ZINC - AND NITROGEN-DOPED BIOMASS-DERIVED CARBON CATALYSTS FOR OXYGEN REDUCTION

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The oxygen reduction reaction (ORR) is a key electrochemical process in fuel cells and metal–air batteries, significantly influencing device efficiency and operational stability. The development of low-cost and sustainable electrocatalysts to replace noble metals remains a major scientific challenge. In this study, activated wood carbon (AWC), derived from alder wood char, was employed for the one-step synthesis of zinc- and nitrogen-doped carbon catalysts (AWC–Zn–N) via co-doping and thermal treatment. The synthesized materials were characterized using ICP-OES, XRD, XPS, SEM-EDS, BET surface area analysis, and Raman spectroscopy to evaluate their structural, compositional, and surface properties. The ORR performance of the AWC–Zn–N catalysts was investigated in an Ar- or O2-saturated 0.1 M KOH solutions using cyclic voltammetry (CV), linear sweep voltammetry (LSV), and the rotating disk electrode method (RDE). Furthermore, the AWC–Zn–N catalyst exhibited promising electrochemical performance toward the oxygen reduction reaction, demonstrating favorable onset potential and stable current response. The incorporation of Zn and N heteroatoms into the carbon matrix facilitates the formation of catalytically active sites and enhances electronic conductivity. These results highlight the potential of Zn- and N-doped biomass-derived carbon materials as efficient and environmentally friendly electrocatalysts for oxygen reduction, offering a promising alternative to precious metal-based materials in sustainable energy technologies.