

SYNTHESIS OF TA-Ni-Zn-LHS (TANNIC ACID-NICKEL-ZINC-LAYERED HYDROXIDE SALTS) AND ITS APPLICATIONS FOR REDUCTIVE-ADSORPTION OF [AuCl₄]⁻ IONS IN AQUEOUS MEDIUM

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ABSTRACT

The synthesis of tannic acid-immobilized Ni-Zn-LHS (*Nickel-Zinc Layered Hydroxide Salts*) and its application for the reductive-adsorption of [AuCl₄]⁻ have been carried out. The Ni-Zn-LHS was synthesized using the coprecipitation method by dissolving Ni(NO₃)₂·6H₂O and Zn(NO₃)₂·4H₂O with a molar ratio of 2:1. The immobilization of tannic acid onto Ni-Zn-LHS was carried out under optimum conditions. The FTIR and XRD instruments were used to examine the success of tannic acid immobilization on Ni-Zn-LHS and the application of TA-Ni-Zn-LHS for the reductive-adsorption of [AuCl₄]⁻.

The results showed that TA-Ni-Zn-LHS could be used to adsorb and subsequently reduce Au(III) to Au(0). The FTIR spectra of TA-Ni-Zn-LHS showed a characteristic absorption peak at wavenumber 1512 cm⁻¹ which was attributed to a vibration of the C=C group of tannic acid immobilized on Ni-Zn-LHS. The adsorption process of [AuCl₄]⁻ ions by TA-Ni-Zn-LHS was optimum at pH 3.0 and tended to follow the Ho pseudo-second-order kinetic model with a constant value of adsorption rate (k) of 0.32 g mg⁻¹ min⁻¹. The adsorption process of the [AuCl₄]⁻ ions followed the Freundlich isotherm model with an adsorption capacity of 3.29 mg g⁻¹. The XRD characterization results of TA-Ni-Zn-LHS-Au material showed characteristic peaks of Au metal at 2θ: 38.27° and 44.48°.

Keywords: Ni-Zn LHS, tannic acid, immobilization, reductive-adsorption, [AuCl₄]⁻

SYNTHESIS OF TA-Ni-Zn-LHS (TANNIC ACID-NICKEL-ZINC-LAYERED HYDROXIDE SALTS) AND ITS APPLICATIONS FOR REDUCTIVE-ADSORPTION OF $[\text{AuCl}_4]^-$ IONS IN AQUEOUS MEDIUM

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INTISARI

Sintesis Ni-Zn-LHS (*Nikel-Zinc Layered Hydroxide Salts*) terimobilisasi asam tanat dan aplikasinya untuk adsorpsi-reduksi $[\text{AuCl}_4]^-$ telah dilakukan. Ni-Zn-LHS disintesis menggunakan metode kopresipitasi dengan mencampurkan $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ dan $\text{Zn}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ dengan perbandingan molar 2:1. Larutan campuran tersebut ditambah dengan NaOH dan selanjutnya diaduk. Proses imobilisasi asam tanat pada Ni-Zn-LHS dilakukan pada kondisi optimum. Instrument FTIR dan XRD digunakan untuk menguji keberhasilan proses imobilisasi asam tanat pada Ni-Zn-LHS dan aplikasi TA-Ni-Zn-LHS untuk adsorpsi-reduksi $[\text{AuCl}_4]^-$.

Hasil penelitian menunjukkan bahwa TA-Ni-Zn-LHS dapat dimanfaatkan sebagai adsorben sekaligus dapat mereduksi Au(III) menjadi Au(0). Spektra FTIR TA-Ni-Zn-LHS menunjukkan adanya puncak serapan yang karakteristik pada bilangan gelombang 1512 cm^{-1} yang merupakan vibrasi gugus C=C dari asam tanat yang terimobilisasi pada Ni-Zn-LHS. Proses adsorpsi ion $[\text{AuCl}_4]^-$ oleh TA-Ni-Zn-LHS optimum pada pH 3,0 dan cenderung mengikuti kinetika pseudo orde dua Ho dengan nilai konstanta laju adsorpsi (k) sebesar $0,32\text{ g mg}^{-1}\text{ min}^{-1}$. Proses adsorpsi ion $[\text{AuCl}_4]^-$ mengikuti model isotherm Freundlich dengan kapasitas adsorpsi sebesar $3,29\text{ mg g}^{-1}$. Hasil karakterisasi XRD material TA-Ni-Zn-LHS setelah proses adsorpsi menunjukkan adanya puncak karakteristik logam Au pada 2θ : $38,27^\circ$ and $44,48^\circ$.

Kata kunci: Ni-Zn LHS, asam tanat, imobilisasi, adsorpsi-reduksi, $[\text{AuCl}_4]^-$