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## REMOVAL OF PHENOLIC COMPOUNDS IN CONSTRUCTED WETLANDS MESOCOSMS TREATING SUGAR CANE STILLAGE AT HIGH SURFACE ORGANIC LOAD RATES

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### Abstract

Ethanol production from sugarcane molasses usually generates large amounts of wastewater (stillage) that causes a severe environmental impact. Stillage contains high organic matter, potassium and sulfate concentrations. One of the major problems is that it contains high concentrations of phenolic compounds, especially melanoidins (around 30 mg/L) which induce toxicity in the microbial soil and aquatic biota when disposed without treatment. Our research group has reported the use of sub-surface flow constructed wetlands (SSFCWs) planted with *Pontederia sagittata* for the treatment of stillage at high surface organic load rates (SOLRs) (50 and 100 g<sub>COD</sub>/m<sup>2</sup>d) without any pre-treatment apart from adjustment at pH 6.0. This system was highly effective at removing COD (85%), BOD<sub>5</sub> (82%), TKN (60%), N-NO<sub>3</sub> (60%) and S-SO<sub>4</sub> (77%). The objective of this work was to evaluate the performance of SSFCWs planted with *P. sagittata* treating stillage and operating at even higher SOLRs: 94 and 188 g<sub>COD</sub>/m<sup>2</sup>d. Special attention was paid to the removal of phenolic compounds. The SSFCWs were operated at two hydraulic retention times (HRT) (5 and 7 days) using two different filter media, volcanic gravel and ceramic material. Samples were taken at three different sections along the SSFCW length: initial (inlet), middle and final (outlet). The results showed that the removal of the total phenolic compounds (initial concentration was 28 mg/L) was significantly higher ( $p < 0.05$ ) with volcanic gravel (81%) compared to ceramic material (73%), after 60 days of treatment at a HRT of 7 days. The initial values of COD (4,480 mg/L) and BOD<sub>5</sub> (2,500 mg/L) were reduced in 81±2.03% and 79±6.91%, respectively in the SSFCWs packed with ceramic material and volcanic gravel, respectively. Sulfates were removed at an average of 67.5±2.5% for both types of filter media at a HRT of 5 days. Plants showed intoxication symptoms in the initial sections of all SSFCWs (they died after 20 days of treatment), mainly due to the high SOLRs tested. On the other hand, the plants in the middle and final sections maintained a healthy appearance during the whole experimental period even though they did not grow. The residual concentrations of nitrates (5 mg/L) and phosphates (2-6 mg/L) that were found in the effluents after treatment, may serve as additional nutrients in ferti-irrigation of sugar cane plantations. This phytotechnology shows potential in the treatment of stillage or any other agro-industrial wastewater containing high levels of organic matter and phenolic compounds.

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