

**SINTESIS Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS (MAGNETITE-NICKEL-ZINC LAYERED HYDROXIDE SALTS) DAN APLIKASINYA SEBAGAI ADSORBEN ION [AuCl<sub>4</sub>]<sup>-</sup> DALAM LARUTAN BERAIR**

LIA KURNIA  
17/418574/PPA/05358

**INTISARI**

Telah dilakukan sintesis *Magnetite-Nickel-Zinc Layered Hydroxide Salts* (Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS) yang bertujuan untuk memperoleh adsorben berupa material berlapis yang bersifat magnetit dan aplikasinya sebagai adsorben ion [AuCl<sub>4</sub>]<sup>-</sup> dalam larutan. Material Ni-Zn-LHS dan magnetit disintesis secara terpisah dengan metode kopresipitasi, kemudian kedua material dikombinasikan dengan metode yang sama. Larutan Zn<sup>2+</sup> dan Ni<sup>2+</sup> (rasio molar 1:2) dicampurkan, kemudian ditambahkan larutan NaOH (0,75 M) sebanyak 32 mL untuk membentuk Ni-Zn LHS. Magnetit disintesis dengan larutan NH<sub>4</sub>OH (1 M) yang ditambahkan ke dalam campuran larutan Fe<sup>2+</sup> dan Fe<sup>3+</sup> (rasio molar 1:2) sampai pH 11,5. Pada sintesis Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS dilakukan dengan metode kopresipitasi dimana padatan magnetit hasil sintesis yang terdispersi dimasukkan ke dalam campuran larutan Zn<sup>2+</sup> dan Ni<sup>2+</sup>, kemudian campuran tersebut dititrasi dengan NaOH sebanyak 32 mL. Ketiga material hasil sintesis dikarakterisasi menggunakan FTIR, XRD, VSM, SEM-EDX, dan TEM. Aplikasi Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS sebagai adsorben ion [AuCl<sub>4</sub>]<sup>-</sup> dipelajari dengan mengkaji pengaruh pH, kinetika dan isoterm adsorpsi.

Hasil penelitian menunjukkan bahwa magnetit yang terdistribusi pada struktur LHS dapat menjadikan Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS sebagai adsorben yang tidak hanya memiliki kemampuan adsorpsi, tetapi juga memiliki sifat kemagnetan sehingga proses pemisahan kembali mudah dilakukan dengan medan magnet eksternal. Hasil VSM menunjukkan nilai kemagnetan Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS sebesar 12,021 emu/g. Adsorpsi optimum ion [AuCl<sub>4</sub>]<sup>-</sup> oleh Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS tercapai pada pH 4 dan mengikuti kinetika pseudo orde dua Ho dengan nilai konstanta laju adsorpsi (k) sebesar 1,7542 x 10<sup>-3</sup> g/mg.menit. Adsorpsi paling sesuai dengan model isoterm adsorpsi Freundlich yang menunjukkan kapasitas adsorpsi 9,055 mg/g. Nilai ini lebih kecil dari kapasitas adsorpsi Ni-Zn LHS yang memiliki nilai 13,921 mg/g.

Kata Kunci: *Nickel, Zinc, Magnetit, LHS, [AuCl<sub>4</sub>]<sup>-</sup>, Adsorpsi*

## **SYNTHESIS OF Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS (MAGNETITE-NICKEL-ZINC LAYERED HYDROXIDE SALTS) AND ITS APPLICATION AS ADSORBENT OF [AuCl<sub>4</sub>]<sup>-</sup> IONS IN AQUEOUS SOLUTION**

LIA KURNIA  
17/418574/PPA/05358

### **ABSTRACT**

The synthesis of Magnetite-Nickel-Zinc Layered Hydroxide Salts (Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS) has been carried out to obtain adsorbents in the form of layered magnetic material and its application as [AuCl<sub>4</sub>]<sup>-</sup> ions adsorbent in solution. Ni-Zn-LHS and magnetite material were synthesized separately by the coprecipitation method, then both materials were combined by the same method. Solutions of Zn<sup>2+</sup> and Ni<sup>2+</sup> (1:2 molar ratio) were mixed to form Ni-Zn LHS, then 32 mL of NaOH solution (0.75 M) was added. Magnetite was synthesized in which the solution of NH<sub>4</sub>OH (1 M) was added into the mixture of Fe<sup>2+</sup> and Fe<sup>3+</sup> solution (1:2 molar ratio) until it reached pH 11.5. The synthesis of Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS was carried out by coprecipitation method in which the dispersed magnetite solid was added to the mixture of Zn<sup>2+</sup> and Ni<sup>2+</sup> solutions, then the mixture was titrated with 32 mL of NaOH. The three synthesized materials were characterized by FTIR, XRD, VSM, SEM-EDX, and TEM. The application of Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS as adsorbent of [AuCl<sub>4</sub>]<sup>-</sup> ions was studied by examining the effect of pH, adsorption kinetics, and isotherm.

The result showed that distributed magnetite in the LHS structure could form Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS as an adsorbent that not only had adsorption capability, but also had magnetic properties so that the separation process was easily carried out with an external magnetic field. The VSM characterization showed that the magnetic property value of the Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS was 12.021 emu/g. The adsorption results showed that the adsorption of [AuCl<sub>4</sub>]<sup>-</sup> ions by Fe<sub>3</sub>O<sub>4</sub>-Ni-Zn LHS optimally at pH 4 and followed the pseudo second-order kinetics of Ho with an adsorption rate constant (k) of 1.7542 x 10<sup>-3</sup> g/mg. The adsorption was most suitable for the Freundlich adsorption isotherm model indicating the adsorption capacity of 9.055 mg/g. This value was smaller than Ni-Zn LHS adsorption capacity which possessed a value of 13.921 mg/g.

Keywords: : Nickel, Zinc, Magnetite, LHS, [AuCl<sub>4</sub>]<sup>-</sup>, Adsorption