

ABSTRAK

EFEKTIVITAS PENGELOLAAN AIR ASAM TAMBANG DENGAN PENERAPAN *FLOATING CONSTRUCTED WETLAND* DI PT. BUKIT ASAM TBK., SUMATERA SELATAN

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Kegiatan penambangan batubara yang memanfaatkan sistem penambangan terbuka, mengekspos mineral sulfida ke udara dan air, dan mengarah pada pembentukan air asam tambang asam. Pengolahan air asam tambang di kolam pengendapan lumpur (KPL) X PT. Bukit Asam merupakan pengolahan aktif berupa pembubuhan kapur yang kerap didapati tantangan dalam memenuhi standar kualitas lingkungan untuk pH dan Mn secara konsisten. Penelitian ini bertujuan untuk mendeskripsikan karakteristik limbah air asam tambang yang tertampung dalam KPL X PT. Bukit Asam Tbk; menganalisis pengaruh akar wangi dan purun tikus dalam penerapan *Floating Constructed Wetland* terhadap nilai parameter pH, TSS, Fe dan Mn skala laboratorium dan menentukan arahan penerapan *Floating Constructed Wetland* di KPL X dalam skala lapangan.

Penelitian diawali dengan pengujian kualitas air asam tambang terhadap parameter pH, TSS, Fe, dan Mn. Parameter pH dan Mn pada inlet menunjukkan hasil melebihi baku mutu. Pengolahan dilakukan dengan pembuatan sistem *floating constructed wetland* skala laboratorium menggunakan reaktor percobaan. Perlakuan percobaan masing-masing variasi jenis tanaman akar wangi (*Vetiveria zizanioides*) dan purun tikus (*Eleocharis dulcis*) dalam waktu 20 hari. Sampel air dianalisis setiap 4 hari sekali menggunakan metode uji sesuai dengan masing-masing parameter kualitas air. Analisis data meliputi efektivitas kedua jenis tanaman yang diterapkan pada *floating constructed wetland* serta analisis statistik deskriptif dan regresi linier sederhana untuk menilai pengaruh jenis tanaman dan durasi pengolahan pada parameter kualitas air.

Berdasarkan hasil penelitian, air asam tambang pada kompartemen inlet KPL X menunjukkan nilai pH sebesar 4,66, kadar TSS sebesar 256 mg/L, konsentrasi Fe sebesar 6,3849 mg/L, dan konsentrasi Mn sebesar 4,2103 mg/L. Efektivitas terbaik untuk menurunkan parameter logam terdapat pada perlakuan dengan tanaman akar wangi sedangkan efektivitas terbaik untuk menurunkan parameter TSS terdapat pada perlakuan dengan tanaman purun tikus. Parameter pH untuk kedua perlakuan hingga hari terakhir belum memenuhi baku mutu yang ditentukan. Rekomendasi pengelolaan yang dapat diterapkan pada daerah penelitian adalah dengan sedimentasi pada kompartemen 2, 4 dan 5. Pembubuhan kapur dilakukan pada kompartemen 3. *floating constructed wetland* dengan tanaman akar wangi diterapkan pada kompartemen 6. desain *floating constructed wetland* dengan rangka apung pipa PVC 4 x 6 m sebanyak 6 buah yang ditanami dengan tanaman akar wangi pada kolam eksisting.

Kata kunci: Air Asam Tambang, *Floating Constructed Wetland*, Akar wangi, Purun Tikus

ABSTRACT

EFFECTIVENESS OF ACID MINE DRAINAGE MANAGEMENT WITH FLOATING CONSTRUCTED WETLAND APPLICATION AT PT. BUKIT ASAM TBK., SUMATERA SELATAN

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Coal mining activities utilize an open-pit system exposing sulfide minerals to air and water. This lead to the formation of acid mine drainage (AMD). AMD Treatment in sedimentation ponds (KPL) X PT. Bukit Asam is an active treatment in the form of lime application which often presents challenges in consistently meeting environmental quality standards for pH and manganese. The aim of this study is to describe the characteristics of AMD waste stored in KPL X at PT Bukit Asam Tbk. Additionally, this study analyzes the impact of vetiver and chinese water chesnut on the implementation of floating constructed wetlands (FCWs) on parameters such as pH, total suspended solids (TSS), iron (Fe), and manganese (Mn) at the laboratory scale.

*The research began by testing the quality of acid mine water based on the pH, TSS, Fe, and Mn parameters. The pH and manganese (Mn) parameters at the inlet and the total suspended solids (TSS) parameter at the outlet showed results that exceeded the quality standards. The treatment involved using an experimental reactor to create a floating constructed wetland system on a laboratory scale. Different types of plants were used for each treatment variation: vetiver (*Vetiveria zizanioides*) and *Eleocharis dulcis*. The hydraulic retention time interval was four days. Water sample analysis was performed every four days using the appropriate testing method for each water quality parameter. Data analysis included an evaluation of the effectiveness of the two types of plants used in the floating constructed wetland, as well as a descriptive statistical analysis and a simple linear regression to assess the impact of plant type and processing duration on the water quality parameters.*

According to the results, the pH of the acid mine water at KPL X is 4,66 and the manganese (Mn) concentration is 4,2103 mg/L. The best effectiveness percentage for reducing Fe and Mn parameters was found in the treatment with vitiver plants while the best effectiveness percentage for reducing TSS parameters was found in the treatment with chinese water chesnut plants. However, the pH parameter for both treatments did not meet the established standards by the end of the experiment. The recommended management that can be applied to the research area are sedimentation compartments in compartment 2, 4, and 5. Lime application was carried out in compartment 3. Floating constructed wetland with vetiver plants applied in compartment 6. The design of floating constructed wetland consisted of 4 x 6 m PVC pipe as floating frames planted with vetiver plants in the existing pond.

*Keyword: Acid Mine Drainage, Floating Constructed Wetland, *Vetivera zizanioides*, *Eleocharis dulcis**