



***SURFACE MODIFICATION OF SILICA (SiO_2) FROM SILICA SCALE OF
GEOTHERMAL INDUSTRY WASTE USING APTES
(3-AMINOPROPYLTRYETHOXYSILANE) AS ADSORBENT FOR Pb^{2+} ION***

Nur Hayati
18/433842/PPA/05657

ABSTRACT

Research on the surface modification of silica (SiO_2) from silica scale of geothermal industry waste using APTES as adsorbent for Pb^{2+} ion has been conducted. Parameters affecting the adsorption of Pb^{2+} ion on SiO_2 -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 SiO_2 -APTES selectivity test against Cu^{2+} , Co^{2+} , Ni^{2+} , and Zn^{2+} ions.

This research was divided into two-part, purification and characterization of SiO_2 -APTES, and the adsorption of Pb^{2+} ion with SiO_2 -APTES. Silica was purified from the geothermal waste of Geo Dipa Dieng. Purification of SiO_2 was conducted by calcination at 600 °C and acidification by 1 M HCl. Modification of SiO_2 with APTES was carried out using ethanol solvents at 70 °C. The characterization of SiO_2 -APTES was used XRF, XRD, SEM-EDS, and FTIR. The concentrations of Pb before and after adsorption were analyzed by AAS.

Adsorption of Pb^{2+} ion was optimum at pH 6. It takes only 30 min to reach the maximum adsorption capacity of SiO_2 -APTES. The experimental data conforms to the pseudosecondary kinetic models. Adsorption of Pb^{2+} ion by SiO_2 -APTES thermodynamically has tendency to follow Langmuir isoterm 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 Pb^{2+} ion was chemical adsorption process. The interaction mechanism between Pb^{2+} ion and the reactive group is mainly electrostatic interaction and complexation. The selectivity from SiO_2 -APTES order of $\text{Pb}^{2+} > \text{Cu}^{2+} > \text{Co}^{2+} > \text{Ni}^{2+} > \text{Zn}^{2+}$.

Keywords: silica scaling, SiO_2 modified, adsorption