

Handling Heavy Metal Waste through Utilization of Lapindo Activated Mud HCl to Realize Environmentally Friendly Industries

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Abstract

Until now, one of the industrial problems (metallurgy, electroplating, electrical equipment, paint, pesticides and jewelry) is heavy metal waste. Some heavy metals that can cause adverse effects on the environment are Chrome (Cr), Lead (Pb), and Mercury (Hg). If the dangerous heavy metal is wasted into the environment, it can cause various problems in the environment and especially can threaten human life. Disorders caused include lumps, tumors, nerve damage, brain damage, and even death. Therefore, it is necessary to handle industrial waste before being disposed of into the environment to eliminate the content of Cr, Pb, and Hg, so that industrial waste is no longer dangerous for humans or the environment. Meanwhile, in Indonesia since 2004 there was an event of natural disasters, namely the Lapindo mudflow. Lapindo mud is a mud produced from a burst of volcanic activity with a volume of 5000 m³/day. This mud has great potential as a heavy metal adsorbent, because it contains polysilic minerals. Polysilic minerals when activated with strong acids such as HCl can produce polysilanol. Polysilanol is one of the most effective adsorbents for heavy metal ions. The purpose of this study was to determine the effect of concentration of activator (HCl) on the content of heavy metals Cr, Pb, and Hg produced from the industrial processes. The activation of Lapindo mud with HCl causes impurities in the mineral component to be decomposed and dissolved with the activator, leaving a lot of pore in the mud. Increasing the number of pores causes the surface area of the touch field of mud which has an active group of silanol. This results in a greater and more effective absorption of heavy metal ions. Heavy metal ions will be trapped in the pores of the mud which have many active silanol groups. The more silica found on the surface of the touch field, the more heavy metals can be absorbed during the adsorption process. In this study a SEM test was carried out to ensure the surface morphology of the sludge was successfully activated. In addition, in this study a quantitative test was conducted using AAS to determine the effect of HCl concentration on adsorption of heavy metals Cr, Pb, and Hg by activated sludge. Based on the results of the study, it was found that the mud had been activated as evidenced by the emergence of many pores in the mud. The pore diameter produced is classified into the mesopore type between 0.2 to 2.5 μm . Mesopori is a type of pore that is best at absorbing heavy metals. The other results obtained that the greater the concentration of HCl activator, the greater the binding capacity of the sludge to heavy metals. According to the results of this study, the best HCl concentration as a Lapindo mud activator is 0.4 M, because the activated sludge with this treatment has the best ability to absorb heavy metals Cr, Pb, and Hg up to 100%.

Keywords

Adsorption, Activated Sludge, HCl, Heavy Metals, and Industrial Waste.

Biographies

Sigit Trimayanto is an Undergraduate at State University of Surabaya in Indonesia majoring in Chemistry. He conducted his reasearch project under the supervision of Prof. Dr. Sari Edi Cahyaningrum, M.Si. at State University of Surabaya, East Java.

Sari Edi Cahyaningrum is a head of Study Program of Chemistry and a Professor of Chemistry at State University of Surabaya. Prof. Sari holds a Bachelor of Science degree in Chemistry from Institut Technology of Sepuluh Nopember, a Master of Science degree in Chemistry from University of Gadjah Mada, and a Doctoral degree in Chemistry from University of Gadjah Mada. His research interests include material science, adsorbent, and inorganic chemistry.