

ILLITE AND ACTIVATED ILLITE FOR DESALINATION APPLICATIONS

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Controlling levels of ions in drinking water and water used in irrigation is one of the challenges in the hands of current researchers. Advancement in nanotechnology brings solutions to many of the current problems involving water quality improvement or greatly ameliorated by using nanosorbents, bioactive nanoparticles, nanostructured catalytic membranes and nanoparticle enhanced filtration among other products and processes. Desalination of water by using clays, clay composites and modified clays to increase their adsorbent capacity has been reported over the recent years.

This study focuses on the potential of low cost clay, illite, as a filter material for desalination. Primary objective of this research was to enhance cation removal ability of illite. Attempts were made to create nano size channels within the clay matrix which can be used to trap different cations present in water. It was anticipated that micro or nano porous channels in clay structure would be developed on activation by heating illite to 340 °C with ammonium chloride. Illite activated with ammonium chloride at three different weight ratios and untreated clay sample were used to achieve the objective of the research. Aqueous solutions having six different initial concentrations of the cations of interest (calcium, magnesium, sodium and potassium ions) were used to test the capacity of these clay samples for removal of cations. Atomic absorption spectroscopy was employed to measure the change of concentration of these cations after shaking with clay samples. The highest percentage change of concentration was 68% and the lowest was 11% with calcium and sodium respectively. The highest and lowest sorption capacities recorded were 11.3 mg of calcium ions (with an initial Ca^{2+} concentration of 0.15 mol dm^{-3}) and 0.13 mg of sodium ions (with an initial Na^+ concentration of 0.01 mol dm^{-3}) per 1 g of filter material. Crystallite sizes calculated from PXRD studies and cation removal capacities suggested that cation vacancies were responsible for enhanced cation removal ability of activated illite samples but chances of creating micro or nano porous channels in clay structure under these conditions has less possibility. Powder x-ray diffraction and x-ray fluorescence were used to characterize clay samples.