

INTISARI

Penambangan emas tradisional dan skala kecil (*Artisanal and Small-scale Gold Mining*) di daerah Boto dan sekitarnya, Kecamatan Jatiroto, Kabupaten Wonogiri, Jawa Tengah telah berlangsung puluhan tahun. Lokasi penambangan emas tersebut berada di sekitar pemukiman serta berdekatan dengan daerah aliran air sungai. Meskipun penambangan emas tradisional sudah tidak aktif dan teknik pengolahan emas dengan metode amalgamasi telah ditinggalkan, tetapi sisa limbah penambangan dan pengolahan emas yang tidak mengalami *treatment* dapat menjadi sumber pencemar dan menyebabkan logam berat terlepas ke lingkungan oleh proses-proses alamiah dan menyebabkan kandungan logam berat dalam air sungai tinggi. Penelitian ini bertujuan untuk menganalisis kandungan dan persebaran logam berat serta faktor-faktor yang berpengaruh pada persebaran logam berat di lokasi penelitian.

Sampel yang diambil pada daerah penelitian yaitu 23 sampel air sungai dan 1 sampel urat batuan. Pengujian kandungan unsur arsen (As), kadmium (Cd), tembaga (Cu), timbal (Pb), dan seng (Zn) dilakukan dengan metode ICP-AES (*Inductively Coupled Plasma-Atomic Emission Spectroscopy*). Hasil uji laboratorium pada sampel air sungai kemudian dianalisis secara spasial dan statistika. Analisis statistika mencakup analisis statistika deskriptif, uji normalitas, uji komparatif, uji korelasi, analisis gugus, dan *principal component analysis* (PCA). Analisis spasial dan statistika dilakukan untuk menganalisis dan menginterpretasi persebaran logam berat dan faktor-faktor yang mempengaruhi persebaran tersebut. Hasil uji laboratorium menunjukkan bahwa hampir semua unsur memiliki kandungan logam berat melebihi standar baku mutu air dan konsentrasi rata-rata logam berat pada air sungai, kecuali As sehingga dapat mengindikasikan bahwa air sungai telah tercemar logam berat. Hampir semua unsur memiliki perbedaan kandungan antara daerah hulu dengan hilir. Daerah hulu di bagian tenggara daerah penelitian memiliki kandungan logam berat yang tinggi disebabkan oleh proses alamiah (geogenik) berupa pelapukan dan alterasi serta proses penggalian tambang yang menyebabkan sumber logam berat tersingkap. Penyebaran Cu dan Zn lebih dipengaruhi oleh proses alamiah, sedangkan Hg dipengaruhi oleh aktivitas penambangan dan pengolahan emas tradisional. Penyebaran As dan Pb oleh faktor antropogenik berupa sisa limbah tambang. Penyebaran Cd dipengaruhi oleh faktor geogenik dan aktivitas agrikultur.

Kata Kunci: air sungai, Boto, logam berat, penambangan emas tradisional dan skala kecil, pencemaran.

ABSTRACT

There are a number of artisanal and small-scale gold mining sites in Boto and its surrounding villages, Jatiroto subdistrict, Wonogiri district, Central Java Province. The artisanal and small-scale gold mining (ASGM) located located around settlements area and near the streams. Although the ASGM activities and processing using amalgamation method were no longer active and abandoned when the study was conducted, but the remaining mine and processing wastes which had not undergone through treatments could still be the source of heavy metal contamination. Natural (geological) processes could make those heavy metals available in the environment so that the concentration of heavy metals in stream water is high. The aims of this study are to analyze heavy metals concentration and distribution, also to analyze the contributing factors of heavy metals distribution. Samples used and taken in this study were 23 stream water samples and one rock vein sample. Laboratory analysis on arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), and zinc (Zn) were carried on using ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectroscopy) method.

The result of laboratory analysis then were analyzed using spatial and statistical analysis. Spatial analysis using kriging interpolation, while the statistical analysis consists of basic statistical analysis, normality tests, comparative tests, correlation analysis, cluster analysis, and principal component analysis (PCA). Those analysis combined together to analyze and interpret the distribution of heavy metals and its contributing factors. Laboratory analysis results showed that the concentration of most heavy metals, excluding As, were exceeding the quality standard of water and the mean concentrations of heavy metals in stream water. Therefore, the stream water in study area is polluted by heavy metals, excluding As. Almost all of heavy metals has different concentrations between upstream and downstream area. Upstream area in southeast of study area has the highest heavy metal concentrations caused by geogenic processes such as alteration and weathering processes and also by mining processes that exposed the source of heavy metals to the surface. The distribution of Cu and Zn are controlled by geogenic processes, while Hg is controlled by traditional mining and processing of gold. As and Pb are more controlled by anthropogenic processes (the remaining mine wastes). Cd distribution are controlled by geogenic processes and agricultural activities almost equally.

Keywords: stream water, Boto, heavy metals, artisanal and small-scale gold mining, pollution