DESIGN AND DEVELOPMENT OF NOVEL POROUS CARBON MATERIALS FROM FOOD WASTE FOR ENVIRONMENTAL AND ENERGY APPLICATIONS

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ABSTRACT

Due to their unique properties, porous carbon materials have been used for decades in a wide range of applications in thermal insulation, water purification, organic compounds and gas sorbents, catalyst supports, energy conversion,[1] drug delivery, tissue engineering and gene transformation.[2] They can be synthesized from a large variety of inexpensive precursors, and they are typically biocompatible.

Synthesis of these materials from food waste has gain interest recently. The billion tons per year of waste biomass that ends up in landfill from households is a low-cost, and sustainable source of carbon to obtain carbonaceous materials. Furthermore, its structure consists of a network of internal channels for the transportation of water and nutrition ingredients, which can contribute as stable macroporous and mesoporous structural framework.[3] In addition, it has many trace elements such as nitrogen, oxygen, boron, and sulfur, which can be doped into the carbon network as heteroatoms.[4]

In this work, porous carbon materials from food waste and oil mill wastewater were fabricated and fully characterized using a combination of analytical techniques, such as Raman spectroscopy, powder X-ray diffraction (PXRD), mid-infrared spectroscopy (FT-IR), to reveal their structure. Waste was treated with the freeze-drying method before the carbonization at high temperatures. The removal of water content from the internal channels of the food waste by Nitrogen shock and subsequent freeze-drying could utilize the interior channels as stable porous frameworks during the carbonization process, for the development of porous carbons with high surface areas and structural integrity.[3] It is noteworthy to add that the high surface areas created from the waste channels can be further used as potential porous scaffolds for multiple energy and environmental applications without any need for cost-effective physical or chemical activation.

KEYWORDS: Porous carbon materials, Food waste, Oil Mill Wastewater, Freeze-Drying process.

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