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## BORON REMOVAL FROM WASTEWATER IN A VERTICAL FLOW CONSTRUCTED WETLANDS

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Excess of boron (B) in the aquatic habitats can cause undesirable B contamination of water, resulting in toxicity of crop and plants, contamination in soil or sediment, and reproductive risks for both animals and human in many semiarid and arid regions. Therefore, water, either from wastewater or other sources of water, should need treatment before being used for irrigation or drinking purposes by human communities, who can suffer from excessive levels of B contamination in water. Several conventional treatment methods including membrane process, ion exchange, and adsorption techniques have been applied for the removal of boron from various types of wastewater. However, removal methods based on conventional strategies are expensive and require costly equipment or chemicals. In comparison to conventional techniques, constructed wetlands (CWs) have experienced significant advancement in recent years to remove pollutants from contaminated water due to their simple operation, eco-friendly properties, and cost effectiveness.

So, in this study, we investigated the performance of a Vertical flow constructed wetland (VFCW) to boron removal. A VFCW bed (0.70 m × 0.24 m<sup>2</sup>) planted with *Vetiveria zizanioides* were used. The bed was filled with light expanded clay aggregates (Leca®NR 3/8, 10 < Ø < 20 mm). A bottom slope of 2% was applied in order to enable the hydraulic collection of the influent continuously distributed by equidistant sprinklers on the top of the bed. A layer of gravel (diameter 10-50 mm) was placed around the outlet valve to prevent clogging with fine particles. A feeding tank (125L), equipped with a submersible pump (Eheim-1250) was used. The flooding level was maintained at 14% by a siphon on the outlet. Inlet and outlet flow were measured. Wastewater samples were collected daily for immediate characterization or frozen at -20°C. Air and bed temperatures were monitored daily. Rainfall was excluded by covering the beds with a tunnel of

transparent fine plastic. A synthetic wastewater was prepared using boric acid as boron source and micronutrients dissolved with tap water according to the operating conditions under study. Each new condition has been in operation up to pseudo-stationary state. It was used two different and increasing boron concentrations ( $15 \pm 1$  and  $30 \pm 1 \text{ mgL}^{-1} \text{ B}$ ) and the flow rate to the VFCW was kept constant, with an hydraulic load ( $H_L$ ) of  $191 \pm 10 \text{ Lm}^{-2}\text{d}^{-1}$ .

Every weekday, from Monday to Friday, wastewater samples were taken, and the flow rate measured at the inlet and outlet of VFCW. In those samples, the dissolved oxygen (DO), electrical conductivity (EC), pH, boron (B) were determined.

The results obtained show that it is possible boron removal in VFCW. Removal efficiency obtained up to  $60 \pm 10 \%$  of boron was obtained. When boron concentration was the highest the plants stop growth and leaves chlorosis was observed. The micronutrients composition (calcium, magnesium, potassium and sodium) in vegetal biomass decreased when wastewater boron concentration increased.

So, it was possible to conclude, that the VFCW performance decrease when wastewater with high boron concentration of  $30 \pm 1 \text{ mgL}^{-1} \text{ B}$  was applied, as well as toxicity signals in plants appear.