Zinc aluminium layered double hydroxides for the removal of iodine and iodide from aqueous solutions

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ABSTRACT

$^{129}$I is a radioactive isotope of iodine that is readily absorbed by the body. In this paper we investigated the potential of a 3:1 Zn/Al layered double hydroxide (LDH) as a sorbent for the removal of iodine and iodide from water. Synthetic $\text{Zn}_6\text{Al}_2(\text{OH})_{16}(\text{CO}_3)\cdot4\text{H}_2\text{O}$ was prepared by the co-precipitation before thermal activation. The LDH was treated with solutions containing iodide and iodine. It was found that iodine could be more easily removed from solution than iodide. Powder X-ray diffraction revealed the destruction of the LDH structure during thermal activation and the successful reformation of a similar LDH material after treatment with the iodide or iodine solution. Thermal decomposition of all samples studied by thermogravimetry appeared to be similar. A new decomposition mechanism similar to one previously described in the literature was proposed for the Zn/Al LDH. The total mass loss of samples treated with iodide and iodine was significantly lower than that of the original LDH indicating that iodine species may form non-removable anions when intercalated into the LDH structure. Evolved gas mass spectrometry failed to detect any iodine species lost as gases during the decomposition of iodide treated LDH however, small quantities of iodine species were observed during decomposition of samples treated with iodine solution.

Keywords: Iodine; Iodide; Radioiodine; Layered double hydroxide; Hydrotalcite; Water purification

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