Porous nitrogen doped carbon materials as High-Active Oxygen Reduction Catalysts Derived from Biomass (Corn Stalk)

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In this study, three catalysts (BC-Zn, BC-HP and BC-Na) were prepared by pyrolyzing corn stalk biomass with ZnCl₂, H₃PO₄ and NaOH acting as activator. We compare and summarize the structure and electrocatalytic activity of these carbon materials for oxygen reduction reaction (ORR). A high-performance doped carbon catalyst (BC-Na) with a BET surface area of up to 1337.27 m² g⁻¹ was prepared by using NaOH as an activating agent. For ORR in alkaline media, BC-Zn exhibited a more negative shift of -0.42 V (vs Hg/HgO) in contrast to BC-HP (-0.31 V) and BC-Na (-0.31 V). Even though BC-Na showed a negative ORR onset potential (E=-0.21 V) in comparison with Pt/C (E=0.09V), its current density reached up to 5.72 mA·cm⁻², which is much higher than Pt/C (3.25 mA·cm⁻²). It is supposed that the excellent electrocatalytic property of BC-Na originated from the combined effect of high specific surface area and N doping. The low-cost and simple approach used in study provides a straightforward route for the preparation of ORR electrocatalysts from biomass.

Keywords: oxygen reduction reaction, catalyst, biomass, activating agent

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