# Hierarchical porous carbon derived from biomass as super adsorbent for Dioxin removal

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Dioxin are emitted in trace quantities from various thermal processes, including municipal waste incineration and coal combustion. The dioxin could be a great threat to human health and ecosystems due to their carcinogenic, teratogenic and gene mutation effects.

Adsorption is an important method to control the emission of dioxins. Carbon materials can be made directly out of waste biomass, are named "sustainable" materials for adsorbents. In this work, a biomass-derived carbon used as a versatile sorbent material, is proposed and studied. A novel strategy, i.e. biomass as carbon precursor, ammonium oxalate as both nitrogen source and foaming agent, hydrocarbonate as foaming agent, affords the carbon material large surface area, excellent hierarchical nanostructure and abundant nitrogen functional groups. Compared with conventional activated carbon, hierarchical porous carbon (NHPC, with nitrogen-doped; HPC, without nitrogen-doped) shows highly efficient absorption property of dioxins. The amount of dioxins adsorbed on hierarchical porous carbon is about 30 times higher than that on activated carbon. The hierarchical porous carbon has not reached saturation after 22 hours of dioxin adsorption, and the adsorption capacity reached to 657.30 ng/g.

Further investigations indicate that the interconnected porous structure and nitrogen functional groups are contributed to the improved diffusion and mass transfer, which result in considerable adsorption performance. Based on the facile preparation process and high adsorption capacity, the biomass-derived hierarchical porous carbon could have promising widespread applications in removing the trace organic pollutants in incineration flue gas.

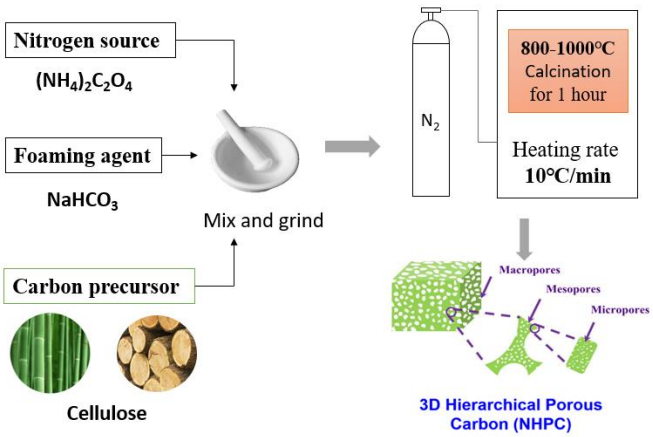


Figure 1. The schematic diagram of the preparation of biomass-derived hierarchical porous carbon

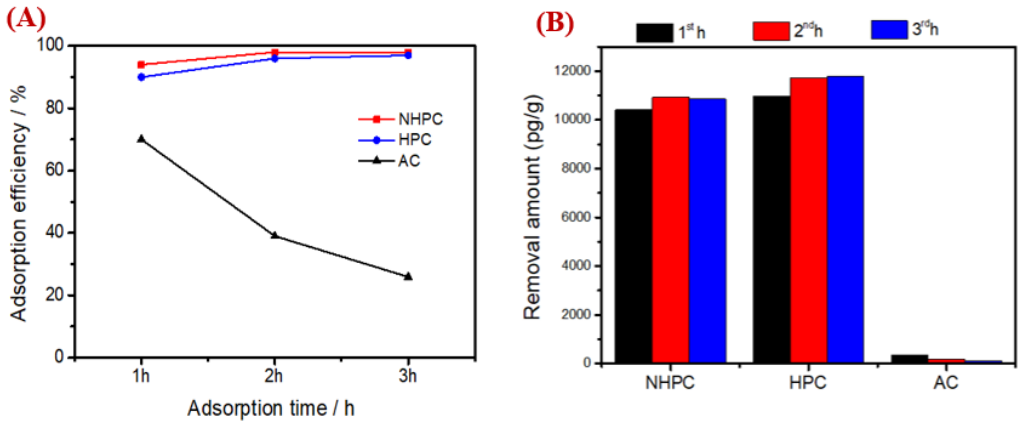


Figure 2(A) The removed efficiency with time on the carbon materials,
(B) The removed amount of dioxin with time on the carbon materials

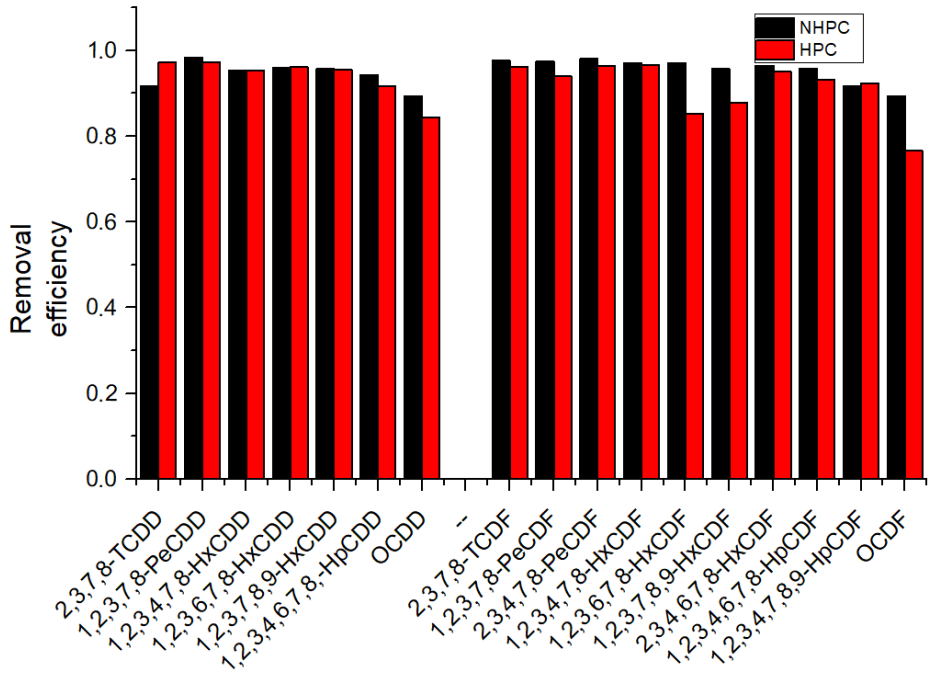


Figure 3. Removal efficiencies of 17 toxic PCDD/F congeners after 1 h adsorption by NHPC and HPC