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**Promotion effects of potassium permanganate on removal of Pb(II), Ni(II)  
and Cd(II) from hydrous manganese dioxide**

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**Abstract:**

Surface properties of Hydrous manganese dioxide (HMO) can be described by Zeta potential (ZP), which is used to determine the performance of Pb(II), Ni(II) and Cd(II) removal. HMO with the highest ZP value (-51 mV) has been proved to have superior heavy metals removal ability. A novel discovery is that  $\text{KMnO}_4$  can facilitate HMO removing heavy metal. The results showed that residual Pb(II), Ni(II) and Cd(II) in pH~8 were 0.01 mg/L, 0.02 mg/L and 0.05 mg/L after depth reaction, respectively. The mechanism of oxidation of Pb(II) in alkaline solution by  $\text{KMnO}_4$  with HMO catalyst was studied. The XPS results demonstrated that HMO improved oxidation efficiency of  $\text{KMnO}_4$  and the products Pb(IV) content increased by 50 percent approximately. The mechanism of Ni(II) removal was similar to Pb(II). Cd(II) could be absorbed but not be oxidized, while  $\text{KMnO}_4$  accelerated Cd(II) removal effect of HMO as well.  $\text{KMnO}_4$  promotion was still existing in the acidic conditions, which showed  $\text{KMnO}_4$  could promote HMO adsorption of heavy metal, and reaction mechanism is required for further study.

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