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One-step synthesis of flour-derived functional nanocarbons with hierarchical pores for versatile environmental applications

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ABSTRACT

In this study, we develops a one-step and scalable approach to synthesize functional carbons with a tuneable and hierarchically porous structure as well as tailored surface chemistry for environmental applications in CO_2 adsorption and carbocatalysis to remove emerging water contaminants. By pyrolyzing a mixture of wheat flour and $NaHCO_3/Na_2CO_3/K_2CO_3$ at 700 °C, honeycomb structured carbons (700-PC) with dominant micropores can be formed and exhibit an excellent CO_2 storage capacity of 6.8 mmol g^{-1} at 0 °C and ambient pressure. By including dicyandiamide in the precursors, coralloid carbon skeletons in a micro- and meso-porous texture are selectively formed in the N-doped hierarchical porous carbons (N-PCs). 800-N-PC (N-PCs prepared at 800 °C) with a high surface area of 3041 m^2 g^{-1} shows an enhanced capacity of 19.4 mmol g^{-1} at 0 °C, 10 bar. For water remediation, 800-N-PC exhibits the most efficient degradation of *p*-hydroxybenzoic acid (HBA) by advanced oxidation processes (AOPs), with a high reaction rate constant of 0.39 min^{-1} at 25 °C. In addition, 800-N-PC shows selective adsorption of HBA in a mixed solution of HBA and