

ON THE EVALUATION OF THE EFFECT OF TORREFACTION AND SLOW PYROLYSIS ON POROSITY AND ADSORPTION PERFORMANCE OF BIOCHAR AND ACTIVATED CARBONS OBTAINED FROM PALM KERNEL SHELL

Marlon Cordoba, University of La Guajira, Colombia
 mfcordoba@uniguajira.edu.co

Farid Chejne, National University Of Colombia, Sede Medellín, Colombia
 Jader Aleán, University of La Guajira, Colombia

Carlos Gómez, National University Of Colombia, Sede Medellín, Colombia

Key Words: Torrefaction, slow pyrolysis, activated carbon, biochar, adsorption.

In this work the impact of torrefaction and slow pyrolysis on the porosity and structural changes of biochar and activated carbons from palm kernel shells was evaluated and is summarized in figure 1. A detailed analysis of torrefaction at various temperatures as a pretreatment stage was conducted, proposing a torrefaction-slow pyrolysis-activation route. The biochar and activated carbon produced from this route were compared with those from direct pyrolysis. Results confirm changes in devolatilization and recombination dynamics, indicating that prior torrefaction favors more decarbonylation reactions resulting in the loss of compounds and functional groups via CO₂ release, which are not evident from direct pyrolysis. In addition, a thorough characterization of biochar was carried out at different pyrolysis temperatures (220, 250, 280, 350, 550, and 700°C) to understand how the porous structure evolves during the slow pyrolysis process. Additionally, the study examines how these changes impact the performance of biochar and activated carbon as adsorbent material for CO₂ and H₂S in gas phase, revealing significant differences in their behavior with each of these gases, related to the porous structure, surface chemistry, and chemical bond type. The results obtained allow us to conclude that the predominant adsorption mechanism for carbon dioxide is physisorption, related to changes in the microporous structure, while for hydrogen sulfide, in addition to a developed porous surface, the oxygenated groups contained on the surface promote a greater adsorption capacity derived from the affinity of these groups with polar molecules with covalent bond-type.

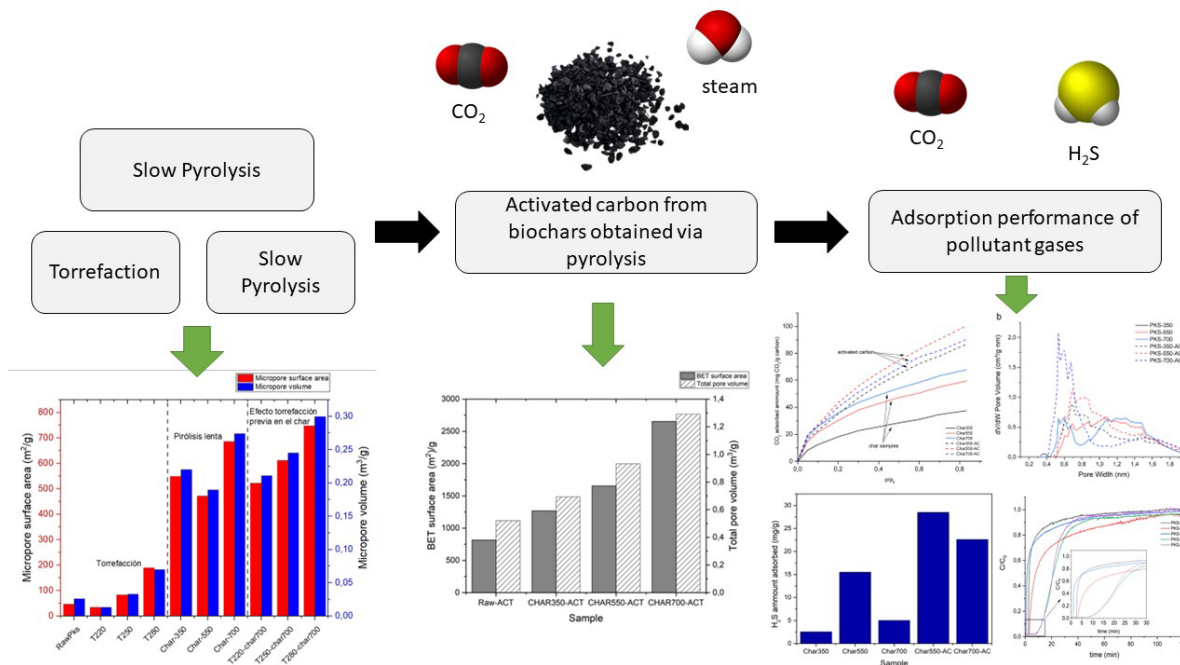


Figure 1. Experimental procedure of this study.