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Review Article

A Review on Boron Pollution and Its Removal Techniques

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ABSTRACT

Boron is one of the minor elements dissolved in natural water and one of the seven essential micronutrient elements required for the normal growth of most plants. Boron is a commonly known drinking water contaminant that affects the reproductability of living organisms. In nature boron appears mostly as boric acid (H_3BO_3) and borax, ($Na_2B_4O_7.10H_2O$). In aquatic systems, it exists primarily as undissociated boric acid and borate ions. The main sources of boron in surface water are urban wastewater containing detergents and cleaning products, industrial effluents and chemical products used in agriculture. When water with high boron concentration is used for irrigation, boron compounds form complexes with heavy metals like Pb, Cu, Co, Ni, Cd etc. and increase the potential toxicity of these heavy metals. In recent years, boron toxicity has gained an increasing interest because of the greater demand for desalinated water, in which boron concentration may be very high for healthy irrigation. There is no easy method available for the removal of boron from water and wastewater. Structural studies have indicated that in borates, the boron atom usually combines with either three or four oxygen atoms forming [BO_3] or [BO_4] groups. Accordingly, the electronic orbitals are hybridized to a planar SPor a three-dimensional SP^3 structure. The commonly used Reverse Osmosis (RO) desalination systems are not efficient enough in boron removal since boric acid might be transported through RO membranes in a manner similar to water. Conventional ion exchange is also inapplicable due to poor ionization of boron acid and requires periodical regeneration of resins when the ion exchange capacity becomes saturated. Biological treatment is inefficient because of the complex boron chemistry. An extensive survey of the literature has been conducted related to technologies that have been developed for boron removal from wastewater. Only the publications concerned with the removal of boron from aqueous solutions have been reviewed and summarized in this paper.

Keywords: Boric acid, Borax, Biological treatment, Reverse osmosis.