

RANGKUMAN

Tuf zeolitik merupakan batuan piroklastik dengan komposisi dominan berupa zeolit yang secara fisik dan kimia berkemampuan sebagai bahan penjerap (adsorpsi) dan penukar kation. Salah satu daerah yang memiliki potensi dan keterdapatan tuf zeolitik yaitu di Hargosari, Kecamatan Gedangsari, Kabupaten Gunungkidul, Yogyakarta. Penelitian ini bertujuan untuk mengetahui karakteristik tuf zeolitik yang mencakup karakteristik fisik, mineralogi dan kimia di Hargosari dan efektivitasnya untuk meremediasi tanah tercemar timbal. Sampel tanah tercemar diambil di lokasi sekitar tempat pembuangan sampah terpadu (TPST) Piyungan, Yogyakarta dengan remediasi yang dilakukan terfokus pada Pb yang memiliki konsentrasi Pb tinggi yaitu 36 ppm dengan didasari oleh penelitian terdahulu. Metode yang digunakan untuk mengetahui karakteristik fisik dan mineralogi tuf zeolitik yaitu deskripsi fisik sampel setangan, analisis petrografi, dan XRD (X-Ray Diffraction), dan analisis kimia meliputi KTK (Kapasitas Tukar Kation). Selain itu juga dilakukan uji *batch* untuk mengontakkan sampel tuf zeolitik dengan sampel larutan tanah tercemar timbal untuk mengetahui efektivitas penjerapan timbal dengan menggunakan mesin pengaduk magnetik dalam waktu 15, 30, 45, 60, 120, 180, 240, dan 1440 menit. Pengukuran konsentrasi timbal selama uji batch menggunakan instrumen ICP-AES (Inductively Coupled Plasma- Atomic Emission Spectrometry). Terdapat 5 sampel tuf zeolitik yang mewakili dari keberagaman tuf zeolitik di Hargosari, kemudian sampel dideskripsikan sifat fisiknya dan dianalisis petrografi serta KTK. 2 sampel terpilih yang memiliki komposisi zeolit paling banyak dan nilai KTK tertinggi dianalisis menggunakan XRD untuk mengetahui jenis zeolitnya yaitu sampel E (STA 10) dan E (STA 17) dengan komposisi mineral zeolit berkisar 38-42% dan didominasi oleh mineral zeolit dengan jenis mordenit, klinoptilolit, analsim dan wairakit serta memiliki nilai KTK terbaik yaitu 76.40 dan 83.20 meq/100 gr yang digunakan untuk uji batch. Hasil uji batch menunjukkan perilaku penjerapan dipengaruhi oleh sifat fisik, mineralogi dan nilai KTK pada sampel. Sampel tuf zeolitik yang memiliki sifat fisik berukuran butir halus, berwarna cerah, tingkat pelapukan rendah dan kekompakan batuan tinggi cenderung memiliki persentase zeolit yang dominan dan nilai KTK yang tinggi sehingga kapasitas penjerapan yang dilakukan juga lebih tinggi. Ketergantungan penjerapan pada nilai pH rendah meningkatkan kompetisi awal ion timbal dengan H⁺. Penjerapan optimum pada sampel D terjadi pada kontak 240 menit dengan efektivitas penjerapan sebesar 93% dan sampel E terjadi pada waktu kontak 240 menit dengan efektivitas penjerapan optimum yaitu 98%.

Kata kunci: Tuf zeolitik, zeolit, penjerapan, timbal, Hargosari.

ABSTRACT

Zeolitic tuff is a pyroclastic rock with a dominant composition in the form of zeolite which physically and chemically has the ability to act as an adsorption and cation exchange agent. One area that has the potential and the presence of zeolitic tuff is in Hargosari, Gedangsari District, Gunungkidul Regency, Yogyakarta. This study aims to determine the characteristics of zeolitic tuff which include physical, mineralogical and chemical characteristics in Hargosari and its effectiveness to remediate lead contaminated soil. Polluted soil samples were taken at locations around integrated landfill (TPST Piyungan), Yogyakarta, with remediation focused on lead which has a high concentration of 36 ppm based on previous research. The methods used to determine the physical characteristics and mineralogy of zeolitic tuff are physical descriptions of hand specimen samples, petrographic analysis, and XRD (X-Ray Diffraction), and chemical analysis including CEC (Cation Exchange Capacity). In addition, a batch test was also carried out to contact the zeolitic tuff sample with a sample of lead contaminated soil solution which aims to determine the effectiveness of Pb uptake by using a magnetic stirrer machine within 15, 30, 45, 60, 120, 180, 240, and 1440 minutes. Measurement of lead concentration during the batch test using the ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectrometry) instrument. There are 5 samples of zeolitic tuff that represent the diversity of zeolitic tuff in Hargosari, then the samples are described for their physical properties and analyzed by petrography and CEC. The 2 selected samples that had the most zeolite composition and the highest CEC value were analyzed using XRD to determine the type of zeolite, namely samples D (STA 10) and E (STA 17) with zeolite mineral composition ranging from 38-42% and dominated by zeolite minerals with the mordenite, clinoptilolite, analcime and wairakit type and had the best CEC values, namely 76 and 82 meq/100 gr which were used for batch testing. Batch test results show that the entrapment behavior is influenced by physical properties, mineralogy and the value of the CEC in the sample. Zeolitic tuff samples that have physical properties of fine grain size, bright color, low weathering rates and high rock cohesiveness tend to have a dominant zeolite percentage and high CEC values so that the adsorption capacity is also higher. Dependence on the entrapment at lower pH increases the initial competition between lead ion and H^+ . The optimum adsorption on sample D occurred at 240 minutes of contact with the effectiveness of the adsorption of 93% and sample E occurred at the contact time of 240 minutes with the optimum absorption effectiveness of 98%.

Keyword: Zeolitic tuf, zeolite, adsorption, lead, Hargosari