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**PENILAIAN RISIKO EKOLOGI DAN IDENTIFIKASI  
SUMBER LOGAM BERAT TIMBAL (Pb) DI SEDIMEN  
SUNGAI BATANG OMBILIN, SAWAHLUNTO**

**TUGAS AKHIR**

Sebagai salah satu persyaratan untuk menyelesaikan

Program Strata A 1 pada  
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## ABSTRAK

*Aktivitas antropogenik di sepanjang Sungai Batang Ombilin, Kota Sawahlunto, berpotensi memengaruhi kualitas sedimen melalui akumulasi logam berat. Penelitian ini bertujuan menganalisis konsentrasi dan sebaran timbal (Pb), mengevaluasi tingkat kontaminasi, risiko ekologis, dan potensi efek biologis, serta mengkaji faktor sumber pencemar pada sedimen Sungai Batang Ombilin. Sampel sedimen permukaan diambil pada sepuluh titik sampling dan konsentrasi logam dianalisis menggunakan Spektrofotometri Serapan Atom (SSA). Tingkat kontaminasi Pb dievaluasi menggunakan Geo-accumulation Index (Igeo) dan Contamination Factor (CF), risiko ekologis menggunakan indeks risiko ekologis, sedangkan potensi efek biologis dievaluasi menggunakan Sediment Quality Guidelines (SQG). PCA, HCA, dan APCS–MLR digunakan untuk mengkaji faktor sumber pencemar berdasarkan Pb, As, Cr, Cu, dan Cd. Konsentrasi Pb berkisar 0,90–7,20 mg/kg dengan rata-rata 3,96 mg/kg dan seluruh titik tergolong tidak tercemar berdasarkan Igeo. Risiko ekologis individual Pb berada pada kategori rendah dengan nilai 0,43–3,47. Konsentrasi Pb berada di bawah ISQG-Low ANZECC, TEC, dan PEC, dengan PEC-Q sebesar 0,007–0,056. Nilai mPEC-Q sebesar 0,235–0,397 menunjukkan potensi efek biologis gabungan kategori sedang yang terutama dipengaruhi As. Nilai RI berkisar 287,31–490,78 dan NRI 186,83–322,87. PCA mempertahankan PC1 dengan eigenvalue 3,375 yang menjelaskan 67,49% varians total. Pada analisis APCS–MLR, model Pb memiliki  $R^2$  0,603, sedangkan nilai 56,20% menunjukkan proporsi varians yang dijelaskan oleh PC1, bukan persentase kontribusi suatu sumber pencemar. Karena hanya satu komponen dipertahankan dan jumlah sampel terbatas, sumber pencemar belum dapat dipisahkan secara spesifik.*

**Kata kunci:** APCS–MLR, logam berat, risiko ekologis, sedimen, timbal.



## ABSTRACT

*Anthropogenic activities along the Batang Ombilin River in Sawahlunto City may affect sediment quality by accumulating heavy metals. This study aimed to analyze the concentration and distribution of lead (Pb), evaluate contamination levels, ecological risks, and potential biological effects, and identify potential sources of heavy metal pollution in the sediments of the Batang Ombilin River. We collected surface sediment samples from ten sampling points and determined metal concentrations using Atomic Absorption Spectrophotometry (AAS). We evaluated Pb contamination using the Geo-accumulation Index (Igeo) and Contamination Factor (CF), and assessed ecological risk using ecological risk indices. Potential biological effects were evaluated using Sediment Quality Guidelines (SQGs). Principal Component Analysis (PCA), Hierarchical Cluster Analysis (HCA), and Absolute Principal Component Scores–Multiple Linear Regression (APCS–MLR) were applied to assess potential pollution sources based on the concentrations of Pb, As, Cr, Cu, and Cd. Pb concentrations ranged from 0.90 to 7.20 mg/kg, with an average concentration of 3.96 mg/kg, and all sampling points were classified as uncontaminated based on Igeo values. The individual ecological risk associated with Pb was categorized as low, with values ranging from 0.43 to 3.47. Pb concentrations were below the ANZECC ISQG-Low, Threshold Effect Concentration (TEC), and Probable Effect Concentration (PEC) guideline values, with PEC-Q values ranging from 0.007 to 0.056. The mPEC-Q values ranged from 0.235 to 0.397, indicating a moderate level of combined potential biological effects, primarily influenced by As. The RI values ranged from 287.31 to 490.78, whereas the NRI values ranged from 186.83 to 322.87. PCA retained one principal component (PC1), with an eigenvalue of 3.375, explaining 67.49% of the total variance. In the APCS–MLR analysis, the Pb model had an R<sup>2</sup> value of 0.603. The value of 56.20% represented the proportion of Pb variance explained by PC1 rather than the percentage contribution of a specific pollution source. Because only one principal component was retained and the number of samples was limited, specific pollution sources could not be reliably distinguished.*

**Keywords:** APCS–MLR, ecological risk, heavy metals, lead, sediment.