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Novel sorbent materials for environmental remediation via Pyrolysis of biomass

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One of the major challenges facing society at this moment is the transition from a non-sustainable, fossil resources-based economy to a sustainable bio-based economy. By producing multiple products, a biorefinery can take advantage of the differences in biomass components and intermediates and maximize the value derived from the biomass feedstock. The high-value products enhance profitability, the high-volume fuel helps meet national energy needs, and the power production reduces costs and avoids greenhouse-gas emissions
From pyrolysis, besides gas and liquid products a solid product - char, is derived as well. This char contains the non converted carbon and can be used for activated carbon production and/or as additive in composite material production. Commercially available activated carbons are still considered expensive due to the use of non-renewable and relatively expensive starting material such as coal.
The present study describes pyrolysis as a method to produce high added value carbon materials such as activated carbons (AC) from agricultural residues pyrolysis. Olive kernel has been investigated as the precursor of the above materials. The produced activated carbon was characterized by proximate and ultimate analyses, BET method and porosity estimation. Furthermore, its adsorption of pesticide compound in aqueous solution by was studied.
Pyrolysis of olive kernel was conducted at 800 oC for 45min in a fixed reactor. For the production of the activated carbon the pyrolytic char was physically activated under steam in the presence of CO_2 at 970oC for 3 h in a bench scale reactor. The active carbons obtained from both scales were characterized by N2 adsorption at 77 K, methyl-blue adsorption (MB adsorption) at room temperature and SEM analysis. Surface area and MB adsorption were found to increase with the degree of burn-off.
The surface area of the activated carbons was found to increase up to 1500 m2/g at a burn-off level of 60–65wt.%, while SEM analysis showed the appearance of micropores to mesopores in the produced tire active carbons. Activated carbon prepared from olive kernel is a super active carbon and used as an adsorbent for the removal of pesticide from aqueous solutions (Bromopropylate). The higher removal achieved was 100% in 60 min.
The produced activated carbon from agricultural residue was proved to be very effective for gas and water stream purification.
Biomass can give a wide spectrum of fuels and materials in the integrated concept of biorefinery