UiO-66-$(SH)_2$: a selective, stable and regenerable adsorbent for the removal of mercury from water

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Mercury is a substance of significant environmental and human health concern. Among different methods reported to remove mercury from (waste)water, adsorption technology was found to be very promising because of its efficiency and its selectivity. Within this context, thiol functionalized adsorbents have a more pronounced affinity for mercury, even in the presence of other competing metals such as Pb^{2+}, Cd^{2+}, Zn^{2+} and Cu^{2+}. In this study, we examined the thiol-based UiO-66 as an adsorbent for the removal of Hg^{2+}. In general, the introduction of the SH-functionality into the framework resulted into a significant increase in the maximum adsorption capacity. Mercury was still well-removed by UiO-66-$(SH)_2$, even at high initial concentrations, resulting in a remarkably high maximum adsorption capacity of 261.4 mg/g, which is 9 times higher than the maximum adsorption capacity of the pristine UiO-66. Even the presence of competing ions such as Na^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, Cl^-, CO_3^{2-}, HCO_3^- among others in the wastewater, did not reduce the removal efficiency of Hg^{2+} showing the potential of this adsorbent in the removal of mercury-contaminated wastewaters. Moreover, the UiO-66$(SH)_2$ demonstrated a remarkable regenerability and recyclability even after 3 adsorption/desorption cycles as can be seen from Figure 1. Full Hg^{2+} desorption was obtained in the first 2 cycles while 89.3 % of the adsorbed Hg^{2+} was removed in the third cycle.

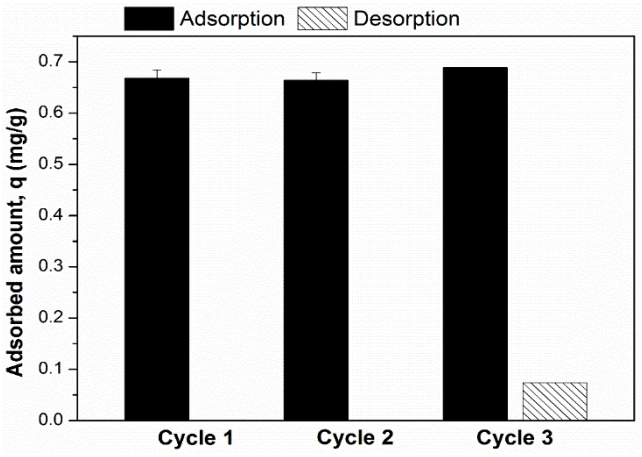

Figure 1. Three consecutive cycles of separate adsorption of 1 mg/L Hg(II), followed by desorption using UiO-66$(SH)_2$ as an adsorbent