Insights into simultaneous efficient removal of tetracycline and Cd by calcined MgMn-layered double hydroxide: performance, mechanism and interaction

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The coexistence of tetracycline (TC) and Cd in actual water was a widespread pollution problem need to be solved urgently. MgMn-layered double hydroxide (MgMn-LDH) and its calcined derivative (MgMn-LDO) was fabricated for simultaneous removal of TC and Cd. In the MgMn-LDO activated peroxymonosulfate (PMS) system, 97.1% of TC was degraded within 20 min with the kobs value of 0.11min^{-1}. The higher oxidizing sites exposed on larger specific surface areas of MgMn-LDO were response to activate PMS generating ·OH, $SO_4^{-\bullet}$, $O_2^{-\bullet}$and $^1O_2$, especially $^1O_2$ for TC degradation. MgMn-LDO also had an excellent adaptability in a wide pH range (from 4 to 10) and actual water such as Pearl River water, 80% of TC decomposition could even achieve in urine. The good reusability and high stability of MgMn-LDO were further verified. Meanwhile, Cd immobilization on MgMn-LDO reached equilibrium within 10 min, and its maximum fixed quantity is 922.208 $mg \cdot g^{-1}$. The mechanism of excellent Cd immobilization resulted from formation of $CdCO_3$ and $Cd(OH)_2$. Finally, the immobilization of TC and Cd on MgMn-LDO could significantly enhance in combined system. Note that, low concentration of Cd had a synergism effect on TC degradation, while hight concentration of Cd had side effect. In order to significantly enhance promotion effect and eliminate side effect in the compound pollution system, a column filled with MgMn-LDO was designed for repairing TC and Cd pollution hierarchically. This study provided an effective strategy to solve the organic-heavy metal combined pollution.

Keywords: MgMn-layered double hydroxide; tetracycline; cadmium