Removal of Aqueous Boron Using Electrospun PVA Fibers

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Boron removal from seawater has always been an issue in RO (reverse osmosis) desalination processes. Typically, a two-pass RO system is used where a stream is bypassed and its pH is drastically elevated to convert $B(OH)_3$, the primary form of aqueous boron, to $B(OH)_4^-$, more suitable form for easy removal by RO membrane. Our study is thus focused to remove $B(OH)_3$ without elevating pH by introducing boron-selective membrane to commercial RO membrane. Because the reaction of $B(OH)_3$ with hydroxyl-based materials such as polyols had already known, we prepared electrospun PVA (polyvinyl alcohol) fibers also having many hydroxyl groups on their surface. The electrospun PVA mat was treated in methanol to secure its stability in water and the chemisorption of $B(OH)_3$ onto the mat was identified by IR and Raman spectroscopies. The interpretation of IR and Raman spectra was supported also by frequency calculation in computation chemistry. Based on the measured equilibrium adsorption capacity of the PVA mat for $B(OH)_3$, the current RO desalination system could be simplified by the introduction of boron-selective electrospun PVA membrane.