

RINGKASAN

Permasalahan pencemaran air akibat aktivitas penambangan batubara menghasilkan air asam tambang (AAT) dengan kandungan logam berat, terutama besi (Fe), yang melebihi ambang batas aman lingkungan. Konsentrasi besi yang tinggi dapat membahayakan ekosistem dan kesehatan manusia. Untuk mengatasi permasalahan tersebut, penelitian ini menggunakan metode fitoremediasi dengan tumbuhan *Cyperus papyrus* dalam sistem *constructed wetland* sebagai solusi pengolahan yang ramah lingkungan, murah, dan mudah diterapkan. Penelitian ini bertujuan untuk menganalisis konsentrasi Fe setelah fitoremediasi menggunakan *Cyperus papyrus* dengan variasi waktu 3, 9, dan 14 hari, menganalisis efektivitas penurunan konsentrasi Fe dengan dan tanpa perlakuan tanaman, serta menilai adanya perbedaan signifikan antara perlakuan menggunakan tanaman dan tanpa tanaman berdasarkan uji statistik. Penelitian dilakukan di PT Gea Lestari, Kecamatan Mestong, Kabupaten Muaro Jambi.

Hasil penelitian menunjukkan bahwa *Cyperus papyrus* mampu menurunkan kadar logam besi secara signifikan dari 10,85 mg/L menjadi 2,315 mg/L dalam waktu 14 hari, sehingga memenuhi baku mutu air limbah pertambangan berdasarkan Keputusan Menteri Negara Lingkungan Hidup Nomor 113 Tahun 2003 sebesar 7 mg/L. Uji statistik T menunjukkan bahwa penurunan kadar Fe tersebut signifikan. Dengan demikian, dapat disimpulkan bahwa fitoremediasi menggunakan *Cyperus papyrus* efektif sebagai metode pengolahan air asam tambang yang tercemar logam berat, serta dapat dijadikan solusi alternatif dalam pengelolaan lingkungan di kawasan pertambangan.

SUMMARY

*The issue of water pollution caused by coal mining activities has resulted in the formation of acid mine drainage (AMD) containing heavy metals, particularly iron (Fe), which exceeds the environmental safety limits. High concentrations of iron can harm both ecosystems and human health. To address this issue, this study employed a phytoremediation method using *Cyperus papyrus* in a constructed wetland system as an environmentally friendly, low-cost, and easily applicable treatment solution. The objectives of this research were to analyze the Fe concentration after phytoremediation using *Cyperus papyrus* with variations in exposure time (3, 9, and 14 days), to evaluate the effectiveness of Fe reduction with and without plant treatment, and to assess whether the differences observed were statistically significant. The study was conducted at PT Gea Lestari, Mestong Subdistrict, Muaro Jambi Regency.*

*The results showed that *Cyperus papyrus* significantly reduced iron levels from 10.85 mg/L to 2.315 mg/L within 14 days, thereby meeting the effluent standard set by the Decree of the State Minister for the Environment No. 113 of 2003, which stipulates a maximum Fe concentration of 7 mg/L. Statistical analysis using a T-test confirmed that the reduction in Fe levels was significant. Therefore, it can be concluded that phytoremediation using *Cyperus papyrus* is an effective method for treating acid mine drainage contaminated with heavy metals and can serve as an alternative solution for environmental management in mining areas.*