

Using a Novel Swampy Forest System as a Strategy to Meet Coal Mine Wastewater Discharge Compliance in Indonesia

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Extended Abstract

Numerous coal mines in Indonesia are faced with toxic acid mine drainage that significantly impacts the aquatic ecosystems and human health. Some areas have a large volume of acid mine discharge containing toxic substances such as metals with a pH of < 4. Mining companies are required to prepare a strict mine closure plan including compliance with environmental regulations, and to fix the major problem of acid mine drainage. The conventional method of acid mine drainage is to neutralize the acidity with quicklime before discharge. This is rather costly. The concept of a Swampy Forest (SF) system is a novel system using a nature-based solution.

This paper will describe the SF system with data from laboratory and field scale experiments. The SF system uses a constructed wetland whereby the acid mine water flow is routed through a series of organic matter, and hyperaccumulator plants that are specially selected to uptake the toxic substances in the wastewater. Initially, the waste stream is treated with empty palm oil empty fruit bunches as organic matter which serves to reduce the acidity and increase the water pH level. Subsequently, in order to reduce the toxic metals, the wastewater is routed through a reclaimed area consisting of specially selected grass and tree species. The grass species selected includes *Eleocharis dulcis*, *Chrysopogon zizanioides*, and *Typha angustifolia*. The tree species selected includes *Melaleuca leucadendra*, *Nauclea subdita* and *Nauclea orientalis*. These grass and tree species are selected among the species around the area.

The SF system was shown to improve the quality of wastewater significantly to meet compliance before discharge. The cost of quicklime can be reduced to be replaced with an environmentally friendlier nature-based SF system.