World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:17, No:10, 2023

Binderless Naturally-extracted Metal-free Electrocatalyst for Efficient NO_x Reduction

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Abstract : Recently, the emission of nitrogen-sulphur oxides (NO_x, SO_2) has become a global issue and causing serious threats to health and the environment. Catalytic reduction of NOx and SO_x gases into friendly gases is considered one of the best approaches. However, regeneration of the catalyst, higher bond-dissociation energy for NOx, i.e., 150.7 kcal/mol, escape of intermediate gas (N_2O, a greenhouse gas) with treated flue-gas, and limited activity of catalyst remains a great challenge. Here, a cheap, binderless naturally-extracted bass-wood thin carbon electrode (TCE) is presented, which shows excellent catalytic activity towards NOx reduction. The bass-wood carbonization at 900 ℃ followed by thermal activation in the presence of CO2 gas at 750 ℃. The thermal activation resulted in an increase in epoxy groups on the surface of the TCE and enhancement in the surface area as well as the degree of graphitization. The TCE unique 3D strongly inter-connected network through hierarchical micro/meso/macro pores that allow large electrode/electrolyte interface. Owing to these characteristics, the TCE exhibited excellent catalytic efficiency towards NOx (~83.3%) under ambient conditions and enhanced catalytic response under pH and sulphite exposure as well as excellent stability up to 168 hours. Moreover, a temperature-dependent activity trend was found where the highest catalytic activity was achieved at 80 ℃, beyond which the electrolyte became evaporative and resulted in a performance decrease. The designed electrocatalyst showed great potential for effective NOx-reduction, which is highly cost-effective, green, and sustainable.

Keywords : electrocatalyst, NOx-reduction, bass-wood electrode, integrated wet-scrubbing, sustainable
Conference Title : ICEBESE 2023 : International Conference on Environmental, Biological, Ecological Sciences and Engineering
Conference Location : Osaka, Japan
Conference Dates : October 30-31, 2023