

***SURFACE MODIFICATION OF SILICA (SiO₂) FROM SILICA SCALE OF
GEOTHERMAL INDUSTRY WASTE USING APTES
(3-AMINOPROPYLTRYETHOXYSILANE) AS ADSORBENT FOR Pb²⁺ ION***

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ABSTRACT

Research on the surface modification of silica (SiO₂) from silica scale of geothermal industry waste using APTES as adsorbent for Pb²⁺ ion has been conducted. Parameters affecting the adsorption of Pb²⁺ ion on SiO₂-APTES which include pH, temperature, concentration, and interaction time. They were used to found the optimum pH, kinetic and thermodynamic parameters. The adsorbent selectivity was determined by performing the SiO₂-APTES selectivity test against Cu²⁺, Co²⁺, Ni²⁺, and Zn²⁺ ions.

This research was divided into two-part, purification and characterization of SiO₂-APTES, and the adsorption of Pb²⁺ ion with SiO₂-APTES. Silica was purified from the geothermal waste of Geo Dipa Dieng. Purification of SiO₂ was conducted by calcination at 600 °C and acidification by 1 M HCl. Modification of SiO₂ with APTES was carried out using ethanol solvents at 70 °C. The characterization of SiO₂-APTES was used XRF, XRD, SEM-EDS, and FTIR. The concentrations of Pb before and after adsorption were analyzed by AAS.

Adsorption of Pb²⁺ ion was optimum at pH 6. It takes only 30 min to reach the maximum adsorption capacity of SiO₂-APTES. The experimental data conforms to the pseudosecondary kinetic models. Adsorption of Pb²⁺ ion by SiO₂-APTES thermodynamically has tendency to follow Langmuir isotherm models with maximum adsorption capacity (q_{max}) from 53.9-66.0 mg g⁻¹. The adsorption process more spontaneous as temperature increased and from the range of the magnitude of ΔH° value (30.9-80.4 kJ mol⁻¹), it was concluded that adsorption of Pb²⁺ ion was chemical adsorption process. The interaction mechanism between Pb²⁺ ion and the reactive group is mainly electrostatic interaction and complexation. The selectivity from SiO₂-APTES order of Pb²⁺>Cu²⁺>Co²⁺>Ni²⁺>Zn²⁺.

Keywords: silica scaling, SiO₂ modified, adsorption