BALL MILLED BIOCHAR EFFECTIVELY REMOVES SULFAMETHOXAZOLE AND SULFAPYRIDINE ANTIBIOTICS FROM WATER AND WASTEWATER

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Release of antibiotics into the environment, which often occurs downstream of wastewater treatment plants, poses a human health threat due to the potential development of bacterial antibiotic resistance. In this study, laboratory experiments were conducted to evaluate the performance of ball milled biochar on the removal of two sulfonamide antibiotics, sulfamethoxazole (SMX) and sulfapyridine (SPY) from water and wastewater. Aqueous batch sorption experiment using both pristine and ball milled biochar derived from bagasse (BG), bamboo (BB) and hickory chips (HC), made at three pyrolysis temperatures (300, 450, 600 oC), showed that ball milling greatly enhanced the SMX and SPY adsorption. The 450 oC ball milled HC biochar and BB biochar exhibited the best removal efficiency for SMX (83.3%) and SPY (89.6%), respectively. A range of functional groups were produced by ball milling, leading to the conclusion that the adsorption of sulfonamides on the biochars was controlled by multiple mechanisms including hydrophobic interaction, π–π interaction, hydrogen bonding, and electrostatic interaction. Due to the importance of electrostatic interaction, SMX and SPY adsorption was pH dependent. In laboratory water solutions, the Langmuir maximum adsorption capacities of SMX and SPY reached 100.3 mg/g and 57.9 mg/g, respectively. When tested in real wastewater solution, the 450 oC ball milled biochar still performed well, especially in the removal of SPY. The maximum adsorption capacities of SMX and SPY in wastewater were 25.7 mg/g and 58.6 mg/g, respectively. Thus, ball milled biochar has great potential for SMX and SPY removal from aqueous solutions including wastewater.

PRESENTER BIO: Jinsheng is a Ph.D. candidate, and his research interest is mainly on emerging water contaminants (e.g., antibiotics and microplastics) and environmental nanotechnology. He has already published ten peer-reviewed research papers (three as the leading author) in top environmental science and engineering journals and a book chapter on emerging contaminants in the environment.