# Potential reuse of the Pd-Cu-BTC for reductive sorption of aqueous Hg(II) by thermal desorption technique

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Mercury is a toxic substance that naturally occurs and is present in the environment in several different forms. All forms can have harmful effects on human health, particularly on the nervous system even at their low concentrations. Thus, the World Health Organization (WHO) established the maximum permissible concentration of Hg(II) in drinking water to 1 µg/L [1]. To efficiently treat aqueous Hg(II) several standard water purification methods, including ion exchange, membrane filtration, bioremediation, and adsorption have been studied to date. However, compared to conventional water treatment technologies, catalytic Hg(II) reductive removal has attracted significant attention because of its many positive characteristics including high removal efficiency, fast reduction kinetics, and no headspace Hg(0) formation.

In this study, the Pd-Cu-BTC catalyst was synthesized using the 1,3,5-benzene tricarboxylic acid as an organic support and its reactivity was checked for the catalytic removal of Hg(II) from aqueous solutions. The Pd-Cu-BTC material is characterized using various methods, including scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDS), XPS, X-ray diffraction (XRD) analysis, transmission electron microscopy (TEM), Mercury Porosimetry, and thermogravimetric analysis (TGA).
The kinetic test results showed the Pd-Cu-BTC catalyst reduced Hg(II) to Hg(0) and removed all the species at a reaction time of 2.5 min. The mercury speciation has been examined for the reuse of the catalyst by thermal desorption technique. Since more than 60% of the solid Hg(II) was converted to solid Hg(0) during the reaction, the concentration of Hg(0) on the catalyst surface increased as the reaction time progressed. Other noble metals such as Pt and Ru-impregnated catalyst was studied, however, Pd-Cu-BTC was the best in terms of reactivity and Hg(0) reductive sorption. No headspace Hg(0) formation was observed during the reaction. The experimental conditions such as pH of suspension, catalyst loading, and Hg(II) concentration have been optimized.

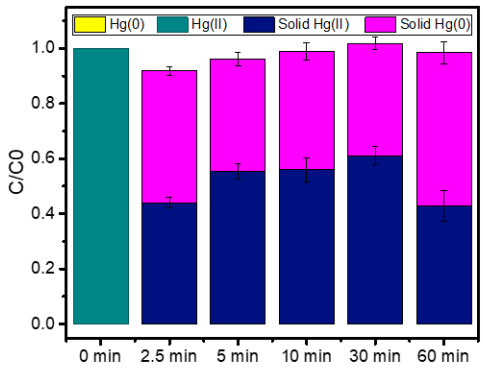


Figure 1. The speciation of solid Hg on the surface of Pd-Cu-BTC.

The experimental results suggest that the reduced Pd-Cu-BTC could be a reactive and feasible catalytic for practical application in water and wastewater treatment to effectively remove aqueous Hg(II) via reductive sorption with enhanced reaction kinetics. The Pd-Cu-BTC can be efficiently reused after thermal desorption at 150ºC for aqueous Hg(II) removal.

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**References**

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