for biochar production [2], aiming to develop an efficient and environmentally friendly approach for pesticide adsorption.

Tree of Heaven, a fast-growing and invasive species, poses a significant challenge to ecosystems. By converting this biomass into biochar through carbonization, we can simultaneously address the issue of invasive species while creating a valuable resource for environmental remediation. The carbonization process involves pyrolysis under controlled conditions to transform the biomass into a stable carbon-rich material with a high surface area and porosity. In this study, we investigate the influence of carbonization parameters, such as temperature, and $ZnCl_2$ activation on the physicochemical properties and adsorption capacity of prepared biochar samples. Characterization techniques, including Scanning Electron Microscopy, Fourier-Transform Infrared, and Raman spectroscopy, were employed to evaluate the biochar's morphology and functional groups.

Batch adsorption experiments are conducted to assess the performance of the Tree of Heaven biochar in removing neonicotinoid pesticides from aqueous solutions. The effects of initial pesticide concentration, contact time, and suspension composition (single components or pesticide mixtures) on the adsorption process are investigated. Adsorption isotherms were employed to analyze the adsorption behavior and understand the mechanisms involved.

Preliminary results demonstrate that the activated tree of heaven-derived biochar exhibits a remarkable adsorption capacity for neonicotinoids. Tested biochar samples present promising adsorbents due to their porous structure and abundance of functional groups, enabling hydrogen bonding with investigated pesticides. Furthermore, the invasive species-derived biochar shows promising stability and reusability, making it a sustainable alternative for long-term pesticide removal applications. These findings contribute to the development of efficient and sustainable solutions for environmental remediation, addressing both the issue of invasive species and pesticide contamination.

1. Safaei Khorram M., Zhang Q., Lin D., Zheng Y., Fang H., Yu Y., J. Environ. Sci. 2016, 44:269–279.
2. Bieser J.M.H., Al-Zayat M., Murtada J., Thomas S.C., Can. J. Soil. Sci. 2022, 102:213–224.