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Acid Mine Drainage Remediation with Small Scale Constructed Wetlands in Ancash Highlands - Perú

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Extended Abstract

Ancash region is the main Cu (20.6%), Zn (38.0%) and Ag (19.6%) producer in Peru [1]. Nevertheless, mine activity has caused the presence of 1235 abandoned and mismanaged mining environmental liabilities [2]; that are source of acid mine drainage (AMD), characterized by low pH water with elevated concentrations of iron, sulphates and heavy metals that impact on basin headwater ecosystems and livelihoods [3]. For this issue, constructed wetlands have emerged as a low-cost and easy-to-operate technology [4]. These systems emulate natural wetland functions through physical, chemical and biological processes, in an environment, which can be controlled and manipulated [5].

Empirical research reported, constructed wetlands are an efficient alternative of removing heavy metals of AMD and improve water quality [6], [7]. However, the performance in the treatment efficiency of each component is still relatively unknown [6], [8]. Therefore, four small scale constructed wetlands (SS-CW) were implemented (0.59mx0.38mx0.24m). These systems were continuously fed with AMD collected from the Mesapata mining environmental liability located in Ancash highland. The flow rate and hydraulic retention time were 5 $L.d^{-1}$ and 3.1 d respectively. From bottom to top, SS-CW 1 was composed of limestone, organic matter (40% compost, 40% domestically animal manure and 20% peat) and macrophytes (*Juncus imbricatus*), SS-CW 2: limestone and organic matter; SS-CW 3: limestone, organic matter, macrophytes and reducing sulfate bacteria, and SS-CW 4: gravel 3/8", organic matter and macrophytes. pH and electrical conductivity were measured using a Hach Sension 156 multiparametric and total iron (Fe) was measured using Iron Test MQuant 114438.

Results show that acid mine drainage in the influent had pH 2.3 ± 0.1 (N=10), electrical conductivity 3018 ± 257.7 $mS.cm^{-1}$ (N=10) and Fe 202.3 ± 34.6 $mg.L^{-1}$ (N=10). In the effluent, for the four SS-CW, pH was > 5.7 and electrical conductivity are > 2149.2 $mS.cm^{-1}$ and Fe < 99.7 $mg.L^{-1}$, also, there is statistically significant difference of pH increase (p-value: 0.022 by ANOVA test) and there is no statistically significant difference in removal of Fe (p-value: 0.0733 by Kruskal-Wallis test) between the SS-CW. The highest Fe removal efficiency was in SS-CW 3 followed by SS-CW 2, SS-CW 4 and SS-CW 2 with 67.1% ± 8.7% (N=8), 64.1% ± 11.7% (N=9), 57.8% ± 8.4% (N=9) and 51.4% ± 17.9% (N=9) respectively. According to literature, SS-CW 3 has best performance because it has all components of a constructed wetland. However, the other SS-CW also present high efficiencies.

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