"MECHANOCHEMICAL RETENTION" OF CADMIUM IN DIOCTAHEDRAL AND TRIOCTAHEDRAL SMECTITES

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The presence of heavy metals in the environment is a potential risk for water and soil quality due to their toxicity to plant, animals and human life. Lots of technologies and treatments have been developed to remove them from aqueous solutions. Several natural and synthetic sorbents have been employed for such aim. Among them, clay minerals have revealed highly potentials in such applications due to their low cost, availability, and low toxicity. Mechanochemical processes allow to activate chemical reactions by inducing different kinds of mechanical stress and without any other energy supply. This study investigated the effect of dry milling on the ability of dioctahedral and trioctahedral smectites to immobilize heavy metals cations. To this purpose a dioctahedral smectite "bentolite L" and a trioctahedral one "laponite RD" were ground with six distinct amount of cadmium chloride in dry conditions by means of zirconia planetary ball mill. Increasing milling time and Cd/clay minerals mass ratio were selected for experimental tests whereas grinding energy and ball to powder ratio were hold to constant value. Cadmium immobilization degree was evaluated by ICP/OES analysis and expressed by the leachable fraction of Cd ions. Two different leaching procedures were adopted: the first one with deionised water and the second one with 1 M MgCl2 solution. Time depending experiments pointed out an increased Cd retention as time increases for both bentolite L and laponite RD. Long time experiments (24 h) showed otherwise that, at the same milling regimes and Cd/clay minerals mass ratio, laponite RD exhibits stronger Cd retention capability than bentolite. Mechanical treatment, depending on time and different mass ratio, induced the increase of retention efficiency. The mechanisms at bases of the "mechanochemical retention" of cadmium by both clay minerals were also characterized by means of solid state and surfaces characterization techniques such as FTIR and XPS of the clay minerals cadmium spiked mixtures, before and after grinding.

Keywords: mechanochemistry, cadmium, clay minerals