Boron Rejection

Boron is a compound widely distributed within the environment both from natural sources and increasingly from industrial activities. In minute concentrations, it serves as an important micronutrient for living organisms. However, in sufficient quantities, it has been shown to have adverse health effects on human beings as well as plants and animals. As a result, boron removal has become an increasingly important compound of concern within water treatment.

GENERAL BORON WATER CHEMISTRY

Unlike most of the other elements in water, boron is not ionized (has no charge). Boron takes two forms in water: boric acid, $B(OH)_3$, or borate ion, $B(OH)_4^-$. The relative concentrations of boric acid and borate ion are dependent on pH (Figure 1), temperature and salinity. Boric acid becomes are prevalent at pH < 8, whereas the borate ion will become dominant at pH > 10.

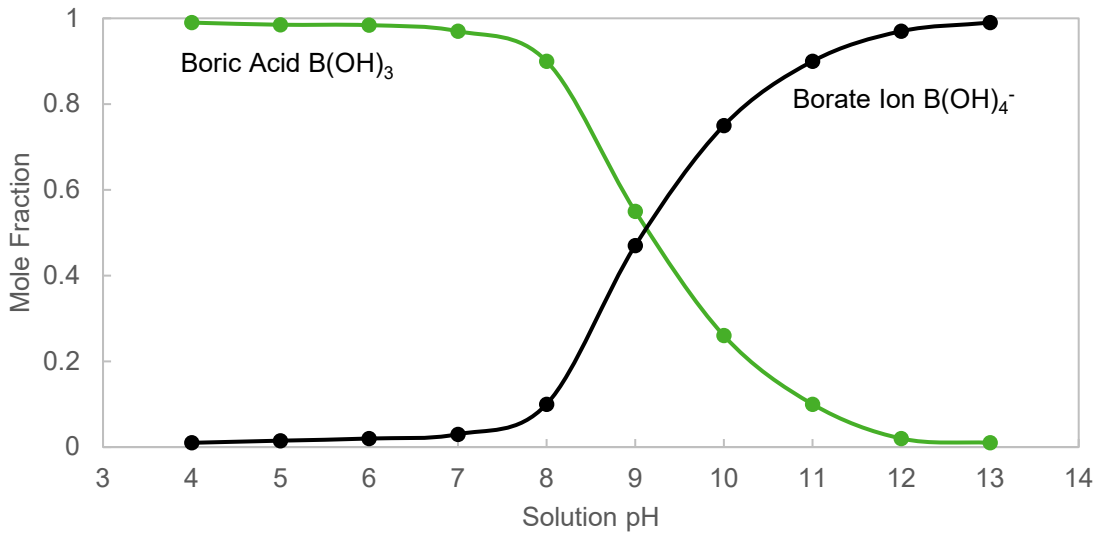

Figure 1. The approximate mole fraction of each species of boron at various pH. Boric acid becomes prevalent at pH < 8 whereas borate ion becomes dominant at pH > 10.

BORON REMOVAL BY REVERSE OSMOSIS

The effectiveness of reverse osmosis as a boron removal technology is highly dependent on the form in which boron is found. Because RO and NF membranes are much better at removing charged ions, the removal of borate ion is easier than the removal of boric acid. The rejection of boron under neutral or acidic conditions where uncharged boric acid is the dominant form is frequently less than 50%. Rejection of boron under highly alkaline conditions where the negatively charged borate ion is dominant can exceed 90%.

Both TRISEP® X-20™ and ACM2 high rejecting RO membranes have proven to reject high amounts of boron.

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