

ABSTRAK

IDENTIFIKASI KANDUNGAN LOGAM BERAT PADA MATA AIR PANAS DAN MATA AIR DINGIN SERTA IMPLIKASI RISIKO GEOMEDIS PADA MATA AIR DINGIN DI KAWASAN GUNUNGAPI DIENG

Oleh

Tita Nurmaningtyas

NIM: 111220255

(Program Studi Sarjana Teknik Geologi)

Kawasan Gunungapi Dieng merupakan lingkungan vulkanik-hidrotermal aktif yang dicirikan oleh keberadaan kawah, mata air panas, mata air dingin, zona alterasi, serta manifestasi panas bumi. Interaksi antara air, batuan vulkanik, fluida hidrotermal, dan struktur geologi berpotensi memengaruhi komposisi kimia mata air, termasuk kandungan logam berat yang dapat berdampak terhadap kualitas lingkungan dan kesehatan masyarakat. Penelitian ini bertujuan untuk mengetahui kondisi geologi tentatif daerah penelitian, menganalisis kandungan dan persebaran logam berat pada mata air panas dan mata air dingin, serta mengevaluasi potensi risiko geomedis pada mata air dingin di Kawasan Gunungapi Dieng.

Metode penelitian meliputi studi literatur, interpretasi data sekunder, observasi geologi lapangan secara spotting, pengambilan sampel batuan dan air, analisis petrografi, pengukuran parameter fisika-kimia air, analisis ion mayor, logam berat, dan unsur jejak menggunakan AAS dan ICP-MS, serta pengolahan data menggunakan diagram Piper, *Heavy Metal Pollution Index* (HPI), *Average Daily Intake* (ADI), *Hazard Quotient* (HQ), *Hazard Index* (HI), dan *Incremental Lifetime Cancer Risk* (ILCR).

Hasil penelitian menunjukkan bahwa daerah penelitian tersusun oleh produk vulkanik Kuartar berupa andesit, basalt, material rombakan vulkanik, dan tuf teralterasi yang berasosiasi dengan sistem hidrotermal Dieng. Mata air dingin menunjukkan pengayaan Mn dan As secara lokal, terutama pada sampel D14, D33, D34, dan D39, sedangkan mata air panas menunjukkan pengayaan Zn dan Pb yang lebih kuat pada beberapa manifestasi panas bumi. Nilai HPI menunjukkan tingkat pencemaran yang bervariasi dari rendah hingga tinggi, dengan mata air panas umumnya memiliki nilai HPI lebih tinggi dibandingkan mata air dingin. Penilaian risiko geomedis pada mata air dingin menunjukkan bahwa beberapa titik memerlukan perhatian karena berkaitan dengan peningkatan kadar Mn, As, pH rendah, dan pengaruh hidrotermal lokal. Dengan demikian, kandungan logam berat dan potensi risiko geomedis di daerah penelitian dikontrol oleh kondisi geologi vulkanik, zona alterasi, jalur rekahan, interaksi air–batuan, serta aktivitas sistem hidrotermal Dieng.

Kata kunci : Dieng, hidrogeokimia, logam berat, mata air dingin, mata air panas, risiko geomedis.

ABSTRACT

IDENTIFICATION OF HEAVY METAL CONTENT IN HOT SPRINGS AND COLD SPRINGS AND ITS IMPLICATIONS FOR GEOMEDICAL RISK IN COLD SPRINGS IN THE DIENG VOLCANIC AREA

By
Tita Nurmaningtyas
NIM: 111220255
(Geological Engineering Undergraduated Program)

The Dieng Volcanic Area is an active volcanic-hydrothermal environment characterized by the presence of craters, hot springs, cold springs, alteration zones, and geothermal manifestations. Interactions among water, volcanic rocks, hydrothermal fluids, and geological structures may influence the chemical composition of springs, including heavy metal contents that may affect environmental quality and public health. This study aims to identify the tentative geological conditions of the study area, analyze the content and distribution of heavy metals in hot springs and cold springs, and evaluate the potential geomedical risks associated with cold springs in the Dieng Volcanic Area.

The research methods include literature study, interpretation of secondary data, limited geological field observations through selected spot checks, rock and water sampling, petrographic analysis, measurement of physicochemical water parameters, major ion analysis, heavy metal and trace element analysis using AAS and ICP-MS, and data processing using Piper diagrams, Heavy Metal Pollution Index (HPI), Average Daily Intake (ADI), Hazard Quotient (HQ), Hazard Index (HI), and Incremental Lifetime Cancer Risk (ILCR).

The results show that the study area is composed of Quaternary volcanic products, including andesite, basalt, volcanic debris material, and altered tuff associated with the Dieng hydrothermal system. Cold springs show local enrichment of Mn and As, particularly in samples D14, D33, D34, and D39, whereas hot springs show stronger enrichment of Zn and Pb in several geothermal manifestations. The HPI values indicate varying levels of pollution, ranging from low to high, with hot springs generally showing higher HPI values than cold springs. The geomedical risk assessment of cold springs indicates that several sampling points require attention due to elevated Mn and As concentrations, low pH, and local hydrothermal influence. Therefore, heavy metal content and potential geomedical risk in the study area are controlled by volcanic geological conditions, alteration zones, fracture pathways, water–rock interaction, and the activity of the Dieng hydrothermal system.

Keywords : Dieng, hydrogeochemistry, heavy metals, cold springs, hot springs, geomedical risk.