ENZYME IMMOBILIZATION ON POROUS CARBON CUBOIDS AS NANOBIOCATALYSTS FOR CARBON DIOXIDE SEQUESTRATION

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ABSTRACT

Nowadays, the imperative need to mitigate carbon dioxide emissions and the consequently climate change has led to the investigation of new approaches to develop effective carbon dioxide capture technologies. The immobilization of enzymes on porous carbon materials is considered as a promising method for carbon dioxide (CO_2) sequestration as a consequence of its high surface area, adjustable porous structure, high selectivity and biocompatibility [1].

In this work ultra-hydrophilic Porous Carbon Cuboids (PCCs) were developed, which exhibit large specific surface area (~900 m^2) and pore distribution of micro- and meso-scale [2]. The possibility of using these nanomaterials as biocatalysts after the enzyme immobilization was studied. The enzyme Carbonic Anhydrase (CA) was immobilized on porous carbon materials by the physical adsorption method (non-covalent immobilization). These nanomaterials were characterized before and after immobilization through a variety of characterization techniques, such as mid-infrared spectroscopy (FT-IR), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), Scanning electron microscopy (SEM) and nitrogen porosimetry (BET). The results confirmed the successful immobilization of the enzyme, the high immobilization yield, as well as the possibility of reusing them in reaction cycles without a significant reduction in their efficiency.

KEYWORDS: CO_2 sequestration, Carbonic Anhydrase, Porous nanomaterials, Porous carbon cuboids

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