

SINTESIS NICKEL LAYERED HYDROXIDE SALT (Ni LHS) SEBAGAI ADSORBEN UNTUK ION $[\text{AuCl}_4]^-$ DALAM LARUTAN

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INTISARI

Sintesis *nickel layered hydroxide salt* (Ni LHS) dan aplikasinya sebagai adsorben ion $[\text{AuCl}_4]^-$ dalam larutan telah dilakukan. Penelitian ini bertujuan untuk mempelajari sintesis dan karakterisasi Ni LHS. Kinerja Ni LHS sebagai adsorben dipelajari dengan cara menentukan kinetika dan isoterm adsorpsi pada keasaman medium ketika Ni LHS stabil terhadap pelarutan.

Material Ni LHS disintesis dengan metode kopresipitasi pada berbagai rasio mol $\text{OH}^-/\text{Ni}^{2+}$ dan dilanjutkan hidrotermal dengan variasi waktu yang berbeda. Kestabilan Ni LHS dikaji pada variasi keasaman larutan dan dilakukan penentuan nilai pH_{pzc} Ni LHS. Adsorpsi $[\text{AuCl}_4]^-$ oleh Ni LHS dipelajari dengan mengkaji pengaruh keasaman larutan, menentukan kinetika dan isoterm adsorpsi. Ni LHS sebelum dan setelah adsorpsi dikarakterisasi menggunakan FTIR, XRD, SEM EDX *Mapping*, dan fotomikroskop stereo.

Hasil XRD menunjukkan bahwa Ni LHS dapat disintesis dengan kondisi optimum pada rasio mol $\text{OH}^-/\text{Ni}^{2+}$ 0,6 dilanjutkan hidrotermal pada temperatur 120°C selama 3 jam. Ni LHS memiliki nilai pH_{pzc} pada 7,52 dan relatif stabil pada kondisi pH 3-12. Adsorpsi $[\text{AuCl}_4]^-$ oleh Ni LHS optimum terjadi pada pH 3 dan mengikuti model kinetika *pseudo* orde dua Ho. Konstanta laju adsorpsi sebesar $0,798 \text{ mg mg}^{-1} \text{ menit}^{-1}$ serta mengikuti model isoterm adsorpsi Langmuir. Kapasitas adsorpsi maksimum (q_{maks}) Ni LHS sebesar $156,8 \text{ mg g}^{-1}$ dengan energi adsorpsi sebesar $29,44 \text{ kJ mol}^{-1}$. Ni LHS tidak hanya mampu mengadsorp $[\text{AuCl}_4]^-$, tetapi juga mereduksi $[\text{AuCl}_4]^-$ yang teradsorp menjadi Au(0) berdasarkan hasil karakterisasi XRD dan fotomikroskop stereo.

Kata kunci: Ni LHS, kopresipitasi, hidrotermal, adsorpsi, $[\text{AuCl}_4]^-$

SYNTHESIS OF NICKEL LAYERED HYDROXIDE SALT (Ni LHS) AS ADSORBENT FOR [AuCl₄]⁻ ION IN SOLUTION

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ABSTRACT

The synthesis of nickel layered hydroxide salt (Ni LHS) and its application as adsorbent of [AuCl₄]⁻ ion in solution have been done. The aim of this research was to learn the synthesis and characterization of Ni LHS. The performance of Ni LHS as adsorbent was studied through the determination of adsorption kinetics and isotherm at medium acidity in which Ni LHS was stable towards dissolution.

Ni LHS was synthesized by the coprecipitation method at a variety of mole ratio OH⁻/Ni²⁺ and then followed by hydrothermal process at various different time. Furthermore, pH_{pzc} and stability of Ni LHS on various medium acidity were investigated. Adsorption of [AuCl₄]⁻ by Ni LHS was studied by investigating the effect of medium acidity, determining adsorption kinetics and isotherm. Ni LHS before and after adsorption were characterized using FTIR, XRD, SEM EDX Mapping, and stereo microscope.

Results showed that Ni LHS can be synthesized with optimum condition at 0.6 OH⁻/Ni²⁺ mole ratio followed by hydrothermal process at 120°C for 3 hours. Ni LHS had pH_{pzc} at 7.52 and relatively stable at pH 3-12. The adsorption of [AuCl₄]⁻ by Ni LHS has the optimum pH of 3 and follows Ho pseudo second order kinetic model. Adsorption rate constant was 0.798 mg mg⁻¹ min⁻¹ and matched well Langmuir adsorption isotherm model. Maximum adsorption capacity (q_{max}) of Ni LHS was 156.8 mg g⁻¹ with adsorption energy was 29.44 kJ mol⁻¹. Ni LHS was not only capable for adsorbing [AuCl₄]⁻ ion, but also reducing [AuCl₄]⁻ to Au(0) as shown by the characterization results of XRD and stereo microscope.

Keywords: Ni LHS, coprecipitation, hydrothermal, adsorption, [AuCl₄]⁻