Effect of pyrolysis, impregnation, and calcination conditions on the physicochemical properties of TiO_2/Biochar composites intended for photocatalytic applications

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Abstract

Biochars are outstanding materials obtained from the pyrolysis of numerous types of biowastes, which have captured the attention of researchers due to their unique physicochemical properties that are attractive for environmental applications. In this work, we have synthesized TiO2/Biochar composites using biochars produced from the thermal treatment at low (or null) oxygen content of Colombian coconut shells. The production of the TiO2/Biochars materials was performed through a facile wet impregnation/calcination method in which, for the first time, the following 4 factors were evaluated on the final physicochemical properties of the material: 1) Temperature and 2) oxygen content in the pyrolysis of the biomass wastes, 3) TiO2/Biochar ratio used in the impregnation and 4) Calcination temperature of the TiO2/Biochar composites. A comprehensive characterization of the novel composites was done, using techniques such as: XRD, XPS, BET, ATR-FTIR, UV-Vis (diffuse reflectance), PL, SEM, and electrochemical analysis (i-t curves and OCP), which allow to elucidate the benefits and drawbacks of these materials in photocatalytic applications.

Keywords:

P25 TiO2; Biochar; Impregnation; Calcination; Physicochemical Characterization; Photocatalysis