

Sustainable utilization of orange peels waste for preparation of activated carbon: Synthesis, Characterization and Hydrogen storage application

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The recovery and reuse of orange peel waste (OP) is a sustainable strategy in a circular economy. In this research, OP was used as the raw material for the preparation of a novel carbonaceous nanomaterial to be used in the adsorption of hydrogen as an alternative in the use of green hydrogen. Activated carbons were synthesized from orange peel using different synthesis conditions. The activation of the carbon was carried out by means of a chemical process with phosphoric acid as activating agent, varying the the activating agent/precursor ratio, and the contact time between them. The activating agent used is a solution of phosphoric acid (50 wt %) in different weight ratios of acid/precursor of 3:1 or 6:1, with resting time of 24 hours. The best support was obtained using a carbonization time of 1 h, a carbonization temperature of 470°C, 6:1 precursor/acid ratio and 24 hours of resting time. According XRD analysis all samples present amorphous structure of activated carbons with BET surface areas of 1000 to 1400 m²/g. With the activated carbons obtained with the best structure and texture, the adsorption of hydrogen and the effects on their meso / microporosity were studied. Said material significantly improved H₂ storage behaviour compared to CMK-3 type nanostructured carbon (3.1% by weight at -196°C

and 10 bar). The synthesized material shows promise in adsorbing hydrogen by weak binding forces (physisorption).