

The potential of biochar and modified kaolinite composites for chromium immobilization and its uptake by *Spinacia oleracea* L. from chromium contaminated soil

HAFIZ MUHAMMAD TAUQEER^{1*},
MUHAMMAD IQBAL², ALI KHAN
SHAHBAZ²

¹Department of Environmental Sciences, University of Gujrat, Hafiz Hayat Campus, Gujrat 50700, Pakistan.

Email address: enviro1537@gmail.com

²Department of Environmental Sciences and Engineering, Government College University, Faisalabad, 38000, Pakistan.

The applications of tannery wastewater significantly contaminated farmlands with chromium (Cr) and have been recognized as an environmental issue due to its bioaccumulation in crops and vegetables. Thus, there is a need to take remedial measures to reduce its bioavailability to crops grown on them. An experiment was conducted to explore the efficiency of coconut-shell biochar and modified kaolinite composites for Cr immobilization and subsequently, its uptake by *Spinacia oleracea*. To achieve this aim, first, kaolinite was modified by heating (450 °C) and the biochar prepared by pyrolyzing the coconut-shell at 450 °C, respectively. A suspension of kaolinite (with and without heating) was prepared by dissolving it in deionized water. The biochar was dipped into the suspension of kaolinite (with and without heating) and stirred for two hours. The soil was spiked with 120 mg kg⁻¹ Cr by using K₂Cr₂O₇. Later, the spiked soil was amended with biochar and kaolinite composites and *S. oleracea* subjected to grow for 120 days. The treatments deployed in this study are control, BCHR, SK (simple kaolinite without heating), MKC (modified kaolinite clay), BCHR+SK and BCHR+MKC. The results revealed that the BCHR+MKC treatment significantly improved *S. oleracea* biomass and reduced Cr concentrations in roots over control. Furthermore, significantly the highest increase in the activities of antioxidants was recorded in BCHR+MKC and BCHR treatments over control. Our results conclude that biochar and kaolinite composites are suitable amendments in reducing Cr phytotoxicity.

Key words: Antioxidants, Biochar, chromium, immobilization, kaolinite, soil