

Abstract

Mercury (Hg) pollution is one of the significant global environmental problems. Hg concentration in water near amalgamation gold mines and mercury mines far exceeds the normal value of the natural water. There is a certain amount of Hg pollution even in the urban road runoff. Constructed wetland (CW) is a common water treatment technology, which can effectively remove many nutrients and heavy metals. In the current study, synthetic water with a total Hg (THg) concentration of $81.23 \pm 42.96 \mu\text{g/L}$ and a partition coefficient of 5.13 ± 0.23 was prepared to simulate the urban road runoff and the gold mines surrounding water. The migration of THg, particulate mercury (PHg) and dissolved mercury (DHg) along the horizontal subsurface flow constructed wetlands (HSSF-CWs) were investigated. Current study was aimed to analyze the effect of operating conditions on the removal of different Hg species; establish a kinetic model for the transformation of different valence states of mercury; and investigate the correlation between Hg and other water quality parameters. The findings of the current work are as follows:

(1) The removal efficiency of THg, PHg and DHg in HSSF CWs were 94.7%, 95.0% and 92.7%, respectively. The THg and PHg were mainly removed in the first quarter of the CWs, accounting for 88.6% and 97.8% of the total removal, respectively. (2) The removal of Hg was mainly affected by HRT, plants and temperature significantly. Findings reveal that no significant relationship was found between HRT and PHg removal, but affected the removal of DHg. Results also reveal that plants have no big role in PHg removal, whereas the removal rate of DHg in planted wetland was 20% higher than that in unplanted wetland. (3) The transformation of different valence states of Hg in CWs were found different. Results show that plants have no effect on the removal of THg and Hg^{2+} , but have a noticeable effect on the removal of Hg^0 . (4) Findings reveal that there is no significant correlation between different Hg species with TSS, but had significant linear correlation with sulfate (SO_4^{2-}) and pH. The current study provided an alternative for the ecological restoration of Hg contaminated water.

Keywords: Mercury; Constructed wetland; Eco-restoration